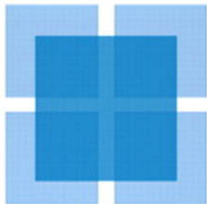


Robin Bade
Michael Parkin



Essential
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Study Plan The Study Plan consists of practice problems taken directly from the end-of-chapter Study Plan Problems and Applications in the textbook.

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You can work these problems in Chapter 4 Study Plan and get instant feedback.

CHAPTER CHECKPOINT

Study Plan Problems and Applications

1. Explain how each of the following events changes the demand of air travel.
 - Airfares tumble, while long-distance bus fares don't change.
 - The price of jet fuel rises.
 - Airlines reduce the number of flights each day.
 - People expect airfares to increase next summer.

3.5 Predicting Changes in Price and Quantity

OPEC deadlocked on oil production hike
Oil prices breached the \$100-a-barrel mark Wednesday after OPEC said it could not reach an agreement about raising crude production.
Source: CNN Money, June 8, 2011

Consider the market for oil when oil prices "breached the \$100-a-barrel mark".
Draw a demand curve and a supply curve consistent with this information. Label both curves.
Draw a point at the equilibrium price and equilibrium quantity. Label it 1.

Now suppose that OPEC members agree to increase production, and the supply curve shifts rightward.
Draw a new equilibrium point. Label it 2.

Initially the price of a barrel of oil is greater than \$100.
When OPEC members agree to increase production, the supply of oil increases and the supply curve shifts rightward.
The equilibrium price of a barrel of oil falls and the equilibrium quantity increases.

Well done!
Initially the price of a barrel of oil is greater than \$100.
When OPEC members agree to increase production, the supply of oil increases and the supply curve shifts rightward.
The equilibrium price of a barrel of oil falls and the equilibrium quantity increases.

Price (dollars per barrel)

120
115
110
105
100
95
90

140 150 160 170
barrels per day

S_0
 S_1
 D_0

105
100
140

0 correct | 0 of 13 complete

Reset

Done

Check Answer

Unlimited Practice As you work each exercise, instant feedback helps you understand and apply the concepts. Many Study Plan exercises contain algorithmically generated values to ensure that you get as much practice as you need.

Learning Resources

Study Plan problems link to learning resources that further reinforce concepts you need to master.

- **Help Me Solve This** learning aids help you break down a problem much the same way as an instructor would do during office hours. Help Me Solve This is available for select problems.
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- A **graphing tool** enables you to build and manipulate graphs to better understand how concepts, numbers, and graphs connect.

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ESSENTIAL FOUNDATIONS OF ECONOMICS

delivers a complete, hands-on learning system designed around active learning.

A Learning-by-Doing Approach

The **Checklist** that begins each chapter highlights the key topics covered and the chapter is divided into sections that directly correlate to the Checklist.

The **Checkpoint** that ends each section provides a full page of practice problems to encourage students to review the material while it is fresh in their minds.

Each chapter opens with a question about a central issue that sets the stage for the material.



Why did the price of coffee soar in 2010 and 2011?

4

Demand and Supply

When you have completed your study of this chapter, you will be able to

- 1 Distinguish between quantity demanded and demand, and explain what determines demand.
- 2 Distinguish between quantity supplied and supply, and explain what determines supply.

CHAPTER CHECKLIST

CHECKPOINT 4.1

Distinguish between quantity demanded and demand, and explain what determines demand.

Practice Problems

The following events occur one at a time in the market for cell phones:

- The price of a cell phone falls.
- Everyone believes that the price of a cell phone will fall next month.
- The price of a call made from a cell phone falls.
- The price of a call made from a land-line phone increases.
- The introduction of camera phones makes cell phones more popular.

1. Explain the effect of each event on the demand for cell phones.
2. Use a graph to illustrate the effect of each event.
3. Does any event (or events) illustrate the law of demand?

In the News

Airlines, now flush, fear a downturn

So far this year, airlines have been able to raise fares but still fill their planes. Source: *The New York Times*, June 10, 2011

MyEconLab

You can work these problems in Study Plan 4.1 and get instant feedback.

supply determine price and quantity in a effects of changes in demand and supply.

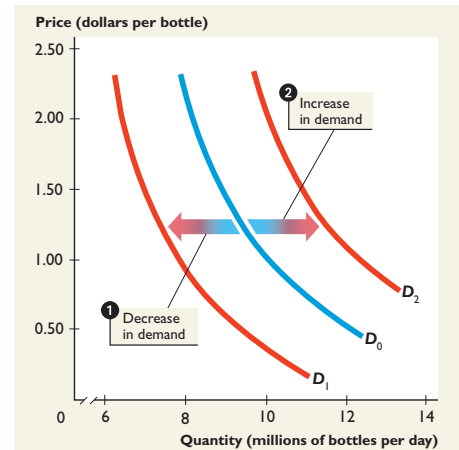
FIGURE 4.3

Changes in Demand

MyEconLab Animation

A change in any influence on buying plans, other than a change in the price of the good itself, changes demand and shifts the demand curve.

- 1 When demand decreases, the demand curve shifts leftward from D_0 to D_1 .
- 2 When demand increases, the demand curve shifts rightward from D_0 to D_2 .



Confidence-Building Graphs

use color to show the direction of shifts and detailed, numbered captions guide students step-by-step through the action.

100% of the figures are animated in MyEconLab, with step-by-step audio narration.

Real Applications

Eye On Boxes apply theory to important issues and problems that shape our global society and individual decisions.

Eye On boxes that build off the chapter opening question help students see the economics behind key issues facing our world.

Practice and Learning Aids in MyEconLab

An end-of-chapter problem based on the chapter-opening issue gives students further practice.

All of the Checkpoint problems are in MyEconLab and available for self-assessment or instructor assignment.

Immediate feedback and problem specific learning aids give students support when they need it most.

EYE on the PRICE OF COFFEE

Why Did the Price of Coffee Soar in 2010 and 2011?

In January 2009, the price of coffee (the kind that you get at Starbucks and similar coffee shops called Arabica) was \$1.25 a pound (point A in Figure 1) and by May 2011, it had risen to \$3.00 a pound (point B). Why did the price of coffee soar? Figure 2, which shows the market for coffee, answers this question. The demand curve D and the supply curve S_{09} determined the equilibrium price and quantity in 2009 at \$1.25 a pound and 950 million pounds. Heavy rain led to exceptionally low harvests in Colombia, Indonesia, Mexico, and Vietnam, which decreased the supply of coffee. The supply curve shifted leftward to S_{11} . The price increased to \$3.00 a pound. The quantity demanded and equilibrium quantity decreased to 800 million pounds.

Figure 1 The price of coffee

Figure 2 The market for coffee

Economics in the News

MyEconLab

To keep you informed about the latest economic news, each day the authors upload two relevant news articles: a microeconomic topic and a macroeconomic topic. Each article includes discussion questions, links to additional online resources, and references to related textbook chapters.

Instructor Assignable Problems and Applications

Your instructor can assign these problems as homework, a quiz, or a test in MyEconLab.

- If after heavy rain and low production, the weather improves and coffee growers enjoy bumper crops, how does
 - The demand for coffee change?
 - The supply of coffee change?
 - The price of coffee change?
 Illustrate your answer with a graphical analysis.
- What is the effect on the equilibrium price and equilibrium quantity of orange juice if the price of apple juice decreases and the wage rate paid to orange grove workers increases?

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Essential Foundations of **ECONOMICS**

Robin Bade

Michael Parkin

University of Western Ontario



SIXTH EDITION

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To Erin, Tessa, Jack, Abby, and Sophie

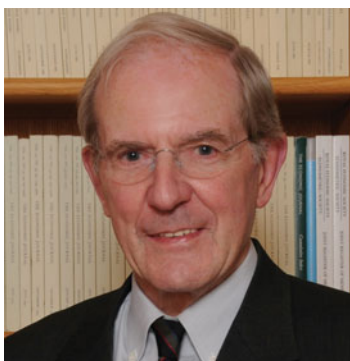
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About the Authors



Robin Bade was an undergraduate at the University of Queensland, Australia, where she earned degrees in mathematics and economics. After a spell teaching high school math and physics, she enrolled in the Ph.D. program at the Australian National University, from which she graduated in 1970. She has held faculty appointments at the University of Edinburgh in Scotland, at Bond University in Australia, and at the Universities of Manitoba, Toronto, and Western Ontario in Canada. Her research on international capital flows appears in the *International Economic Review* and the *Economic Record*.

Robin first taught the principles of economics course in 1970 and has taught it (alongside intermediate macroeconomics and international trade and finance) most years since then. She developed many of the ideas found in this text while conducting tutorials with her students at the University of Western Ontario.



Michael Parkin studied economics in England and began his university teaching career immediately after graduating with a B.A. from the University of Leicester. He learned the subject on the job at the University of Essex, England's most exciting new university of the 1960s, and at the age of 30 became one of the youngest full professors. He is a past president of the Canadian Economics Association and has served on the editorial boards of the *American Economic Review* and the *Journal of Monetary Economics*. His research on macroeconomics, monetary economics, and international economics has resulted in more than 160 publications in journals and edited volumes, including the *American Economic Review*, the *Journal of Political Economy*, the *Review of Economic Studies*, the *Journal of Monetary Economics*, and the *Journal of Money, Credit, and Banking*. He is author of the best-selling textbook, *Economics* (Addison-Wesley), now in its Ninth Edition.

Robin and Michael are a wife-and-husband team. Their most notable joint research created the Bade-Parkin Index of central bank independence and spawned a vast amount of research on that topic. They don't claim credit for the independence of the new European Central Bank, but its constitution and the movement toward greater independence of central banks around the world were aided by their pioneering work. Their joint textbooks include *Macroeconomics* (Prentice-Hall), *Modern Macroeconomics* (Pearson Education Canada), and *Economics: Canada in the Global Environment*, the Canadian adaptation of Parkin, *Economics* (Addison-Wesley). They are dedicated to the challenge of explaining economics ever more clearly to an ever-growing body of students.

Music, the theater, art, walking on the beach, and five fast-growing grandchildren provide their relaxation and fun.

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ECONOMICS

Brief Contents

| | | |
|--------|---|--|
| PART 1 | INTRODUCTION | |
| | 1 | Getting Started, 1 |
| | 2 | The U.S. and Global Economies, 31 |
| | 3 | The Economic Problem, 59 |
| | 4 | Demand and Supply, 83 |
| PART 2 | A CLOSER LOOK AT MARKETS | |
| | 5 | Elasticities of Demand and Supply, 111 |
| | 6 | Efficiency and Fairness of Markets, 137 |
| | 7 | Government Actions in Markets, 167 |
| | 8 | Global Markets in Action, 195 |
| | 9 | Externalities: Pollution, Education, and Health Care, 223 |
| PART 3 | PRICES, PROFITS, AND INDUSTRY PERFORMANCE | |
| | 10 | Production and Cost, 249 |
| | 11 | Perfect Competition, 277 |
| | 12 | Monopoly, 305 |
| | 13 | Monopolistic Competition and Oligopoly, 337 |
| PART 4 | MONITORING THE MACROECONOMY | |
| | 14 | GDP: A Measure of Total Production and Income, 367 |
| | 15 | Jobs and Unemployment, 397 |
| | 16 | The CPI and the Cost of Living, 419 |
| PART 5 | UNDERSTANDING THE MACROECONOMY | |
| | 17 | Potential GDP and the Economic Growth, 443 |
| | 18 | Money and the Monetary System, 475 |
| | 19 | Aggregate Supply and Aggregate Demand, 505 |
| | 20 | Fiscal Policy and Monetary Policy, 531 |
| | | Glossary G-1 |
| | | Index I-1 |
| | | Credits C-1 |

This page intentionally left blank

Contents

PART 1 INTRODUCTION



CHAPTER 1 Getting Started 1

CHAPTER CHECKLIST 1

1.1 Definition and Questions 2

- Scarcity, 2
- Economics Defined, 2
- What, How, and For Whom? 3
- When Is the Pursuit of Self-Interest in the Social Interest? 4

CHECKPOINT 1.1 7

1.2 The Economic Way of Thinking 8

- Economic Ideas, 8
- A Choice Is a Tradeoff, 8
- Rational Choice, 8
- Benefit: What You Gain, 9
- Cost: What You *Must* Give Up, 9
- How Much? Choosing at the Margin, 10
- Choices Respond to Incentives, 11
- Economics as Social Science, 12
- Economics as Policy Tool, 14

CHECKPOINT 1.2 16

CHAPTER SUMMARY 17

CHAPTER CHECKPOINT 18

Appendix: Making and Using Graphs 21

- Interpreting Data Graphs, 22
- Interpreting Graphs Used in Economic Models, 24
- The Slope of a Relationship, 27
- Relationships Among More Than Two Variables, 28

APPENDIX CHECKPOINT 30

■ EYE on the PAST

- Adam Smith and the Birth of Economics as a Social Science, 13

■ EYE on the BENEFIT AND COST OF SCHOOL

- Did You Make the Right Decision? 15



CHAPTER 2 The U.S. and Global Economies 31

CHAPTER CHECKLIST 31

2.1 What, How, and For Whom? 32

- What Do We Produce? 32
- How Do We Produce? 34
- For Whom Do We Produce? 37

CHECKPOINT 2.1 38

2.2 The Global Economy 39

- The People, 39
- The Countries, 39
- What* in the Global Economy? 40
- How* in the Global Economy? 42
- For Whom* in the Global Economy? 43

CHECKPOINT 2.2 45

2.3 The Circular Flows 46

- Households and Firms, 46
- Markets, 46
- Real Flows and Money Flows, 46
- Governments, 48
- Governments in the Circular Flow, 49
- Federal Government Expenditures and Revenue, 50
- State and Local Government Expenditures and Revenue, 51
- Circular Flows in the Global Economy, 52

CHECKPOINT 2.3 54

CHAPTER SUMMARY 55

CHAPTER CHECKPOINT 56

■ EYE on the U.S. ECONOMY

- What We Produce, 33

■ EYE on the PAST

- Changes in What We Produce, 34

■ EYE on the U.S. ECONOMY

- Changes in How We Produce in the Information Economy, 36

- **EYE on the iPhone**
Who Makes the iPhone? 41
- **EYE on YOUR LIFE**
The U.S. and Global Economies in Your Life, 45
- **EYE on the PAST**
Growing Government, 52
- **EYE on the GLOBAL ECONOMY**
The Ups and Downs in International Trade, 54

 **CHAPTER 3**
The Economic Problem 59
CHAPTER CHECKLIST 59

- 3.1 Production Possibilities** 60
Production Possibilities Frontier, 60
CHECKPOINT 3.1 65
- 3.2 Opportunity Cost** 66
The Opportunity Cost of a Cell Phone, 66
Opportunity Cost and the Slope of the PPF, 67
Opportunity Cost Is a Ratio, 67
Increasing Opportunity Costs Are Everywhere, 68
Your Increasing Opportunity Cost, 68
CHECKPOINT 3.2 70
- 3.3 Economic Growth** 71
CHECKPOINT 3.3 72
- 3.4 Specialization and Trade** 73
Comparative Advantage, 74
Achieving Gains from Trade, 76
CHECKPOINT 3.4 78
- CHAPTER SUMMARY** 79
- CHAPTER CHECKPOINT** 80

- **EYE on YOUR LIFE**
Your Production Possibilities Frontier, 64
- **EYE on the ENVIRONMENT**
Is Wind Power Free? 68
- **EYE on the U.S. ECONOMY**
Guns Versus Butter, 69
- **EYE on the GLOBAL ECONOMY**
Hong Kong’s Rapid Economic Growth, 72

- **EYE on the U.S. ECONOMY**
No One Knows How to Make a Pencil, 73
- **EYE on YOUR LIFE**
Your Comparative Advantage, 76

 **CHAPTER 4**
Demand and Supply 83
CHAPTER CHECKLIST 83

- Competitive Markets** 84
- 4.1 Demand** 85
The Law of Demand, 85
Demand Schedule and Demand Curve, 85
Individual Demand and Market Demand, 87
Changes in Demand, 88
Change in Quantity Demanded Versus Change in Demand, 90
CHECKPOINT 4.1 91
- 4.2 Supply** 92
The Law of Supply, 92
Supply Schedule and Supply Curve, 92
Individual Supply and Market Supply, 94
Changes in Supply, 95
Change in Quantity Supplied Versus Change in Supply, 97
CHECKPOINT 4.2 98
- 4.3 Market Equilibrium** 99
Price: A Market’s Automatic Regulator, 99
Predicting Price Changes: Three Questions, 100
Effects of Changes in Demand, 101
Effects of Changes in Supply, 102
Changes in Both Demand and Supply, 104
CHECKPOINT 4.3 106

CHAPTER SUMMARY 107

CHAPTER CHECKPOINT 108

- **EYE on the PRICE OF COFFEE**
Why Did the Price of Coffee Soar in 2010 and 2011? 103
- **EYE on YOUR LIFE**
Using Demand and Supply, 103

PART 2 A CLOSER LOOK AT MARKETS

CHAPTER 5
Elasticities of Demand and Supply 111
CHAPTER CHECKLIST 111

- 5.1 The Price Elasticity of Demand** 112
 Percentage Change in Price, 112
 Percentage Change in Quantity Demanded, 113
 Elastic and Inelastic Demand, 114
 Influences on the Price Elasticity of Demand, 114
 Computing the Price Elasticity of Demand, 116
 Interpreting the Price Elasticity of Demand Number, 117
 Elasticity Along a Linear Demand Curve, 118
 Total Revenue and the Price Elasticity of Demand, 120
 Applications of the Price Elasticity of Demand, 122

CHECKPOINT 5.1 123

- 5.2 The Price Elasticity of Supply** 124
 Elastic and Inelastic Supply, 124
 Influences on the Price Elasticity of Supply, 124
 Computing the Price Elasticity of Supply, 126

CHECKPOINT 5.2 128

- 5.3 Cross Elasticity and Income Elasticity** 129
 Cross Elasticity of Demand, 129
 Income Elasticity of Demand, 130

CHECKPOINT 5.3 132**CHAPTER SUMMARY** 133**CHAPTER CHECKPOINT** 134
 **EYE on the GLOBAL ECONOMY**

Price Elasticities of Demand, 119

 **EYE on the PRICE OF GAS**

What Do You Do When the Price of Gasoline Rises? 121

 **EYE on YOUR LIFE**

Your Price Elasticities of Demand, 131


CHAPTER 6
Efficiency and Fairness of Markets 137
CHAPTER CHECKLIST 137

- 6.1 Allocation Methods and Efficiency** 138
 Resource Allocation Methods, 138
 Using Resources Efficiently, 141
CHECKPOINT 6.1 145
- 6.2 Value, Price, and Consumer Surplus** 146
 Demand and Marginal Benefit, 146
 Consumer Surplus, 147
CHECKPOINT 6.2 148
- 6.3 Cost, Price, and Producer Surplus** 149
 Supply and Marginal Cost, 149
 Producer Surplus, 150
CHECKPOINT 6.3 151

- 6.4 Are Markets Efficient?** 152
 Marginal Benefit Equals Marginal Cost, 152
 Total Surplus Is Maximized, 153
 The Invisible Hand, 153
 Market Failure, 155
 Sources of Market Failure, 156
 Alternatives to the Market, 157

CHECKPOINT 6.4 158

- 6.5 Are Markets Fair?** 159
 It's Not Fair If the *Rules* Aren't Fair, 159
 It's Not Fair If the *Result* Isn't Fair, 159
 Compromise, 161

CHECKPOINT 6.5 162**CHAPTER SUMMARY** 163**CHAPTER CHECKPOINT** 164
 **EYE on the U.S. ECONOMY**

The Invisible Hand and e-Commerce, 154

 **EYE on PRICE GOUGING**

Should Price Gouging Be Illegal? 160

 **EYE on YOUR LIFE**

Allocation Methods, Efficiency, and Fairness, 161

CHAPTER 7
Government Actions
in Markets 167

CHAPTER CHECKLIST 167

- 7.1 Taxes on Buyers and Sellers** 168
 - Tax Incidence, 168
 - Taxes and Efficiency, 169
 - Incidence, Inefficiency, and Elasticity, 170
 - Incidence, Inefficiency, and the Elasticity of Demand, 171
 - Incidence, Inefficiency, and the Elasticity of Supply, 172
 - CHECKPOINT 7.1** 173
- 7.2 Price Ceilings** 174
 - A Rent Ceiling, 174
 - Are Rent Ceilings Efficient? 177
 - Are Rent Ceilings Fair? 178
 - If Rent Ceilings Are So Bad, Why Do We Have Them? 178
 - CHECKPOINT 7.2** 179
- 7.3 Price Floors** 180
 - The Minimum Wage, 181
 - Is the Minimum Wage Efficient? 184
 - Is the Minimum Wage Fair? 185
 - If the Minimum Wage Is So Bad, Why Do We Have It? 185
 - CHECKPOINT 7.3** 186
- 7.4 Price Supports in Agriculture** 187
 - How Governments Intervene in Markets for Farm Products, 187
 - Price Support: An Illustration, 187
 - CHECKPOINT 7.4** 190

CHAPTER SUMMARY 191

CHAPTER CHECKPOINT 192

- **EYE on the U.S. ECONOMY**
 The Federal Minimum Wage, 183
- **EYE on PRICE REGULATION**
 Can the President Repeal the Laws of Supply and Demand? 185
- **EYE on YOUR LIFE**
 Price Ceilings and Price Floors, 189

CHAPTER 8
Global Markets in Action 195

CHAPTER CHECKLIST 195

- 8.1 How Global Markets Work** 196
 - International Trade Today, 196
 - What Drives International Trade? 196
 - Why the United States Imports T-Shirts, 198
 - Why the United States Exports Airplanes, 199
 - CHECKPOINT 8.1** 200
- 8.2 Winners, Losers, and Net Gains from Trade** 201
 - Gains and Losses from Imports, 202
 - Gains and Losses from Exports, 203
 - CHECKPOINT 8.2** 204
- 8.3 International Trade Restrictions** 205
 - Tariffs, 205
 - Import Quotas, 209
 - Other Import Barriers, 211
 - Export Subsidies, 211
 - CHECKPOINT 8.3** 212
- 8.4 The Case Against Protection** 213
 - Three Traditional Arguments for Protection, 213
 - Four Newer Arguments for Protection, 215
 - Why Is International Trade Restricted? 216
 - CHECKPOINT 8.4** 218

CHAPTER SUMMARY 219

CHAPTER CHECKPOINT 220

- **EYE on the U.S. ECONOMY**
 U.S. Exports and Imports, 197
- **EYE on GLOBALIZATION**
 Who Wins and Who Loses from Globalization? 201
- **EYE on the PAST**
 The History of U.S. Tariffs, 205
- **EYE on YOUR LIFE**
 International Trade, 217

CHAPTER 9 Externalities: Pollution, Education, and Health Care 223

CHAPTER CHECKLIST 223

Externalities in Our Daily Lives 224

Negative Production Externalities, 224

Positive Production Externalities, 224

Negative Consumption Externalities, 225

Positive Consumption Externalities, 225

9.1 Negative Externalities: Pollution 226

Private Costs and Social Costs, 226

Production and Pollution:

How Much? 228

Property Rights, 229

The Coase Theorem, 230

Government Actions in the Face
of External Costs, 231

Switching to Clean Technologies, 233

CHECKPOINT 9.1 235

9.2 Positive Externalities: Education and Health Care 236

Private Benefits and Social Benefits, 236

Government Actions in the Face of External
Benefits, 238

CHECKPOINT 9.2 244

CHAPTER SUMMARY 245

CHAPTER CHECKPOINT 246

■ EYE on the U.S. ECONOMY

U.S. Air Pollution Trends, 233

■ EYE on CLIMATE CHANGE

How Can We Limit Climate Change? 234

■ EYE on the U.S. ECONOMY

Education Quality: Charter Schools and
Vouchers, 241

■ EYE on YOUR LIFE

Externalities in Your Life, 241

■ EYE on HEALTH CARE

Does Health Care Need Fixing? 242

PART 3 PRICES, PROFITS, AND INDUSTRY PERFORMANCE

CHAPTER 10 Production and Cost 249

CHAPTER CHECKLIST 249

10.1 Economic Cost and Profit 250

The Firm's Goal, 250

Accounting Cost and Profit, 250

Opportunity Cost, 250

Economic Profit, 251

CHECKPOINT 10.1 253

SHORT RUN AND LONG RUN 254

10.2 Short-Run Production 255

Total Product, 255

Marginal Product, 256

Average Product, 258

CHECKPOINT 10.2 260

10.3 Short-Run Cost 261

Total Cost, 261

Marginal Cost, 262

Average Cost, 263

Why the Average Total Cost Curve

Is U-Shaped, 265

Cost Curves and Product Curves, 266

Shifts in the Cost Curves, 266

CHECKPOINT 10.3 268

10.4 Long-Run Cost 269

Plant Size and Cost, 269

The Long-Run Average Cost Curve, 270

CHECKPOINT 10.4 272

CHAPTER SUMMARY 273

CHAPTER CHECKPOINT 274

■ EYE on YOUR LIFE

Your Average and Marginal Grades, 259

■ EYE on RETAILERS' COSTS

Which Store Has the Lower Costs: Wal-Mart
or 7-Eleven? 271

CHAPTER 11 Perfect Competition 277

CHAPTER CHECKLIST 277

Market Types 278

- Perfect Competition, 278
- Other Market Types, 278

11.1 A Firm's Profit-Maximizing Choices 279

- Price Taker, 279
- Revenue Concepts, 279
- Profit-Maximizing Output, 280
- Marginal Analysis and the Supply Decision, 282
- Temporary Shutdown Decision, 283
- The Firm's Short-Run Supply Curve, 284

CHECKPOINT 11.1 286

11.2 Output, Price, and Profit in the Short Run 287

- Market Supply in the Short Run, 287
- Short-Run Equilibrium in Normal Times, 288
- Short-Run Equilibrium in Good Times, 289
- Short-Run Equilibrium in Bad Times, 290

CHECKPOINT 11.2 291

11.3 Output, Price, and Profit in the Long Run 292

- Entry and Exit, 293
- The Effects of Exit, 294
- Change in Demand, 295
- Technological Change, 295
- Is Perfect Competition Efficient? 298
- Is Perfect Competition Fair? 299

CHECKPOINT 11.3 300

CHAPTER SUMMARY 301

CHAPTER CHECKPOINT 302

■ EYE on the AUTO INDUSTRY

Why Did GM Fail? 296

■ EYE on YOUR LIFE

The Perfect Competition that You Encounter, 299

CHAPTER 12 Monopoly 305

CHAPTER CHECKLIST 305

12.1 Monopoly and How it Arises 306

- How Monopoly Arises, 306
- Monopoly Price-Setting Strategies, 308

CHECKPOINT 12.1 309

12.2 Single-Price Monopoly 310

- Price and Marginal Revenue, 310
- Marginal Revenue and Elasticity, 311
- Output and Price Decision, 312

CHECKPOINT 12.2 314

12.3 Monopoly and Competition Compared 315

- Output and Price, 315
- Is Monopoly Efficient? 316
- Is Monopoly Fair? 317
- Rent Seeking, 317
- Create a Monopoly by Rent Seeking, 318
- Rent-Seeking Equilibrium, 318

CHECKPOINT 12.3 319

12.4 Price Discrimination 320

- Price Discrimination and Consumer Surplus, 320
- Profiting by Price Discriminating, 321
- Perfect Price Discrimination, 322
- Price Discrimination and Efficiency, 324

CHECKPOINT 12.4 325

12.5 Monopoly Regulation 326

- Efficient Regulation of a Natural Monopoly, 326
- Second-Best Regulation of a Natural Monopoly, 327

CHECKPOINT 12.5 332

CHAPTER SUMMARY 333

CHAPTER CHECKPOINT 334

■ EYE on the U.S. ECONOMY

Airline Price Discrimination, 324

■ EYE on MICROSOFT

Are Microsoft's Prices Too High? 329

■ EYE on YOUR LIFE

Monopoly in Your Everyday Life, 331

CHAPTER 13 Monopolistic Competition and Oligopoly 337

CHAPTER CHECKLIST 337

13.1 What Is Monopolistic Competition? 338

- Large Number of Firms, 338
- Product Differentiation, 338
- Competing on Quality, Price, and Marketing, 338

| | |
|---|-----|
| Entry and Exit, | 339 |
| Identifying Monopolistic Competition, | 339 |
| Output and Price in Monopolistic Competition, | 341 |
| The Firm's Profit-Maximizing Decision, | 341 |
| Long Run: Zero Economic Profit, | 342 |
| Monopolistic Competition and Perfect Competition, | 343 |
| CHECKPOINT 13.1 | 344 |
| 13.2 Product Development and Marketing | 345 |
| Innovation and Product Development, | 345 |
| Marketing, | 346 |
| CHECKPOINT 13.2 | 349 |
| 13.3 Oligopoly | 350 |
| Collusion, | 350 |
| Duopoly in Airplanes, | 351 |
| The Duopolists' Dilemma, | 352 |
| CHECKPOINT 13.3 | 354 |
| 13.4 Game Theory | 355 |
| What Is a Game? | 355 |
| The Prisoners' Dilemma, | 355 |

| | |
|--|-----|
| The Duopolists' Dilemma, | 357 |
| Advertising and Research Games in Oligopoly, | 358 |
| Repeated Games, | 360 |
| Is Oligopoly Efficient? | 361 |
| CHECKPOINT 13.4 | 362 |

CHAPTER SUMMARY 363**CHAPTER CHECKPOINT** 364

| | |
|---------------------------------------|-----|
| EYE on the U.S. ECONOMY | |
| Examples of Monopolistic Competition, | 340 |
| EYE on CELL PHONES | |
| Which Cell Phone? | 346 |
| EYE on YOUR LIFE | |
| Some Selling Costs You Pay, | 348 |
| EYE on YOUR LIFE | |
| A Game You Might Play, | 360 |
| EYE on the CHIPS DUOPOLY | |
| Are Two Computer Chip-Makers Too Few? | 361 |

PART 4 MONITORING THE MACROECONOMY

CHAPTER 14 **GDP: A Measure of Total Production and Income** 367

CHAPTER CHECKLIST 367

| | |
|--|-----|
| 14.1 GDP, Income, and Expenditure | 368 |
| GDP Defined, | 368 |
| Circular Flows in the U.S. Economy, | 369 |
| Expenditure Equals Income, | 370 |
| CHECKPOINT 14.1 | 372 |

| | |
|--|-----|
| 14.2 Measuring U.S. GDP | 373 |
| The Expenditure Approach, | 373 |
| The Income Approach, | 375 |
| GDP and Related Measures of Production and Income, | 377 |
| Real GDP and Nominal GDP, | 378 |
| Calculating Real GDP, | 378 |
| Using the Real GDP Numbers, | 379 |
| CHECKPOINT 14.2 | 380 |

| | |
|--|-----|
| 14.3 The Uses and Limitations of Real GDP | 381 |
| The Standard of Living Over Time, | 381 |
| Tracking the Course of the Business Cycle, | 382 |

| | |
|---|-----|
| The Standard of Living Among Countries, | 384 |
| Goods and Services Omitted from GDP, | 385 |
| Other Influences on the Standard of Living, | 386 |
| CHECKPOINT 14.3 | 388 |

CHAPTER SUMMARY 389**CHAPTER CHECKPOINT** 390

| | |
|---|-----|
| Appendix: Measuring Real GDP | 393 |
| The Problem with Base-Year Prices, | 393 |
| Value Production in the Prices of Adjacent Years, | 393 |
| APPENDIX CHECKPOINT | 396 |

| | |
|---|-----|
| EYE on the U.S. ECONOMY | |
| Is a Computer Program an Intermediate Good or a Final Good? | 374 |
| EYE on the BOOMS AND BUSTS | |
| How Do We Track the Booms and Busts of Our Economy, | 384 |
| EYE on YOUR LIFE | |
| Making GDP Personal, | 386 |
| EYE on the GLOBAL ECONOMY | |
| Which Country Has the Highest Standard of Living? | 387 |

CHAPTER 15 Jobs and Unemployment 397

CHAPTER CHECKLIST 397

15.1 Labor Market Indicators 398

- Current Population Survey, 398
- Population Survey Criteria, 398
- Two Main Labor Market Indicators, 399
- Alternative Measures of Unemployment, 400

CHECKPOINT 15.1 402

15.2 Labor Market Trends and Fluctuations 403

- Unemployment Rate, 403
- The Participation Rate, 404
- Alternative Measures of Unemployment, 406
- A Closer Look at Part-Time Employment, 407

CHECKPOINT 15.2 408

15.3 Unemployment and Full Employment 409

- Frictional Unemployment, 409
- Structural Unemployment, 409
- Cyclical Unemployment, 410
- “Natural” Unemployment, 410
- Unemployment and Real GDP, 411

CHECKPOINT 15.3 414

CHAPTER SUMMARY 415

CHAPTER CHECKPOINT 416

EYE on the U.S. ECONOMY

The Current Population Survey, 401

EYE on the GLOBAL ECONOMY

Unemployment Around the World, 404

EYE on the GLOBAL ECONOMY

Women in the Labor Force, 405

EYE on the UNEMPLOYED

How Long Does It Take to Find a Job? 410

EYE on YOUR LIFE

Your Labor Market Status and Activity, 412

CHAPTER 16 The CPI and the Cost of Living 419

CHAPTER CHECKLIST 419

16.1 The Consumer Price Index 420

- Reading the CPI Numbers, 420
- Constructing the CPI, 420
- The CPI Market Basket, 420
- The Monthly Price Survey, 421
- Calculating the CPI, 422
- Measuring Inflation and Deflation, 423

CHECKPOINT 16.1 425

16.2 The CPI and Other Price Level Measures 426

- Sources of Bias in the CPI, 426
- The Magnitude of the Bias, 427
- Two Consequences of the CPI Bias, 428
- Alternative Measures of the Price Level and Inflation Rate, 429

CHECKPOINT 16.2 431

16.3 Nominal and Real Values 432

- Dollars and Cents at Different Dates, 432
- Nominal and Real Values in Macroeconomics, 433
- Nominal GDP and Real GDP, 433
- Nominal Wage Rate and Real Wage Rate, 434
- Nominal Interest Rate and Real Interest Rate, 436

CHECKPOINT 16.3 438

CHAPTER SUMMARY 439

CHAPTER CHECKPOINT 440

EYE on The PAST

700 Years of Inflation and Deflation, 424

EYE on the U.S. ECONOMY

Deflating the GDP Balloon, 433

EYE on the PAST

The Nominal and Real Wage Rates of Presidents of the United States, 435

EYE on BOX OFFICE HITS

Which Movie *Really* Was the Biggest Box Office Hit? 436

EYE on YOUR LIFE

A Student’s CPI, 437

PART 5 UNDERSTANDING THE MACROECONOMY**CHAPTER 17**
Potential GDP and the Economic Growth 443**CHAPTER CHECKLIST** 443**Macroeconomic Approaches and Pathways** 443

The Three Main Schools of Thought, 444

Today's Consensus, 445

The Road Ahead, 446

17.1 Potential GDP 447

The Production Function, 448

The Labor Market, 449

CHECKPOINT 17.1 455**17.2 The Basics of Economic Growth** 456

Calculating Growth Rates, 456

The Magic of Sustained Growth, 457

CHECKPOINT 17.2 459**17.3 labor productivity Growth** 460

Labor Productivity, 460

Saving and Investment in Physical Capital, 460

Expansion of Human Capital and Discovery of New Technologies, 462

Combined Influences Bring Labor Productivity Growth, 463

CHECKPOINT 17.3 466**17.4 Achieving Faster Growth** 467

Preconditions for Economic Growth, 467

Policies to Achieve Faster Growth, 468

How Much Difference Can Policy Make? 469

CHECKPOINT 17.4 470**CHAPTER SUMMARY** 471**CHAPTER CHECKPOINT** 472**EYE on the U.S. ECONOMY**

The Lucas Wedge and the Okun Gap, 446

EYE on the GLOBAL ECONOMY

Potential GDP in the United States and European Union, 447

EYE on U.S. POTENTIAL GDP

Why Do Americans Earn More and Produce More Than Europeans? 454

EYE on the GLOBAL ECONOMY

Why Are Some Nations Rich and Others Poor? 458

EYE on YOUR LIFE

How You Influence and Are Influenced by Economic Growth, 465

**CHAPTER 18**
Money and the Monetary System 475**CHAPTER CHECKLIST** 475**18.1 What Is Money?** 476

Definition of Money, 476

The Functions of Money, 476

Money Today, 478

Official Measures of Money: M1 and M2, 478

Checks, Credit Cards, Debit Cards, and E-Checks, 479

An Embryonic New Money: E-Cash, 480

CHECKPOINT 18.1 481**18.2 The Banking System** 482

Commercial Banks, 482

Thrift Institutions, 485

Money Market Funds, 485

CHECKPOINT 18.2 486**18.3 The Federal Reserve System** 487

The Structure of the Federal Reserve, 487

The Fed's Policy Tools, 488

How the Fed's Policy Tools Work, 489

CHECKPOINT 18.3 490**18.4 Regulating the Quantity of Money** 491

Creating Deposits by Making Loans, 491

How Open Market Operations Change the Monetary Base, 493

The Multiplier Effect of an Open Market Operation, 496

The Money Multiplier, 497

CHECKPOINT 18.4 500**CHAPTER SUMMARY** 501**CHAPTER CHECKPOINT** 502**EYE on the PAST**

The "Invention" of Banking, 483

EYE on the U.S. ECONOMY

Commercial Banks Under Stress in the Financial Crisis, 485

EYE on YOUR LIFE

Money and Your Role in Its Creation, 491

■ **EYE on CREATING MONEY**

How Does the Fed Create Money and Regulate Its Quantity? 498

CHAPTER 19
Aggregate Supply and Aggregate Demand 505

CHAPTER CHECKLIST 505

19.1 Aggregate Supply 506
Aggregate Supply Basics, 506
Changes in Aggregate Supply, 509
CHECKPOINT 19.1 511

19.2 Aggregate Demand 512
Aggregate Demand Basics, 512
Changes in Aggregate Demand, 514
The Aggregate Demand Multiplier, 516
CHECKPOINT 19.2 517

19.3 Explaining Economic Trends and Fluctuations 518
Macroeconomic Equilibrium, 518
Three Types of Macroeconomic Equilibrium, 519
Economic Growth and Inflation Trends, 520
The Business Cycle, 521
Inflation Cycles, 522
Deflation and the Great Depression, 524
CHECKPOINT 19.3 526

CHAPTER SUMMARY 527

CHAPTER CHECKPOINT 528

■ **EYE on the U.S. ECONOMY**
U.S. Economic Growth, Inflation, and the Business Cycle 502

■ **EYE on YOUR LIFE**
Using the AS-AD Model 524

■ **EYE on the BUSINESS CYCLE**
Why Did the U.S. Economy Go into Recession in 2008? 525

Discretionary Fiscal Policy: Demand-Side Effects, 535
Discretionary Fiscal Policy: Supply-Side Effects, 537
Limitations of Discretionary Fiscal Policy, 539
Automatic Fiscal Policy, 540
Cyclical and Structural Budget Balances, 540
Schools of Thought and Cracks in Today's Consensus, 541

CHECKPOINT 20.1 543

20.2 The Federal Reserve and Monetary Policy 544

The Monetary Policy Process, 544
The Federal Funds Rate Target, 545
The Ripple Effects of the Fed's Actions, 546
Monetary Stabilization in the AS-AD Model, 548
The Fed Eases to Fight Recession, 548
Limitations of Monetary Stabilization Policy, 551
CHECKPOINT 20.2 552

CHAPTER SUMMARY 553

CHAPTER CHECKPOINT 554

■ **EYE on the PAST**
Federal Revenues, Outlays, Deficits, and Debt, 534

■ **EYE on the U.S. ECONOMY**
A Social Security and Medicare Time Bomb, 539

■ **EYE on the U.S. ECONOMY**
The U.S. Structural and Cyclical Budget Balances, 541

■ **EYE on the FISCAL STIMULUS**
Can Fiscal Stimulus End a Recession? 542

■ **EYE on THE FED IN A CRISIS**
Did the Fed Save Us From Another Great Depression? 550

■ **EYE on YOUR LIFE**
Fiscal and Monetary Policy and How They Affect You, 551

Glossary G-1

Index I-1

Credits C-1

CHAPTER 20
Fiscal Policy and Monetary Policy 531

CHAPTER CHECKLIST 531

20.1 The Federal Budget and Fiscal Policy 532
The Federal Budget, 532

Preface



Students know that throughout their lives they will make economic decisions and be influenced by economic forces. They want to understand the economic principles that can help them navigate these forces and guide their decisions. *Essential Foundations of Economics* is our attempt to satisfy this want.

The response to our earlier editions from hundreds of colleagues across the United States and throughout the world tells us that most of you agree with our view that to achieve its goals, the principles course must do four things well. It must

- Motivate with compelling issues and questions
- Focus on core ideas
- Steer a path between an overload of detail and too much left unsaid
- Encourage and aid learning by doing

The Foundations icon with its four blocks (on the cover and throughout the book) symbolizes this four-point approach that has guided all our choices in writing this text and creating its comprehensive teaching and learning supplements.

WHAT'S NEW IN THE SIXTH EDITION

The extraordinary events in the U.S. and global economies provide a rich display of economic forces in action through which students can be motivated to discover the economic way of thinking. The global financial crisis, slump, and faltering recovery; ongoing tensions that result from globalization and international outsourcing; the continued spectacular expansion of China and India in the information-age economy; enhanced concern about climate change; relentless pressure on the federal budget from the demands of an aging population and increased defense and homeland security expenditures; the dilemma posed by slow recovery and rising government debt; and the ever-growing federal budget deficit and national debt are just a few of these interest-arousing events. All of them feature at the appropriate points in our new edition, and the text and examples are all thoroughly updated to reflect the most recently available data and events.

Every chapter contains many small changes, all designed to enhance clarity and currency. We have also made a few carefully selected major changes that we describe below.

■ New Features

We have simplified the chapter openers to grab student attention and provide instant focus for the chapter. Each chapter opens with a question about a central issue that the chapter addresses and is illustrated with a carefully selected photograph. An *Eye On* box returns to and discusses the question and an end-of-chapter problem, that is also in the MyEconLab Homework and Test Manager, makes the issue available for assignment with automatic grading. This feature enables the student to get the point of the chapter quickly; ties the chapter together; and enables the instructor to focus on a core issue in class and for practice.

The Chapter Checkpoint (the last three pages of each chapter) has been thoroughly revised. The first page contains problems and applications for the student to work, which are replicated in the MyEconLab Study Plan. The second page contains problems and applications for the instructor to assign for homework, quiz, or test. Many of these problems and applications are new to the sixth edition and include mini case studies from recent news stories. The third page contains a short multiple choice quiz. This quiz, also available in MyEconLab for student practice, hits the high points of the chapter and enables students to test themselves on the types of questions they are likely to encounter on tests and exams.

The Checkpoints at the end of each major section of a chapter have been reorganized to separate practice with basic analysis and “In the News” applications. Worked solutions are provided for both types of questions.

■ Major Content Changes in Introductory Chapters

You’re in school! Did you make the right decision? Who makes the iPhone? Is wind power free? Why did the price of coffee soar in 2010 and 2011? These are the questions that motivate the four introductory chapters.

We reworked Chapter 1 to strengthen the explanation and illustration of the economic way of thinking by placing the student center stage and focusing on the decision to remain in school or get a full-time job. Our goal is to engage the student from the outset of the course, grab attention, and show the relevance of economics and its place in everyday life. We also revised and improved our explanation of the scientific method in economics.

Chapter 3 has a more gradual and fully illustrated explanation of the mutual gains from trade arising from comparative advantage and a new *Eye On* box on the power of specialization and trade through the classic story of the production of the pencil.

■ Major Content Changes in Micro Chapters (Parts 2 and 3)

What do you do when the price of gasoline rises? Should price gouging be illegal? Can the President repeal the laws of supply and demand? Who wins and who loses from globalization? How can we limit climate change? Does health care need fixing? Which store has the lower costs: Wal-Mart or 7-Eleven? Why did GM fail? Are Microsoft’s prices too high? Which cell phone? Are two

computer-chip makers two too few? These are the motivating questions and features of *Eye On* boxes and end-of chapter problems in the 9 micro chapters.

Overall, these chapters have been well-received and positively reviewed, so for the most part we have limited our changes to refinements and updating data and examples. Beyond these many smaller innovations, we have made two larger structural changes.

The first of these is a reorganization of the chapters that deal with externalities, public goods, and common resources. In the fifth edition, we covered public goods and positive externalities on one chapter and negative externalities and common resources in another. In the sixth edition, we have reverted to our earlier organization of this material. Chapter 9 explains all types of externalities. It explains negative externalities, illustrated with pollution, and positive externalities, illustrated with knowledge (education and research). A new *Eye On* features Caroline Hoxby's research on charter schools and vouchers. This chapter also explains health-care markets and public health externalities. The U.S. health-care market is compared with those in other countries and Laurence Kotlikoff's voucher-based "Medicare Part C for All" is described.

■ Major Content Changes in Macro Chapters (Parts 4 and 5)

The macroeconomic events and debates triggered by the 2007 global financial crisis, the 2008–2009 recession, the stubbornly slow recovery, and the headwinds of the European debt problems of 2011 permeate the macro chapters, all of which have been radically updated and revised. Policy features at every possible opportunity throughout these chapters.

How do we track our economy's booms and busts? How long does it take to find a job? Which movie *really* was the biggest box office hit? Why do Americans earn more and produce more than Europeans? Why are some nations rich and others poor? How does the Fed create money and regulate its quantity? Why did the U.S. economy go into recession in 2008? Can fiscal stimulus end a recession? Did the Fed save us from another Great Depression? These are the motivating questions and features of *Eye On* boxes and end-of-chapter problems in the 7 macro chapters.

Our macro coverage, like our micro, has been generally well-received, so again we have limited most of our revision to refining explanations and ensuring that our coverage is thoroughly up-to-date.

Beyond this careful updating and fine-tuning, we have made five more substantial change in the macro chapters. First, in Chapter 17 "Potential GDP and Economic Growth," we have thoroughly revised the section on labor productivity growth. We have built the explanation of the effects on labor productivity around the productivity curve—the relationship between real GDP per hour of labor and capital per hour of labor. This change makes our treatment more mainstream and less reliant on the preceding chapter and potential GDP. It also makes the contrast between the effects of capital accumulation and technological change more vivid.

Second, in Chapter 18 "Money and the Monetary System," we include a description of QE2 and "operation twist."

Third, in Chapter 19 "Aggregate Supply and Aggregate Demand," we have revised and developed a more graphic application section that shows how the

AS-AD model explains economic growth, inflation, and the business cycle. This chapter also has a new explanation of “demand-pull” and “cost-push” inflation cycles. These applications and exercises using the *AS-AD* model provide additional practice in working with the model and show its relevance to the U.S. economy today.

Fourth, in Chapter 20 “Fiscal Policy and Monetary Policy,” we have provided a new section that explains the distinction between a structural deficit and a cyclical deficit.

THE FOUNDATIONS VISION

■ Focus on Core Concepts

Each chapter of *Foundations* concentrates on a manageable number of main ideas (most commonly three or four) and reinforces each idea several times throughout the chapter. This patient, confidence-building approach guides students through unfamiliar terrain and helps them to focus their efforts on the most important tools and concepts of our discipline.

■ Many Learning Tools for Many Learning Styles

Foundations’ integrated print and electronic package builds on the basic fact that students have a variety of learning styles. In MyEconLab, students have a powerful tool at their fingertips: They can complete all Checkpoint problems online and get instant feedback, work interactive graphs, assess their skills by taking Practice Tests, and receive a personalized Study Plan, and step-by-by help through the feature called “Help Me Solve This.”

■ Diagrams That Tell the Whole Story

We developed the style of our diagrams with extensive feedback from faculty focus group participants and student reviewers. All of our figures make consistent use of color to show the direction of shifts and contain detailed, numbered captions designed to direct students’ attention step-by-step through the action. Because beginning students of economics are often apprehensive about working with graphs, we have made a special effort to present material in as many as three ways—with graphs, words, and tables—in the same figure. In an innovation that seems necessary, but is to our knowledge unmatched, nearly all of the information supporting a figure appears on the same page as the figure itself. No more flipping pages back and forth!

■ Real-World Connections That Bring Theory to Life

Students learn best when they can see the purpose of what they are studying, apply it to illuminate the world around them, and use it in their lives.

Eye On boxes offer fresh new examples to help students see that economics is everywhere. Current and recent events appear in *Eye On the U.S. Economy* boxes; we place current U.S. economic events in global and historical perspectives in our *Eye on the Global Economy* and *Eye on the Past* boxes; and we show how students can use economics in day-to-day decisions in *Eye On Your Life* boxes.

The *Eye On* boxes that build off of the chapter-opening question help students see the economics behind key issues facing our world and highlight a major aspect of the chapter's story.

ORGANIZATION

We have organized the sequence of material and chapters in what we think is the most natural order in which to cover the material. But we recognize that there are alternative views on the best order. We have kept this fact and the need for flexibility firmly in mind throughout the text. Many alternative sequences work, and the Flexibility Chart on p. xxxiii explains the alternative pathways through the chapters. In using the flexibility information, keep in mind that the best sequence is the one in which we present the material. And even chapters that the flexibility chart identifies as strictly optional are better covered than omitted.

MYECONLAB

MyEconLab

MyEconLab has been designed and refined with a single purpose in mind: to create those moments of understanding that transform the difficult into the clear and obvious. With comprehensive homework, quiz, test, and tutorial options, instructors can manage all their assessment needs in one program.

- All of the Checkpoint and Chapter Checkpoint Problems and Applications are assignable and automatically graded in MyEconLab.
- Extra problems and applications, including algorithmic, draw-graph, and numerical exercises are available for student practice or instructor assignment.
- Problems and applications that use real-time data continuously update.
- Test Item File questions are available for assignment as homework.
- Custom Exercise Builder gives instructors the flexibility of creating their own problems for assignment.
- Gradebook records each student's performance and time spent on the Tests and Study Plan and generates reports by student or by chapter.

Real-Time Data The real-time data problems are new. These problems load the latest available data from FRED, a comprehensive up-to-date data set maintained by the Federal Reserve Bank of St Louis. The questions are graded with feedback in exactly the same way as those based on static data.

Experiments in MyEconLab Experiments are a fun and engaging way to promote active learning and mastery of important economic concepts. Pearson's Experiments program is flexible and easy for instructors and students to use.

- Single-player experiments allow your students to play against virtual players from anywhere at anytime so long as they have an internet connection.
- Multiplayer experiments allow you to assign and manage a real-time experiment with your class.
- Pre and post-questions for each experiment are available for assignment in MyEconLab.

For a complete list of available experiments, visit www.myeconlab.com

Economics in the News Economics in the News is a turn-key solution to bringing daily news into the classroom. Updated daily during the academic year, the authors upload two relevant articles (one micro, one macro) and provide discussion questions.

Videos A comprehensive suite of ABC news videos, which address current topics such as education, energy, Federal Reserve policy, and business cycles, is available for classroom use. Video-specific exercises are available for instructor assignment.

AACSB and Learning Outcomes All end-of-chapter and Test Item File questions are tagged in two ways: to AACSB standards and to discipline-specific Learning Outcomes. These two separate tagging systems allow professors to build assessments around desired departmental and course outcomes and track results in MyEconLab's gradebook.

We are the authors of the MyEconLab content for *Essential Foundations of Economics* and have worked hard to ensure that it is tightly integrated with the book's content and vision. For more information, visit the online demonstration at www.myeconlab.com.

MyEconLab Also Includes

- Enhanced Pearson eText, available within the online course materials and offline via an iPad app, allows instructors and students to highlight, bookmark, and take notes.
- Advanced Communication Tools enable students and instructors communication through email, discussion board, chat, and ClassLive.
- Customization options provide new and enhanced ways to share documents, add content, and rename menu items.
- Prebuilt courses offer a turn-key way for instructors to create a course that includes pre-built assignments distributed by chapter.
- Temporary Access for students who are awaiting financial aid provides a seventeen-day grace period of temporary access.
- One Place for students to access all their MyLab Courses. Students and instructors can register, create, and access all of their courses, regardless of discipline, from one convenient online location: www.pearsonmylab.com.

SUPPORT MATERIALS FOR INSTRUCTORS AND STUDENTS

Essential Foundations of Economics is accompanied by the most comprehensive set of teaching and learning tools ever assembled. Each component of our package is organized by Checkpoint topic for a tight, seamless integration with both the textbook and the other components. In addition to authoring the MyEconLab and PowerPoint content, we have helped in the reviewing and revising of the Study Guide, Solutions Manual, Instructor's Manual, and Test Item Files to ensure that every element of the package achieves the consistency that students and teachers need.

■ Study Guide

Mark Rush of the University of Florida has prepared the Study Guide, which is available in both print and electronic formats in MyEconLab. It provides an expanded Chapter Checklist that enables the student to break the learning tasks

down into smaller, bite-sized pieces; self-test materials; and additional practice problems. The Study Guide has been carefully coordinated with the text, MyEconLab, and the Test Item Files.

■ Solutions Manual

The Solutions Manual, written by Mark Rush, and checked for accuracy by Jeannie Gillmore, contains the solutions to all the Checkpoint Practice Problems and Chapter Checkpoint Problems and Applications. It is available for download in Word and PDF formats.

■ Instructor's Manual

The Instructor's Manual, written by Luke Armstrong and edited by Mark Rush, contains chapter outlines and road maps, additional exercises with solutions, a comprehensive Chapter Lecture resource, and a virtual encyclopedia of suggestions on how to enrich class presentation and use class time efficiently. Both the micro and macro portions have been updated to reflect changes in the main text as well as infused with a fresh and intuitive approach to teaching this course. It is available for download in Word and PDF formats.

■ Three Test Item Files and TestGen

More than 7,000 multiple-choice, numerical, fill-in-the-blank, short answer, essay, and integrative questions make up the three Test Item Files that support *Essentials Foundations of Economics*. Mark Rush reviewed and edited questions from four dedicated principles instructors to form one of the most comprehensive testing systems on the market. Our microeconomics authors are Carol Dole (Jacksonville University); Luke Armstrong (Lee College); and Fola Odebunmi (Cypress College). Our macroeconomics questions were written by Carol Dole and Homer Guevara, Jr. (Northwest Vista College). The entire set of questions is available for download in Word, PDF, and TestGen formats.

All three Test Item Files are available in test generator software (TestGen with QuizMaster). TestGen's graphical interface enables instructors to view, edit, and add questions; transfer questions to tests; and print different forms of tests. Instructors also have the option to reformat tests with varying fonts and styles, margins, and headers and footers, as in any word-processing document. Search and sort features let the instructor quickly locate questions and arrange them in a preferred order. QuizMaster, working with your school's computer network, automatically grades the exams, stores the results on disk, and allows the instructor to view and print a variety of reports.

■ PowerPoint Resources

We have created the PowerPoint resources based on our 20 years of experience using this tool in our own classrooms. Six sets of PowerPoint presentations are available:

- Lecture notes with full-color, animated figures, and tables from the textbook
- Figures and tables from the textbook, animated with step-by-step walk-through for instructors to use in their own personal slides.
- Eye On features

- Checkpoint Practice Problems and solutions
- Alternative lecture notes with full-color, animated figures and tables that use examples different from those in the textbook
- Clicker-enabled slides for your Personal Response System. The slides consist of 10 multiple choice questions from the Study Guide for each chapter. You can use these in class to encourage active learning.

■ Instructor's Resource Disk

This disk contains the Instructor's Manual, Solutions Manual, and Test Item Files in Word and PDF formats. It also contains the Computerized Test Item Files (with a TestGen program installer) and Powerpoint resources. It is compatible with both Windows and Macintosh operating systems.

For your convenience, all instructor resources are also available online via our centralized supplements Web site, the Instructor Resource Center (www.pearsonhighered.com/irc). For access or more information, contact your local Pearson representative or request access online at the Instructor Resource Center.

ACKNOWLEDGMENTS

Working on a project such as this one generates many debts that can never be repaid. But they can be acknowledged, and it is a special pleasure to be able to do so here and to express our heartfelt thanks to each and every one of the following long list, without whose contributions we could not have produced *Foundations*.

Mark Rush again coordinated, managed, and contributed to our Study Guide, Solutions Manual, Instructor's Manual, and Test Item Files. He assembled, polished, wrote, and rewrote these materials to ensure their close consistency with the text. He and we were in constant contact as all the elements of our text and package came together. Mark also made many valuable suggestions for improving the text and the Checkpoint Problems. His contribution went well beyond that of a reviewer, and his effervescent sense of humor kept us all in good spirits along the way.

Working closely with Mark, Luke Armstrong wrote content for the Instructor's Manual. Carol Dole, Luke Armstrong, Fola Odeunmi and Homer Guevara, Jr. authored new questions for the Test Item Files.

The ideas that ultimately became *Foundations* began to form over dinner at the Andover Inn in Andover, Massachusetts, with Denise Clinton and Sylvia Mallory. We gratefully acknowledge Sylvia's role not only at the birth of this project but also in managing its initial development team. Denise has been our ongoing inspiration for more than 10 years. She is the most knowledgeable economics editor in the business, and we are privileged to have the benefit of her enormous experience.

The success of *Foundations* owes much to its outstanding Sponsoring Editor, Adrienne D'Ambrosio. Adrienne's acute intelligence and sensitive understanding of the market have helped sharpen our vision of this text and package. Her value-added on this project is huge. It has been, and we hope it will for many future editions remain, a joy to work with her.

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Jonathan Boylan created the new impressive cover design and converted the raw ideas of our brainstorming into an outstandingly designed text.

Susan Schoenberg, Media Director, Denise Clinton, Media Publisher, Melissa Honig, Senior Media Producer, and Noel Lotz, MyEconLab Content Lead have set a new standard for online learning and teaching resources. Building on the pioneering work of Michelle Neil, Susan worked creatively to improve our technology systems. Melissa managed the building of MyEconLab, and Noel provided reviews of the content. They have all been sources of high energy, good sense, and level-headed advice and quickly found creative solutions to all our technology problems.

Nancy Freihofer, our outstanding, ever calm, Project Manager, worked with a talented team at Integra, Project Editor, Heather Johnson, and designer, art coordinator, and typesetter. Our copy editor, Catherine Baum, gave our work a thorough review and helpful polish, and our proofreader ensured the most error-free text we have yet produced.

Our Executive Marketing Manager, Lori DeShazo, has been a constant source of good judgment and sound advice on content and design issues, ranging over the entire package from text to print and electronic supplements. Dave Theisen reviewed our previous edition and gave excellent advice (much of which we have taken) on areas that needed adjusting to achieve the clarity that we seek.

Richard Parkin, our technical illustrator, created the figures in the text, the dynamic figures in the eText, and the animated figures in the PowerPoint presentations and contributed many ideas to improve the clarity of our illustrations. Laurel Davies provided painstakingly careful work on MyEconLab questions and acted as one of its accuracy checkers.

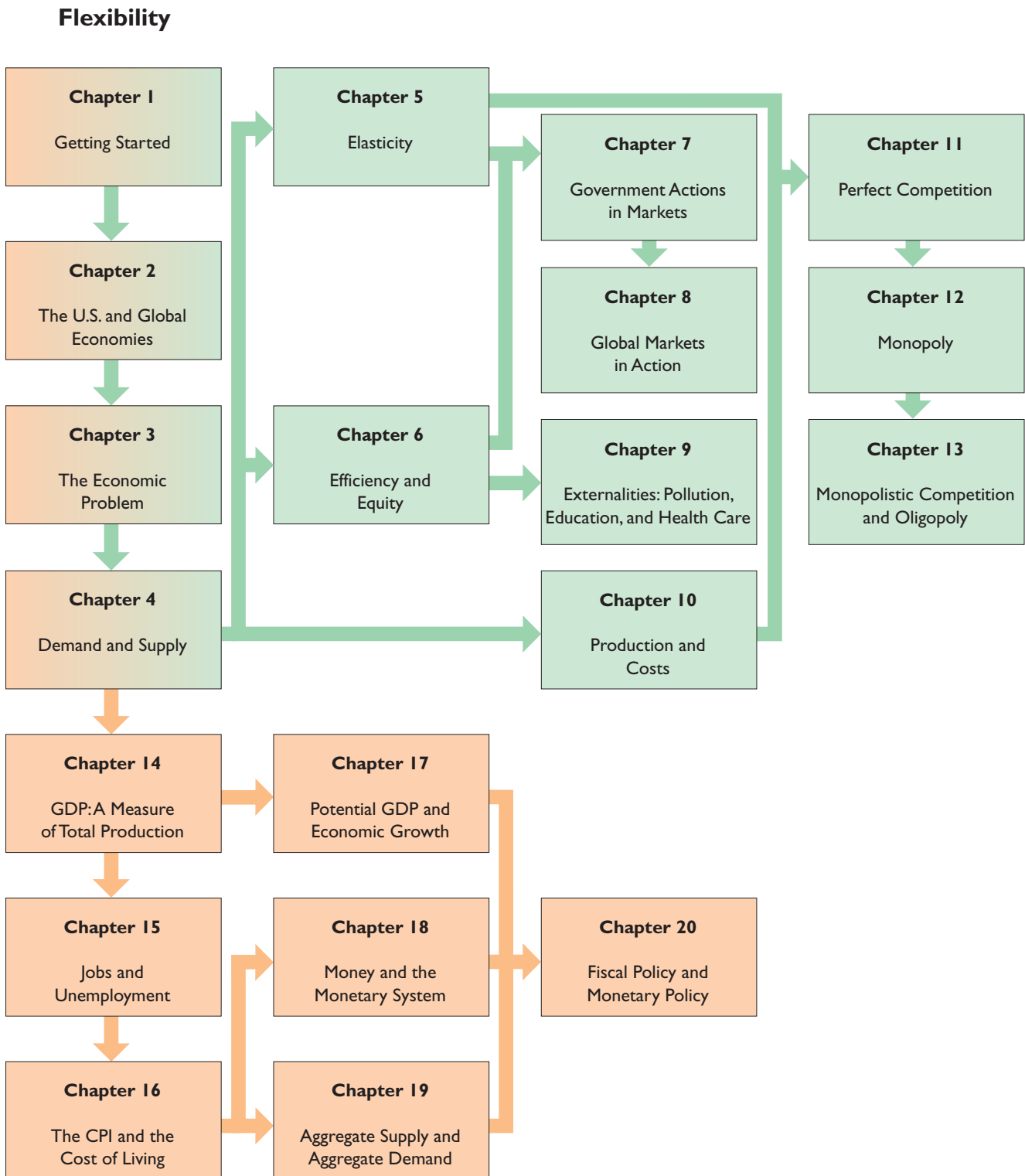
Jeannie Gillmore, our personal assistant, worked closely with us in creating MyEconLab exercises and guided solutions.

Finally, our reviewers, whose names appear on the following pages, have made an enormous contribution to this text and MyEconLab resources. Once again we find ourselves using superlatives, but they are called for. In the many texts that we've written, we've not seen reviewing of the quality that we enjoyed on this revision. It has been a pleasure (if at times a challenge) to respond constructively to their many excellent suggestions.

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ESSENTIAL FOUNDATIONS OF ECONOMICS: FLEXIBILITY CHART



Start here ...

... then jump to any of these ...

... and jump to any of these after doing the prerequisites indicated

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You're in school!
Did you make the right decision?

Getting Started

When you have completed your study of this chapter, you will be able to

- 1 Define economics and explain the kinds of questions that economists try to answer.
- 2 Explain the ideas that define the economic way of thinking.



CHAPTER CHECKLIST

1.1 DEFINITION AND QUESTIONS

We all want more than we can get. We want good health and long lives. We want spacious and comfortable homes. We want running shoes and jet skis. We want the time to enjoy our favorite sports, video games, novels, music, and movies; to travel to exotic places; and just to hang out with friends. Human wants exceed the resources available to satisfy them, and this fact is the source of all economic questions and problems.

■ Scarcity

Our inability to satisfy all our wants is called **scarcity**. The ability of each of us to satisfy our wants is limited by the time we have, the incomes we earn, and the prices we pay for the things we buy. These limits mean that everyone has unsatisfied wants. The ability of all of us as a society to satisfy our wants is limited by the productive resources that exist. These resources include the gifts of nature, our labor and ingenuity, and the tools and equipment that we have made.

Everyone, poor and rich alike, faces scarcity. A student wants Beyoncé's latest album and a paperback but has only \$10.00 in his pocket. He faces scarcity. Brad Pitt wants to spend a week in New Orleans discussing plans for his new eco-friendly housing and he also wants to spend the week promoting his new movie. He faces scarcity. The U.S. government wants to increase defense spending and cut taxes. It faces scarcity. An entire society wants improved health care, an Internet connection in every classroom, an ambitious space exploration program, clean lakes and rivers, and so on. Society faces scarcity.

Faced with scarcity, we must make choices. We must choose among the available alternatives. The student must choose the album or the paperback. Brad Pitt must choose New Orleans or promoting his new movie. The government must choose defense or tax cuts. And society must choose among health care, computers, space exploration, the environment, and so on. Even parrots face scarcity!

■ Economics Defined

Economics is the social science that studies the choices that individuals, businesses, governments, and entire societies make as they cope with *scarcity*, the *incentives* that influence those choices, and the arrangements that coordinate them.

The subject has two broad parts:

- Microeconomics, and
- Macroeconomics

Microeconomics

Microeconomics is the study of the choices that individuals and businesses make and the way these choices interact and are influenced by governments. Some examples of microeconomic questions are: Will you buy a 3-D television or a standard one? Will Nintendo sell more units of Wii if it cuts the price? Will a cut in the income tax rate encourage people to work longer hours? Will a hike in the gas tax encourage more people to drive hybrid or smaller automobiles? Are MP3 downloads killing CDs?

Scarcity

The condition that arises because wants exceed the ability of resources to satisfy them.



Not only do I want a cracker—we all want a cracker!

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Economics

The social science that studies the choices that individuals, businesses, governments, and entire societies make as they cope with *scarcity*, the *incentives* that influence those choices, and the arrangements that coordinate them.

Microeconomics

The study of the choices that individuals and businesses make and the way these choices interact and are influenced by governments.

Macroeconomics

Macroeconomics is the study of the aggregate (or total) effects on the national economy and the global economy of the choices that individuals, businesses, and governments make. Some examples of macroeconomic questions are: Why did production and jobs expand slowly in the United States during 2010 and 2011? Why are incomes growing much faster in China and India than in the United States? Why are production and incomes stagnating in Japan? Why are Americans borrowing more than \$2 billion a day from the rest of the world?

Two big questions provide a useful summary of the scope of economics:

- How do choices end up determining *what, how, and for whom* goods and services get produced?
- When do choices made in the pursuit of *self-interest* also promote the *social interest*?

■ What, How, and For Whom?

Goods and services are the objects and actions that people value and produce to satisfy human wants. Goods are *objects* that satisfy wants. Running shoes and ketchup are examples. Services are *actions* that satisfy wants. Haircuts and rock concerts are examples. We produce a dazzling array of goods and services that range from necessities such as food, houses, and health care to leisure items such as Blu-ray players and roller coaster rides.

What?

What determines the quantities of corn we grow, homes we build, and health-care services we produce? Sixty years ago, 25 percent of Americans worked on a farm. That number has shrunk to less than 3 percent today. Over the same period, the number of people who produce goods—in mining, construction, and manufacturing—has also shrunk, from 30 percent to 20 percent. The decrease in farming and the production of goods is matched by an increase in the production of services. How will these quantities change in the future as ongoing changes in technology make an ever-wider array of goods and services available to us?

How?

How are goods and services produced? In a vineyard in France, basket-carrying workers pick the annual grape crop by hand. In a vineyard in California, a huge machine and a few workers do the same job that a hundred grape pickers in France do. Look around you and you will see many examples of this phenomenon—the same job being done in different ways. In some stores, checkout clerks key in prices. In others, they use a laser scanner. One farmer keeps track of his livestock feeding schedules and inventories by using paper-and-pencil records, while another uses a computer. GM hires workers to weld auto bodies in some of its plants and uses robots to do the job in others.

Why do we use machines in some cases and people in others? Do mechanization and technological change destroy more jobs than they create? Do they make us better off or worse off?

Macroeconomics

The study of the aggregate (or total) effects on the national economy and the global economy of the choices that individuals, businesses, and governments make.

Goods and services

The objects (goods) and the actions (services) that people value and produce to satisfy human wants.



In a California vineyard a machine and a few workers do the same job as a hundred grape pickers in France.



A doctor gets more of the goods and services produced than a nurse or a medical assistant gets.

For Whom?

For whom are goods and services produced? The answer to this question depends on the incomes that people earn and the prices they pay for the goods and services they buy. At given prices, a person who has a high income is able to buy more goods and services than a person who has a low income. Doctors earn much higher incomes than do nurses and medical assistants, so doctors get more of the goods and services produced than nurses and medical assistants get.

You probably know about many other persistent differences in incomes. Men, on average, earn more than women. Whites, on average, earn more than minorities. College graduates, on average, earn more than high school graduates. Americans, on the average, earn more than Europeans, who in turn earn more, on average, than Asians and Africans. But there are some significant exceptions. The people of Japan and Hong Kong now earn an average income similar to that of Americans. And there is a lot of income inequality throughout the world.

What determines the incomes we earn? Why do doctors earn larger incomes than nurses? Why do men earn more, on average, than women? Why do college graduates earn more, on average, than high school graduates? Why do Americans earn more, on average, than Africans?

Economics explains how the choices that individuals, businesses, and governments make and the interactions of those choices end up determining *what*, *how*, and *for whom* goods and services get produced. In answering these questions, we have a deeper agenda in mind. We're not interested in just knowing how many Blu-ray players get produced, how they get produced, and who gets to enjoy them. We ultimately want to know the answer to the second big economic question that we'll now explore.

■ When Is the Pursuit of Self-Interest in the Social Interest?

Every day, you and 311 million other Americans, along with 7 billion people in the rest of the world, make economic choices that result in "*what*," "*how*," and "*for whom*" goods and services are produced.

Are the goods and services produced, and the quantities in which they are produced, the right ones? Do the scarce resources get used in the best possible way? Do the goods and services that we produce go to the people who benefit most from them?

Self-Interest and the Social Interest

Choices that are the best for the individual who makes them are choices made in the pursuit of **self-interest**. Choices that are the best for society as a whole are said to be in the **social interest**. The social interest has two dimensions: *efficiency* and *equity*. We'll explore these concepts in later chapters. For now, think of efficiency as being achieved by baking the biggest possible pie, and think of equity as being achieved by sharing the pie in the fairest possible way.

You know that your own choices are the best ones for you—or at least you *think* they're the best at the time that you make them. You use your time and other resources in the way that makes most sense to you. But you don't think much about how your choices affect other people. You order a home delivery pizza because you're hungry and want to eat. You don't order it thinking that the delivery person or the cook needs an income. You make choices that are in your self-interest—choices that you think are best for you.

Self-interest

The choices that are best for the individual who makes them.

Social interest

The choices that are best for society as a whole.

When you act on your economic decisions, you come into contact with thousands of other people who produce and deliver the goods and services that you decide to buy or who buy the things that you sell. These people have made their own decisions—what to produce and how to produce it, whom to hire or whom to work for, and so on.

Like you, everyone else makes choices that they think are best for them. When the pizza delivery person shows up at your home, he's not doing you a favor. He's earning his income and hoping for a good tip.

Could it be possible that when each one of us makes choices that are in our own best interest—our self-interest—it turns out that these choices are also the best for society as a whole—in the social interest?

Much of the rest of this book helps you to learn what economists know about this question and its answer. To help you start thinking about the question, we're going to illustrate it with four topics that generate heated discussion in today's world. You're already at least a little bit familiar with each one of them. They are

- Globalization
- The Information Age
- Climate change
- A Social Security time bomb

Globalization

Globalization—the expansion of international trade and the production of components and services by firms in other countries—has been going on for centuries. But in recent years, its pace accelerated. Microchips, satellites, and fiber-optic cables have lowered the cost of communication. A video-conference of people who live 10,000 miles apart has become an everyday and easily affordable event.

This explosion of communication has globalized production decisions. When Nike produces more sports shoes, people in Malaysia get more work. When Steven Spielberg wants an animation sequence for a new movie, programmers in New Zealand write the code. And when China Airlines wants a new airplane, Americans who work for Boeing build it.

Globalization is bringing rapid income growth, especially in Asia. China, already the world's second largest economy, will become the largest in the 2020s.

But globalization is leaving some people behind. Jobs in manufacturing and routine services are shrinking in the United States and Europe. And the nations of Africa and parts of South America are not sharing in the prosperity that globalization is bringing to other parts of the world.

The owners of multinational firms benefit from lower production costs and consumers benefit from low-cost imported goods. But don't displaced American workers lose? And doesn't even the worker in Malaysia, who sews your new shoes for a few cents an hour, also lose? Is globalization in the social interest, or does globalization just benefit some at the expense of others?

The Information Age

We are living at a time of extraordinary economic change that has been called the *Information Revolution*. This name suggests a parallel with the *Industrial Revolution* that occurred around 1800 and the *Agricultural Revolution* of 12,000 years ago.

The changes that occurred during the last 25 years were based on one major technology: the microprocessor or computer chip. The spin-offs from faster and



Workers in Asia make our shoes.



The computer chip has transformed our lives.

cheaper computing have been widespread in telecommunications, music and movie recording, and the automation of millions of routine tasks that previously required human decision and action. You encounter these automated tasks every day when you check out at the grocery store, use an ATM, or call a government department or large business. All the new products and processes and the low-cost computing power that made them possible resulted from people pursuing their self-interest. They did not result from any grand design or government plan.

When Gordon Moore set up Intel and started making chips, and Bill Gates quit Harvard to set up Microsoft, they weren't thinking how much easier it would be for you to turn in your essay on time if you had a better computer. Moore and Gates and thousands of other entrepreneurs were in hot pursuit of the big payoffs that many of them achieved. Yet their actions made many other people better off. They advanced the social interest.

But were resources used in the best possible way? Or did Intel and Microsoft set their prices too high and put their products out of reach for too many people? And did they really need to be rewarded with billions of dollars?

Climate Change

The Earth is getting hotter and the ice at the two poles is melting. Since the late nineteenth century, the Earth's surface temperature has increased about 1 degree Fahrenheit, and close to a half of that increase occurred over the past 25 years.

Most climate scientists believe that the current warming has come at least in part from human economic activity—from self-interested choices—and that, if left unchecked, the warming will bring large future economic costs.

Are the choices that each of us makes to use energy damaging the social interest? What needs to be done to make our choices serve the social interest? Would the United States joining with other nations to limit carbon emissions serve the social interest? What other measures might be introduced?



Human activity is raising the Earth's temperature.



A Social Security time bomb is ticking as benefits grow faster than contributions.

A Social Security Time Bomb

Every year since 2001, the U.S. government has run a budget deficit. On average, the government has spent \$1.8 billion a day more than it has received in taxes. The government's debt has increased each day by that amount. Over the ten years 2002 through 2011, government debt increased by \$6.5 trillion. Your personal share of this debt is \$21,600.

Also, since 2001, Americans bought goods and services from the rest of the world in excess of what foreigners have bought from the United States to the tune of \$5.7 trillion. To pay for these goods and services, Americans borrowed from the rest of the world.

These large deficits are just the beginning of an even bigger problem. From about 2019 onwards, the retirement and health-care benefits to which older Americans are entitled are going to cost increasingly more than current taxes can cover. With no changes in taxes or benefit rates, the deficit and debt will swell ever higher.

Deficits and the debts they create cannot persist indefinitely, and debts must somehow be repaid. They will most likely be repaid by you, not by your parents. When we make our voter choices and our choices to buy from or sell to the rest of the world, we pursue our self-interest. Do our choices serve the social interest?

We'll return to all these questions at various points throughout this text.

CHECKPOINT 1.1

Define economics and explain the kinds of questions that economists try to answer.

MyEconLab

You can work these problems in Study Plan 1.1 and get instant feedback.

Practice Problems

1. Economics studies choices that arise from one fact. What is that fact?
2. Provide three examples of wants in the United States today that are especially pressing but not satisfied.
3. In the following three news items, find examples of the *what*, *how*, and *for whom* questions: “With more research, we will cure cancer”; “A good education is the right of every child”; “Congress raises taxes to curb the deficit.”
4. How does a new Starbucks in Beijing, China, influence self-interest and the social interest?
5. How does Facebook influence self-interest and the social interest?

In the News

1. According to the Bureau of Labor Statistics (BLS), high-paying jobs in health care and jobs in leisure, hospitality, and education will expand quickly over the next five years. How does the BLS expect *what* and for *whom* goods and services are produced to change in the next five years?
2. In May 2011, businesses cut hiring because higher prices of gas pushed up costs and higher food prices forced consumers to cut spending.

Source: CNNMoney, June 4, 2011

Did businesses and consumers act in their self-interest or the social interest?

Solutions to Practice Problems

1. The fact is scarcity—human wants exceed the resources available.
2. Security from international terrorism, cleaner air in our cities, better public schools. (You can perhaps think of some more.)
3. More research is a *how* question, and a cure for cancer is a *what* question. Good education is a *what* question, and every child is a *for whom* question. Raising taxes is a *for whom* question.
4. Decisions made by Starbucks are in Starbucks’ self-interest but they serve the self-interest of its customers and so contribute to the social interest.
5. Facebook serves the self-interest of its investors, users, and advertisers. It also serves the social interest by enabling people to share information.

Solutions to In the News

1. The BLS expects the goods and services produced by workers in health care, leisure, hospitality, and education to increase. For whom goods and services are produced are the people who work in these expanding industries.
2. Businesses made their decisions on the basis of their costs, so they acted in their self-interest. Consumers’ decisions to cut spending was made on the basis of the prices they face, so they acted in their self-interest.

1.2 THE ECONOMIC WAY OF THINKING

The definition of economics and the kinds of questions that economists try to answer give you a flavor of the scope of economics. But they don't tell you how economists *think* about these questions and how they go about seeking answers to them. You're now going to see how economists approach their work.

We'll break this task into two parts. First, we'll explain the ideas that economists use to frame their view of the world. These ideas will soon have you thinking like an economist. Second, we'll look at economics both as a social science and as a policy tool that governments, businesses, and *you* can use.

■ Economic Ideas

Six ideas define the *economic way of thinking*:

- A choice is a *tradeoff*
- People make *rational choices* by comparing benefits and costs.
- *Benefit* is what you gain from something.
- *Cost* is what you *must give up* to get something.
- Most choices are "*how much*" choices made at the *margin*.
- Choices respond to *incentives*.

■ A Choice Is a Tradeoff

Because we face scarcity, we must make choices. And when we make a choice, we select from the available alternatives. For example, you can spend Saturday night studying for your next economics test or having fun with your friends, but you can't do both of these activities at the same time. You must choose how much time to devote to each. Whatever choice you make, you could have chosen something else.

You can think about your choices as tradeoffs. A **tradeoff** is an exchange—giving up one thing to get something else. When you choose how to spend your Saturday night, you face a tradeoff between studying and hanging out with your friends.

■ Rational Choice

The most basic idea of economics is that in making choices, people act rationally. A **rational choice** is one that uses the available resources to best achieve the objective of the person making the choice.

Only the wants and preferences of the person making a choice are relevant to determine its rationality. For example, you might like chocolate ice cream more than vanilla ice cream, but your friend prefers vanilla. So it is rational for you to choose chocolate and for your friend to choose vanilla.

A rational choice might turn out not to have been the best choice after the event. For example, a farmer might decide to plant wheat rather than soybeans. Then, when the crop comes to market, the price of soybeans might be much higher than the price of wheat. The farmer's choice was rational when it was made, but subsequent events made it less profitable than the alternative choice.

The idea of rational choice provides an answer to the first economic question: What goods and services will be produced and in what quantities? The answer is: The goods and services that people rationally choose to buy.

Tradeoff

An exchange—giving up one thing to get something else.

Rational choice

A choice that uses the available resources to best achieve the objective of the person making the choice.

But how do people choose rationally? Why have most people chosen to buy Microsoft’s Windows operating system rather than another? Why do more people today choose an iPhone rather than a BlackBerry? Why has the U.S. government chosen to fund the building of an interstate highway system and not an interstate high-speed railroad system?

The answer is that we make rational choices by comparing *benefits* and *costs*.

■ Benefit: What You Gain

The **benefit** from something is the gain or pleasure that it brings and is determined by personal *preferences*—by what a person likes and dislikes and the intensity of those feelings. If you get a huge kick out of “Guitar Hero,” that video game brings you a large benefit. And if you have little interest in listening to Yo Yo Ma playing a Vivaldi cello concerto, that activity brings you a small benefit.

Some benefits are large and easy to identify, such as the benefit that you get from being in school. A big piece of that benefit is the goods and services that you will be able to enjoy with the boost to your earning power when you graduate. Some benefits are small, such as the benefit you receive from a slice of pizza.

Economists measure benefit as the most that a person is *willing to give up* to get something. You are willing to give up a lot to be in school. But you would give up only an iTunes download for a slice of pizza.

■ Cost: What You Must Give Up

The **opportunity cost** of something is the best alternative that must be given up to get it.

To make the idea of opportunity cost concrete, think about your opportunity cost of being in school. It has two components: the things you can’t afford to buy and the things you can’t do with your time.

Start with the things you can’t afford to buy. You’ve spent all your income on tuition, residence fees, books, and a laptop. If you weren’t in school, you would have spent this money on tickets to ball games and movies and all the other things that you enjoy. But that’s only the start of the things you can’t afford to buy because you’re in school. You’ve also given up the opportunity to get a job and buy the things that you could afford with your higher income. Suppose that the best job you could get if you weren’t in school is working at Citibank as a teller

Benefit

The benefit of something is the gain or pleasure that it brings.

Opportunity cost

The opportunity cost of something is the best thing you *must* give up to get it.



For these students, the opportunity cost of being in school is worth bearing.



For the full-time bank teller, the opportunity cost of remaining in school is too high.

earning \$24,000 a year. Another part of your opportunity cost of being in school is all the things that you could buy with that extra \$24,000.

As you well know, being a student eats up many hours in class time, doing homework assignments, preparing for tests, and so on. To do all these school activities, you must give up many hours of what would otherwise be leisure time spent with your friends.

So the opportunity cost of being in school is the best alternative things that you can't afford and don't have the spare time to enjoy. You might want to put a dollar value on that cost or you might just list all the items that make up the opportunity cost.

The examples of opportunity cost that we've just considered are *all-or-nothing costs*—you're either in school or not in school. Most situations are not like this one. They involve choosing *how much* of an activity to do.

■ How Much? Choosing at the Margin

You can allocate the next hour between studying and instant messaging your friends, but the choice is not all or nothing. You must decide how many minutes to allocate to each activity. To make this decision, you compare the benefit of a little bit more study time with its cost—you make your choice *at the margin*.

Other words for “margin” are “border” or “edge.” You can think of a choice at the margin as one that adjusts the border or edge of a plan to determine the best course of action. Making a choice at the **margin** means comparing the relevant alternatives systematically and incrementally.

Marginal Cost

The opportunity cost of a one-unit increase in an activity is called **marginal cost**. The marginal cost of something is what you *must* give up to get *one additional* unit of it. Think about your marginal cost of going to the movies for a third time in a week. Your marginal cost of seeing the movie is what you must give up to see that one additional movie. It is *not* what you give up to see all three movies. The reason is that you've already given up something for two movies, so you don't count that cost as resulting from the decision to see the third movie.

The marginal cost of any activity increases as you do more of it. You know that going to the movies decreases your study time and lowers your grade. Suppose that seeing a second movie in a week lowers your grade by five percentage points. Seeing a third movie will lower your grade by more than five percentage points. Your marginal cost of moviegoing is increasing as you see more movies.

Marginal Benefit

The benefit of a one-unit increase in an activity is called **marginal benefit**. Marginal benefit is what you gain from having *one more* unit of something. But the marginal benefit from something is *measured* by what you *are willing* to give up to get that *one additional* unit of it.

A fundamental feature of marginal benefit is that it diminishes. Think about your marginal benefit from movies. If you've been studying hard and haven't seen a movie this week, your marginal benefit from seeing your next movie is large. But if you've been on a movie binge this week, you now want a break and your marginal benefit from seeing your next movie is small.

Because the marginal benefit from a movie decreases as you see more movies, you are willing to give up less to see one additional movie. For example, you know that going to the movies decreases your study time and lowers your grade.

Margin

A choice on the margin is a choice that is made by comparing *all* the relevant alternatives systematically and incrementally.

Marginal cost

The opportunity cost that arises from a one-unit increase in an activity. The marginal cost of something is what you *must* give up to get *one additional* unit of it.

Marginal benefit

The benefit that arises from a one-unit increase in an activity. The marginal benefit of something is *measured* by what you *are willing* to give up to get *one additional* unit of it.

You pay for seeing a movie with a lower grade. You might be willing to give up ten percentage points to see your first movie in a week, but you won't be willing to take such a big hit on your grade to see a second movie in a week. Your willingness to pay to see a movie decreases as the number of movies increases.

Making a Rational Choice

So, will you go to the movies for that third time in a week? If the marginal cost of the movie is less than the marginal benefit from it, your rational choice will be to see the third movie. If the marginal cost exceeds the marginal benefit, your rational choice will be to spend the evening studying. As long as the marginal benefit from something exceeds or equals its marginal cost, our choice is rational and our scarce resources are used to make us as well off as possible.

■ Choices Respond to Incentives

The choices we make depend on the incentives we face. An **incentive** is a reward or a penalty—a “carrot” or a “stick”—that encourages or discourages an action. We respond positively to “carrots” and negatively to “sticks.” The carrots are marginal benefits; the sticks are marginal costs. A change in marginal benefit or a change in marginal cost changes the incentives that we face and leads us to change our actions.

Most students believe that the payoff from studying just before a test is greater than the payoff from studying a month before a test. In other words, as a test date approaches, the marginal benefit from studying increases and the incentive to study becomes stronger. For this reason, we observe an increase in study time and a decrease in leisure pursuits during the last few days before a test. And the more important the test, the greater is this effect.

A change in marginal cost also changes incentives. For example, suppose that last week, you found your course work easy and you scored 100 percent on your practice quizzes. You figured that the marginal cost of taking an evening off to enjoy a movie was low and that your grade on the next test would not suffer, so you had a movie feast. But this week the going has gotten tough. You're just not getting it, and your practice test scores are low. If you take off even one evening, your grade on next week's test will suffer. The marginal cost of seeing a movie is now high so you decide to give the movies a miss.

A central idea of economics is that by observing *changes in incentives*, we can predict how *choices change*.

Incentive

A reward or a penalty—a “carrot” or a “stick”—that encourages or discourages an action.



Changes in marginal benefit and marginal cost change the incentive to study or to enjoy a movie.

■ Economics as Social Science

Economists try to understand and predict the effects of economic forces by using the *scientific method* first developed by physicists. The scientific method is a commonsense way of systematically checking what works and what doesn't work.

A scientist begins with a question or a puzzle about cause and effect arising from some observed facts. An economist might wonder why computers are getting cheaper and more computers are being used. Are computers getting cheaper because more people are buying them? Or are more people buying computers because they are getting cheaper? Or is some third factor causing both the price of a computer to fall and the quantity of computers bought to increase?

Economic Models

A scientist's second step is to build a model that provides a possible answer to the question of interest. All sciences use models. An **economic model** is a description of some feature of the economic world that includes only those features assumed necessary to explain the observed facts.

A model is analogous to a map. If you want to know about valleys and mountains, you use a physical map; if you're studying nations, you use a political map; if you want to drive from *A* to *B* in an unfamiliar city, you use a street map; and if you're a telephone engineer who is wanting to fix a broken connection, you use a map of the wires and tubes under the streets.

Sometimes, in the natural sciences, models are physical objects such as a plastic model of an atom or DNA. But models are also mathematical and often can be visualized in graphs. You can imagine a Lego model of an economy but you can also see that such a model wouldn't be very revealing. So in economics we use mathematical and graph-based models.

The questions we posed about the price and quantity of computers are answered by an economic model called the "demand and supply model" that you will study in Chapter 4.

Check Models Against Facts

A scientist's third step is to check the proposed model against the facts. Physicists can check whether their models correspond to the facts by doing experiments. For example, with a particle accelerator, a physicist can test a model of the structure of an atom.

Economists have a harder time than physicists but they still approach the task in a scientific manner. To check an economic model against the facts, economists use natural experiments, statistical investigations, and economic experiments.

A natural experiment is a situation that arises in the ordinary course of economic life in which the one factor of interest is different and other things are equal (or similar). For example, Canada has higher unemployment benefits than the United States, but the people in the two nations are similar. So to study the effect of unemployment benefits on the unemployment rate, economists might compare the United States with Canada.

A statistical investigation looks for a **correlation**—a tendency for the values of two variables to move together (either in the same direction or in opposite directions) in a predictable and related way. For example, cigarette smoking and lung cancer are correlated. Sometimes a correlation shows a causal influence of one variable on the other. Smoking does cause lung cancer. But sometimes the direction of causation is hard to determine.

Economic model

A description of some feature of the economic world that includes only those features assumed necessary to explain the observed facts.

Correlation

The tendency for the values of two variables to move together in a predictable and related way.



EYE on the PAST

Adam Smith and the Birth of Economics as a Social Science

Many people had written about economics before Adam Smith did, but he made economics a social science.

Born in 1723 in Kirkcaldy, a small fishing town near Edinburgh, Scotland, Smith was the only child of the town's customs officer. Lured from his professorship (he was a full professor at 28) by a wealthy Scottish duke who gave him a pension of £300 a year—ten times the average income at that time—Smith devoted ten years to writing his masterpiece, *An Inquiry into the Nature and Causes of the Wealth of Nations*, published in 1776.

Why, Adam Smith asked in that book, are some nations wealthy while others are poor? He was pondering these questions at the height of the Industrial Revolution. During these years, new technologies were applied to the manufacture of textiles, iron, transportation, and agriculture.

Adam Smith answered his questions by emphasizing the role of the division of labor and free markets. To illustrate his argument, he used the example of a pin factory. He guessed that one person, using the hand tools available in the 1770s, might make 20 pins a day. Yet, he observed, by using those same hand tools but breaking the process into a number of individually small operations in which people specialize—by the division of labor—ten people could make a staggering 48,000 pins a day. One draws out the wire, another straightens it, a third cuts it, a fourth points it, a fifth grinds it. Three specialists make the head, and a fourth attaches it. Finally, the pin is polished and packaged.

But a large market is needed to support the division of labor: One factory employing ten workers would

need to sell more than 15 million pins a year to stay in business!



An economic experiment puts people in a decision-making situation and varies the influence of one factor at a time to discover how they respond.

Disagreement: Normative versus Positive

Economists sometimes disagree about assumptions and models. They also sometimes disagree about what policy should be followed. Some disagreements can be settled by appealing to further facts, but others cannot.

Disagreements that can't be settled by facts are *normative statements*—statements about what *ought to be*. These statements depend on values and cannot be tested. The statement “We *ought to* cut back on our use of coal” is a normative statement. You may agree or disagree with it, but you can't test it. It doesn't assert a fact that can be checked. Economists as social scientists try to steer clear of normative statements.

Disagreements that *can* be settled by facts are *positive statements*—statements about *what is*. A positive statement might be right or wrong and we can discover which by careful observation of facts. “Our planet is warming because of the quantity of coal that we're burning” is a positive statement. It could be right or wrong, and it can be tested.

■ Economics as Policy Tool

Economics is useful, and you don't have to be an economist to think like one and to use the insights of economics as a policy tool. The subject provides a way of approaching problems in all aspects of our lives:

- Personal
- Business
- Government

Personal Economic Policy

Should you take out a student loan? Should you get a weekend job? Should you buy a used car or a new one? Should you rent an apartment or take out a loan and buy a condominium? Should you pay off your credit card balance or make just the minimum payment? How should you allocate your time between study, working for a wage, caring for family members, and having fun? How should you allocate your time between studying economics and your other subjects? Should you leave school after getting a bachelor's degree or should you go for a master's or a professional qualification?

All these questions involve a marginal benefit and a marginal cost. Although some of the numbers might be hard to pin down, you will make more solid decisions if you approach these questions with the tools of economics.

Business Economic Policy

Should Sony make only flat panel televisions and stop making conventional ones? Should Texaco get more oil and gas from the Gulf of Mexico or from Alaska? Should Palm outsource its online customer services to India or run the operation from California? Should Marvel Studios produce *Spider-Man 4*, a sequel to *Spider-Man 3*? Can Microsoft compete with Google in the search engine business? Can eBay compete with the surge of new Internet auction services? Is Alex Rodriguez really worth \$32,000,000 to the New York Yankees?

Like personal economic questions, these business questions involve the evaluation of a marginal benefit and a marginal cost. Some of the questions require a broader investigation of the interactions of individuals and businesses. But again, by approaching these questions with the tools of economics and by hiring economists as advisers, businesses can make better decisions.

Government Economic Policy

How can California balance its budget? Should the federal government cut taxes or raise them? How can the tax system be simplified? Should people be permitted to invest their Social Security money in stocks that they pick themselves? Should Medicaid and Medicare be extended to the entire population? Should there be a special tax to penalize corporations that send jobs overseas? Should cheap foreign imports of furniture and textiles be limited? Should the farms that grow tomatoes and sugar beets receive a subsidy? Should water be transported from Washington and Oregon to California?

These government policy questions call for decisions that involve the evaluation of a marginal benefit and a marginal cost and an investigation of the interactions of individuals and businesses. Yet again, by approaching these questions with the tools of economics, governments can make better decisions.

Notice that all the policy questions we've just posed involve a blend of the positive and the normative. Economics can't help with the normative part—the objective. But for a given objective, economics provides a method of evaluating alternative solutions. That method is to evaluate the marginal benefits and marginal costs and to find the solution that brings the greatest available gain.



EYE on the BENEFIT AND COST OF SCHOOL

Did You Make the Right Decision?

Did you make the right decision when you chose school over looking for a full-time job? Or, if you have a full-time job and you're studying in what would be your leisure time, did you make the right choice? Does school provide a big enough benefit to justify its cost?

The Benefits of School

Being in school has many benefits but they fall into two broad categories: present enjoyment and a higher future income.

You can easily make a list of all the fun things you do with your friends in school that would be harder to do if you didn't have these friends and opportunities for social interaction that school provides.

Putting a dollar value on the items in your list would be hard but it is possible to put a dollar value, or rather an expected dollar value, on the other benefit—a higher future income.

On average, a high-school graduate earns \$40,000 a year. A graduate with a bachelor's degree earns, on average, \$76,000 a year.

So by being in school, you can expect (on average) to increase your annual earnings by \$36,000 a year.

This number is likely to grow as the economy becomes more productive and prices and earnings rise.

The Costs of School

The costs of being in school for a full-time student are:

- Tuition
- Books
- Other study costs
- Forgone earnings

For a student in state university in her or his home state, tuition runs at around \$7,000 per year.

Books and other study costs run at around \$1,000 per year.

Forgone earnings are the wage of a high-school graduate in a starter job. That is around \$24,000 a year.

So the total annual cost is about \$32,000 or \$96,000 for a 3-year degree and \$128,000 for a 4-year degree.

Benefit-Cost Balance

The benefit of extra earnings alone brings in \$36,000 a year or \$360,000 in 10 years and \$1,440,000 in a working life of 40 years.

The costs are incurred in the present and the benefits accrue in the future, so we need to lower the benefits to be able to compare them properly with the costs. You'll learn how to do that later in your economics course. But even allowing for the fact that the costs are now and the benefits in the future, the net gain is big!

Is School Always Best?

Alex Rodriguez, the highest earning baseball player (\$32,000,000 in 2011) ever, turned down a scholarship at the University of Miami and chose instead to sign with the Seattle Mariners right out of high school. With a 0.311 batting average, he quickly rose through the player ranks and played his first Major League game at the age of 18.

Alex Rodriguez's opportunity cost of a college education vastly exceeded the benefit he could expect to get from it. So Alex, like you, made the right decision.



MyEconLab

You can work these problems in Study Plan 1.2 and get instant feedback.



CHECKPOINT 1.2

Explain the ideas that define the economic way of thinking.

Practice Problems

Every week, Kate plays tennis for two hours, and her grade on each math test is 70 percent. Last week, after playing for two hours, Kate considered playing for another hour. She decided to play for another hour and cut her study time by one hour. But last week, her math grade fell to 60 percent. Use this information to work Problems 1 to 4.

1. What was Kate's opportunity cost of the third hour of tennis?
2. Given that Kate played the third hour, what can you conclude about her marginal benefit and marginal cost of the second hour of tennis?
3. Was Kate's decision to play the third hour of tennis rational?
4. Did Kate make her decision on the margin?

In the News

The *New York Times* reports that cruise lines have been slashing prices and cruise sales are up. It says this surge of interest tells us that despite the uncertain economic climate, people clearly need more fun in their lives and view their vacations as a valuable and necessary part of it.

1. In deciding whether to take a cruise would you face a tradeoff?
2. How would you make a rational choice about taking a cruise?
3. What would be the marginal benefit from a cruise? What would be the marginal cost of a cruise?
4. Why would you expect a lower price to increase the number of people who decide to take a cruise?

Solutions to Practice Problems

1. Kate's opportunity cost of the third hour of tennis was the drop in her grade of ten percentage points.
2. The marginal benefit from the second hour of tennis must have exceeded the marginal cost of the second hour because Kate chose to play the third hour.
3. If marginal benefit exceeded marginal cost, Kate's decision was rational.
4. Kate made her decision on the margin because she compared the benefit and cost of one more hour (marginal benefit and marginal cost).

Solutions to In the News

1. You would face a tradeoff because you would have to forgo something else that you might otherwise do with your resources (time and budget).
2. You would make a rational choice by comparing the marginal benefit from a cruise and the marginal cost of taking one.
3. The marginal benefit from a cruise is the most you are willing to pay for one. The marginal cost is what you would have to pay to take a cruise.
4. With a lower price, more people will have a marginal benefit that exceeds the price and they will chose to take a cruise.

CHAPTER SUMMARY

Key Points

1. Define economics and explain the kinds of questions that economists try to answer.

- Economics is the social science that studies the choices that we make as we cope with scarcity and the incentives that influence and reconcile our choices.
- Microeconomics is the study of individual choices and interactions, and macroeconomics is the study of the national economy and global economy.
- The first big question of economics is: How do the choices that people make end up determining *what*, *how*, and *for whom* goods and services are produced?
- The second big question is: When do choices made in the pursuit of *self-interest* also promote the *social interest*?

2. Explain the ideas that define the economic way of thinking.

- Six ideas define the economic way of thinking:
 1. A choice is a *tradeoff*.
 2. People make *rational* choices by comparing benefits and costs .
 3. *Benefit* is what you gain when you get something (measured by what you *are willing to give up to get it*).
 4. *Cost* is what you *must give up to get something*.
 5. A “how much” choice is made on the *margin* by comparing *marginal benefit* and *marginal cost*.
 6. Choices respond to *incentives*.
- Economists use the *scientific method* to try to understand how the economic world works. They create economic models and test them using natural experiments, statistical investigations, and economic experiments.
- Economics is a tool for personal, business, and government decisions.

Key Terms

| | | |
|-----------------------|----------------------|--------------------|
| Benefit, 9 | Macroeconomics, 3 | Rational choice, 8 |
| Correlation, 12 | Margin, 10 | Scarcity, 2 |
| Economic model, 12 | Marginal benefit, 10 | Self-interest, 4 |
| Economics, 2 | Marginal cost, 10 | Social interest, 4 |
| Goods and services, 3 | Microeconomics, 2 | Tradeoff, 8 |
| Incentive, 11 | Opportunity cost, 9 | |

MyEconLab

You can work these problems in Chapter 1 Study Plan and get instant feedback.

LIST 1

- Local car sales in India grow at their slowest pace in two years.
- Coffee prices rocket.
- Globalization has reduced African poverty.
- The government must cut its deficit.
- Apple sells 2 million iPhones a month.

LIST 2

- Low-income people pay too much for housing.
- The number of U.S. farms has decreased over the past 50 years.
- Toyota expands parts production in the United States.
- Imports from China are swamping U.S. department stores.
- The population of rural United States is declining.

CHAPTER CHECKPOINT

Study Plan Problems and Applications

1. Provide three examples of scarcity that illustrate why even the 1,210 billionaires in the world face scarcity.
2. Label each entry in List 1 as dealing with a microeconomic topic or a macroeconomic topic. Explain your answer.

Use the following information to work Problems 3 to 6.

The Social Network had world-wide box office receipts of \$225 million. The movie had a production budget of about \$70 million and additional marketing costs of about \$50 million. Creating a successful movie brings pleasure to millions, generates work for thousands, and makes a few rich.

3. What contribution does a movie like *The Social Network* make to coping with scarcity? When you buy a ticket to see a movie in a theater, are you buying a good or a service?
4. Who decides whether a movie is going to be a blockbuster? How do you think the creation of a blockbuster movie influences *what, how, and for whom* goods and services are produced?
5. What are some of the components of marginal cost and marginal benefit that the producer of a movie faces?
6. Suppose that Jesse Eisenberg had been offered a bigger and better part in another movie and that to hire him for *The Social Network*, the producer had to double Jesse's pay. What incentives would have changed? How might the changed incentives have changed the choices that people made?
7. Pam, Pru, and Pat are deciding how they will celebrate the New Year. Pam prefers to take a cruise, is happy to go to Hawaii, but does not want to go skiing. Pru prefers to go skiing, is happy to go to Hawaii, but does not want to take a cruise. Pat prefers to go to Hawaii or to take a cruise but does not want to go skiing. Their decision is to go to Hawaii. Is this decision rational? What is the opportunity cost of the trip to Hawaii for each of them? What is the benefit that each gets?
8. Label each of the entries in List 2 as a positive or a normative statement.
9. What is the social interest? Distinguish it from self-interest. In your answer give an example of self-interest and an example of social interest.

Use the following information to work Problems 10 to 12.

Hundreds line up for 5 p.m. Eminem ticket giveaway

Hundreds of Eminem fans lined up to get a free ticket to the rapper's secret concert. Although tickets would be released at 5 p.m., people lined up all day. Eminem will release his new album *Relapse* (his first in 5 years) on the same day.

Source: *Detroit Free Press*, May 18, 2009

10. Eminem is giving away tickets to his show in a 1,500-seat theater in Detroit. What is free and what is scarce? Explain your answer.
11. What do you think Eminem's incentive is to give a free show? Was his decision made in self-interest or in the social interest? Explain.
12. Because all the tickets were free, was the marginal benefit from the concert zero? Explain your answer.

Instructor Assignable Problems and Applications

Your instructor can assign these problems as homework, a quiz, or a test in [MyEconLab](#).

1. Which of the following are components of the opportunity cost of being a full-time student? The cost of:
 - Tuition and books
 - Residence and a meal plan
 - A subscription to the *New Yorker* magazine
 - The income a student will earn after graduating
2. Think about the following news items and label each as involving a *what*, *how*, or *for whom* question:
 - Today, most stores use computers to keep their inventory records, whereas 20 years ago most stores used paper records.
 - Health-care professionals and drug companies recommend that Medicaid drug rebates be made available to everyone in need.
 - A doubling of the gas tax might lead to a better public transit system.
3. On Friday June 16, 2011, the headlines in List 1 appeared in *The Wall Street Journal*. Classify each headline as a signal that the news article is about a microeconomic topic or a macroeconomic topic. Explain your answers.
4. Your school decides to increase the intake of new students next year. To make its decision, what economic concepts would it have considered? Would the school have used the “economic way of thinking” in reaching its decision? Would the school have made its decision on the margin?
5. Provide two examples of monetary and two examples of non-monetary incentives, a carrot and a stick of each, that government policies use to influence behavior.
6. Think about each of the items in List 2 and explain how they affect incentives and might change the choices that people make:
7. Does the decision to make a blockbuster movie mean that some other more desirable activities get fewer resources than they deserve? Is your answer positive or normative? Explain your answer.
8. Provide two examples of economics being used as a tool by each of a student, a business, and a government. Classify your examples as dealing with microeconomic topics and macroeconomic topics.

Use the following news clip to work Problems 9 to 12.

Obama will drive up miles-per-gallon requirements

Obama’s revision of auto-emission and fuel-economy standards will require automakers to boost fuel economy to 35.5 miles per gallon by 2016, notching up 5% each year from 2012, to limit the amount of carbon dioxide cars can emit.

Source: *USA Today*, May 18, 2009

9. What are two benefits of the new miles-per-gallon requirements? Are these benefits in someone’s self-interest or in the social interest?
10. What are two benefits of the new auto-emission standards?
11. What costs associated with the new miles-per-gallon requirements arise from decisions made in self-interest and in the social interest?
12. What costs associated with the new auto-emission standards arise from decisions made in self-interest and in the social interest?

LIST 1

- Apple Opens Locker for Songs.
- U.S. Household Debt Falls.
- Indian Carriers Set to Order 60 Airbus Planes.
- U.S. Trade Gap Narrows.

LIST 2

- A hurricane hits Central Florida.
- The World Series begins tonight but a storm warning is in effect for the area around the stadium.
- The price of a personal computer falls to \$50.
- Unrest in the Middle East sends the price of gas to \$5 a gallon.

MyEconLab

You can work this quiz in Chapter 1 Study Plan and get instant feedback.

Multiple Choice Quiz

1. Which of the following describes the reason why scarcity exists?
 - A. Governments make bad economic decisions.
 - B. The gap between the rich and the poor is too wide.
 - C. Wants exceed the resources available to satisfy them.
 - D. There is too much unemployment.
2. Which of the following defines economics? Economics is the social science that studies _____.
 - A. the best way of eliminating scarcity
 - B. the choices made to cope with scarcity, how incentives influence those choices, and how the choices are coordinated
 - C. how money is created and used
 - D. the inevitable conflict between self-interest and the social interest
3. Of the three big questions, *what*, *how*, and *for whom*, which of the following is an example of a *how* question?
 - A. Why do doctors and lawyers earn high incomes?
 - B. Why don't we produce more small cars and fewer gas guzzlers?
 - C. Why do we use machines rather than migrant workers to pick grapes?
 - D. Why do college football coaches earn more than professors?
4. Which of the following is not a key idea in the economic way of thinking?
 - A. People make rational choices by comparing costs and benefits.
 - B. Poor people are discriminated against and should be treated more fairly.
 - C. A rational choice is made at the margin.
 - D. Choices respond to incentives.
5. A rational choice is _____.
 - A. the best thing you must forgo to get something
 - B. what you are willing to forgo to get something
 - C. made by comparing marginal benefit and marginal cost
 - D. the best for society
6. Which of the following best illustrates your marginal benefit from studying?
 - A. The knowledge you gain from studying 2 hours a night for a month
 - B. The best things forgone by studying 2 hours a night for a month
 - C. What you are willing to give up to study for one additional hour
 - D. What you must give up to be able to study for one additional hour
7. The scientific method uses models to _____.
 - A. clarify normative disagreements
 - B. avoid the need to study real questions
 - C. replicate all the features of the real world
 - D. focus on those features of reality assumed relevant for understanding a cause and effect relationship
8. Which of the following is a positive statement?
 - A. We should stop using corn to make ethanol because it is raising the cost of food.
 - B. You will get the most out of college life if you play a sport once a week.
 - C. Competition among cell phone providers across the borders of Canada, Mexico, and the United States has driven roaming rates down.
 - D. Bill Gates ought to spend more helping to eradicate malaria in Africa.

APPENDIX: MAKING AND USING GRAPHS

When you have completed your study of this appendix, you will be able to

- 1 Interpret graphs that display data.
- 2 Interpret the graphs used in economic models.
- 3 Define and calculate slope.
- 4 Graph relationships among more than two variables.

Basic Idea

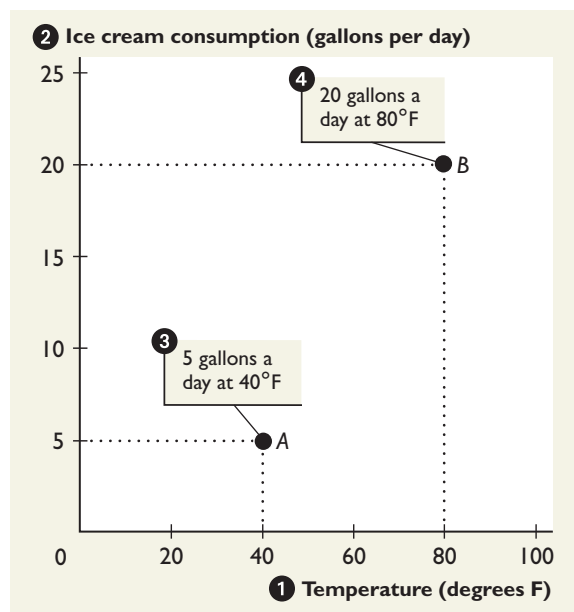
A graph represents a quantity as a distance and enables us to visualize the relationship between two variables. To make a graph, we set two lines called *axes* perpendicular to each other, like those in Figure A1.1. The vertical line is called the *y-axis*, and the horizontal line is called the *x-axis*. The common zero point is called the *origin*. In Figure A1.1, the *x-axis* measures temperature in degrees Fahrenheit. A movement to the right shows an increase in temperature, and a movement to the left shows a decrease in temperature. The *y-axis* represents ice cream consumption, measured in gallons per day.

To make a graph, we need a value of the variable on the *x-axis* and a corresponding value of the variable on the *y-axis*. For example, if the temperature is 40°F, ice cream consumption is 5 gallons a day at point *A* in Figure A1.1. If the temperature is 80°F, ice cream consumption is 20 gallons a day at point *B* in Figure A1.1. Graphs like that in Figure A1.1 can be used to show any type of quantitative data on two variables.

FIGURE A1.1

Making a Graph

MyEconLab Animation



All graphs have axes that measure quantities as distances.

- 1 The horizontal axis (*x-axis*) measures temperature in degrees Fahrenheit. A movement to the right shows an increase in temperature.
- 2 The vertical axis (*y-axis*) measures ice cream consumption in gallons per day. A movement upward shows an increase in ice cream consumption.
- 3 Point *A* shows that 5 gallons of ice cream are consumed on a day when the temperature is 40°F.
- 4 Point *B* shows that 20 gallons of ice cream are consumed on a day when the temperature is 80°F.

Scatter diagram

A graph of the value of one variable against the value of another variable.

Time-series graph

A graph that measures time on the x -axis and the variable or variables in which we are interested on the y -axis.

Trend

A general tendency for the value of a variable to rise or fall over time.

Cross-section graph

A graph that shows the values of an economic variable for different groups in a population at a point in time.

■ Interpreting Data Graphs

A **scatter diagram** is a graph of the value of one variable against the value of another variable. It is used to reveal whether a relationship exists between two variables and to describe the relationship. Figure A1.2 shows two examples.

Figure A1.2(a) shows the relationship between expenditure and income. Each point shows expenditure per person and income per person in the United States in a given year from 2000 to 2010. The points are “scattered” within the graph. The label on each point shows its year. The point marked 04 shows that in 2004, income per person was \$28,990 and expenditure per person was \$27,401. This scatter diagram reveals that as income increases, expenditure also increases.

Figure A1.2(b) shows the relationship between the percentage of Americans who own a cell phone and the average monthly cell phone bill. This scatter diagram reveals that as the cost of using a cell phone falls, the number of cell phone subscribers increases.

A **time-series graph** measures time (for example, months or years) on the x -axis and the variable or variables in which we are interested on the y -axis. Figure A1.2(c) shows an example. In this graph, time (on the x -axis) is measured in years, which run from 1980 to 2010. The variable that we are interested in is the price of coffee, and it is measured on the y -axis.

A time-series graph conveys an enormous amount of information quickly and easily, as this example illustrates. It shows when the value is

1. High or low. When the line is a long way from the x -axis, the price is high, as it was in 2008. When the line is close to the x -axis, the price is low, as it was in 1993.
2. Rising or falling. When the line slopes upward, as in 1994, the price is rising. When the line slopes downward, as in 1998, the price is falling.
3. Rising or falling quickly or slowly. If the line is steep, then the price is rising or falling quickly. If the line is not steep, the price is rising or falling slowly. For example, the price rose quickly in 1994 and slowly in 1984. The price fell quickly in 1998 and slowly in 2003.

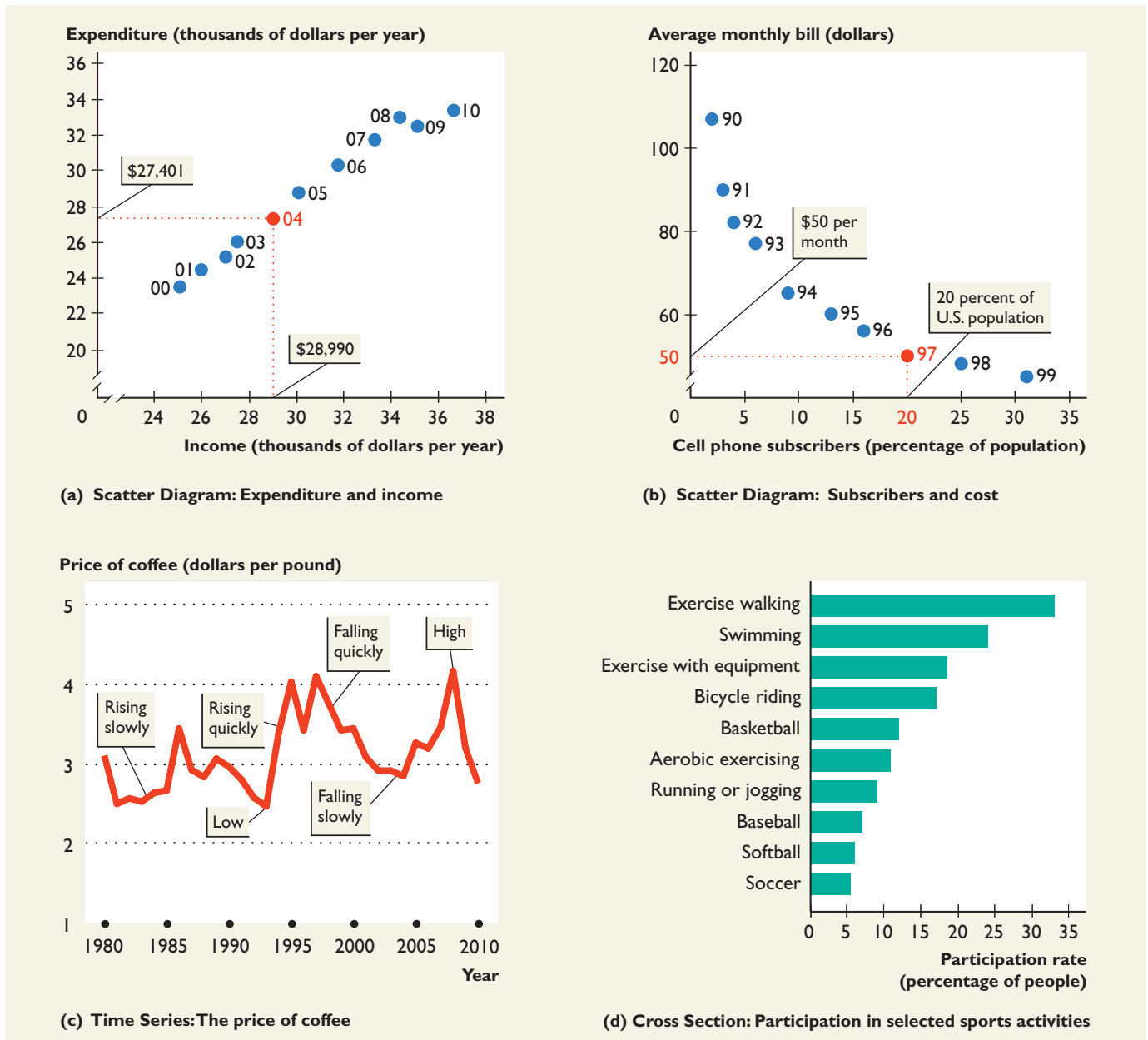
A time-series graph also reveals whether the variable has a trend. A **trend** is a general tendency for the value of a variable to rise or fall over time. You can see that the price of coffee had a general tendency to rise from 1980 to the late 1990s. That is, although the price rose and fell, it had a general tendency to rise.

With a time-series graph, we can compare different periods quickly. Figure A1.2(c) shows that the period after 1990 was different from the period before 1990. The price of coffee jumped during the early 1990s, remained high for a number of years, then fell quickly before rising again to a new high. This graph conveys a wealth of information, and it does so in much less space than we have used to describe only some of its features.

A **cross-section graph** shows the values of an economic variable for different groups in a population at a point in time. Figure A1.2(d) is an example of a cross-section graph. It shows the percentage of people who participate in selected sports activities in the United States. This graph uses bars rather than dots and lines, and the length of each bar indicates the participation rate. Figure A1.2(d) enables you to compare the participation rates in these ten sporting activities. And you can do so much more quickly and clearly than by looking at a list of numbers.

FIGURE A1.2
Data Graphs

MyEconLab Animation



A scatter diagram reveals the relationship between two variables. In part (a), as income increases, expenditure almost always increases. In part (b), as the monthly cell phone bill falls, the percentage of people who own a cell phone increases.

A time-series graph plots the value of a variable on the y-axis against time on the x-axis. Part (c) plots the price of coffee

year from 1980 to 2010. The graph shows when the price of coffee was high and low, when it increased and decreased, and when it changed quickly and changed slowly.

A cross-section graph shows the value of a variable across the members of a population. Part (d) shows the participation rate in the United States in each of ten sporting activities.

■ Interpreting Graphs Used in Economic Models

We use graphs to show the relationships among the variables in an economic model. An *economic model* is a simplified description of the economy or of a component of the economy such as a business or a household. It consists of statements about economic behavior that can be expressed as equations or as curves in a graph. Economists use models to explore the effects of different policies or other influences on the economy in ways similar to those used to test model airplanes in wind tunnels and models of the climate.

Figure A1.3 shows graphs of the relationships between two variables that move in the same direction. Such a relationship is called a **positive relationship** or **direct relationship**.

Positive relationship or direct relationship

A relationship between two variables that move in the same direction.

Linear relationship

A relationship that graphs as a straight line.

Part (a) shows a straight-line relationship, which is called a **linear relationship**. The distance traveled in 5 hours increases as the speed increases. For example, point A shows that 200 miles are traveled in 5 hours at a speed of 40 miles an hour. And point B shows that the distance traveled in 5 hours increases to 300 miles if the speed increases to 60 miles an hour.

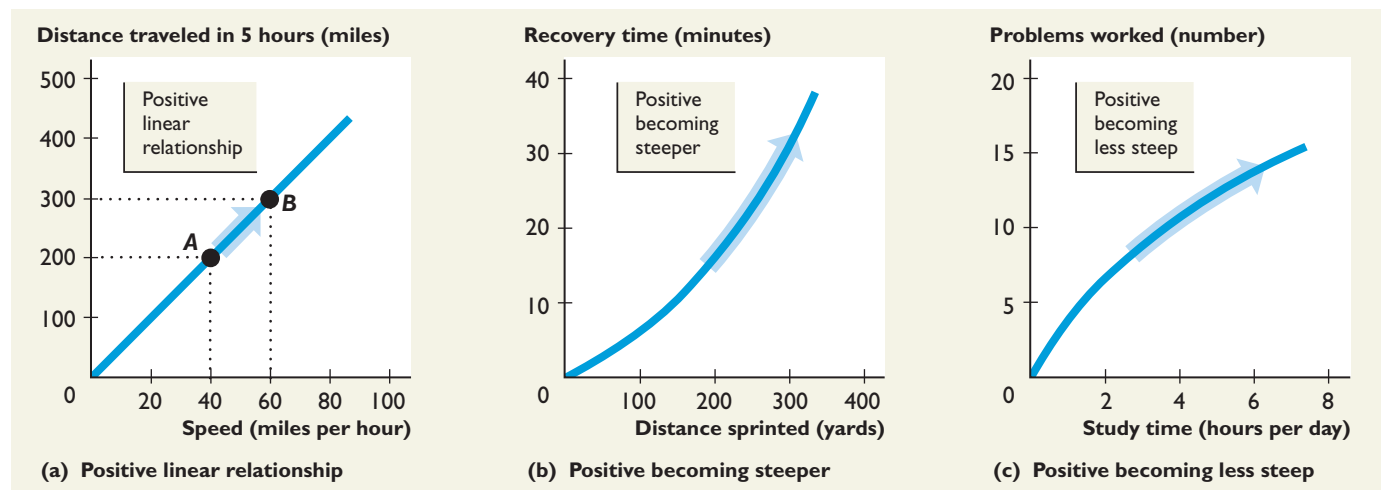
Part (b) shows the relationship between distance sprinted and recovery time (the time it takes the heart rate to return to its normal resting rate). An upward-sloping curved line that starts out quite flat but then becomes steeper as we move along the curve away from the origin describes this relationship. The curve slopes upward and becomes steeper because the extra recovery time needed from sprinting another 100 yards increases. It takes 5 minutes to recover from sprinting 100 yards but 15 minutes to recover from sprinting 200 yards.

Part (c) shows the relationship between the number of problems worked by a student and the amount of study time. An upward-sloping curved line that starts out quite steep and becomes flatter as we move away from the origin shows this

■ FIGURE A1.3

Positive (Direct) Relationships

MyEconLab Animation



Part (a) shows that as speed increases, the distance traveled in a given number of hours increases along a straight line.

Part (b) shows that as the distance sprinted increases, recovery time increases along a curve that becomes steeper.

Part (c) shows that as study time increases, the number of problems worked increases along a curve that becomes less steep.

relationship. Study time becomes less effective as you increase the hours worked and become more tired.

Figure A1.4 shows relationships between two variables that move in opposite directions. Such a relationship is called a **negative relationship** or **inverse relationship**.

Part (a) shows the relationship between the number of hours spent playing squash and the number of hours spent playing tennis when the total number of hours available is five. One extra hour spent playing tennis means one hour less playing squash and vice versa. This relationship is negative and linear.

Part (b) shows the relationship between the cost per mile traveled and the length of a journey. The longer the journey, the lower is the cost per mile. But as the journey length increases, the fall in the cost per mile becomes smaller. This feature of the relationship is shown by the fact that the curve slopes downward, starting out steep at a short journey length and then becoming flatter as the journey length increases. This relationship arises because some of the costs, such as auto insurance, are fixed, and as the journey length increases, the fixed costs are spread over more miles.

Part (c) shows the relationship between the amount of leisure time and the number of problems worked by a student. Increasing leisure time produces an increasingly large reduction in the number of problems worked. This relationship is a negative one that starts out with a gentle slope at a small number of leisure hours and becomes steeper as the number of leisure hours increases. This relationship is a different view of the idea shown in Figure A1.3 (c).

Many relationships in economic models have a maximum or a minimum. For example, firms try to make the largest possible profit and to produce at the lowest possible cost. Figure A1.5 shows relationships that have a maximum or a minimum.

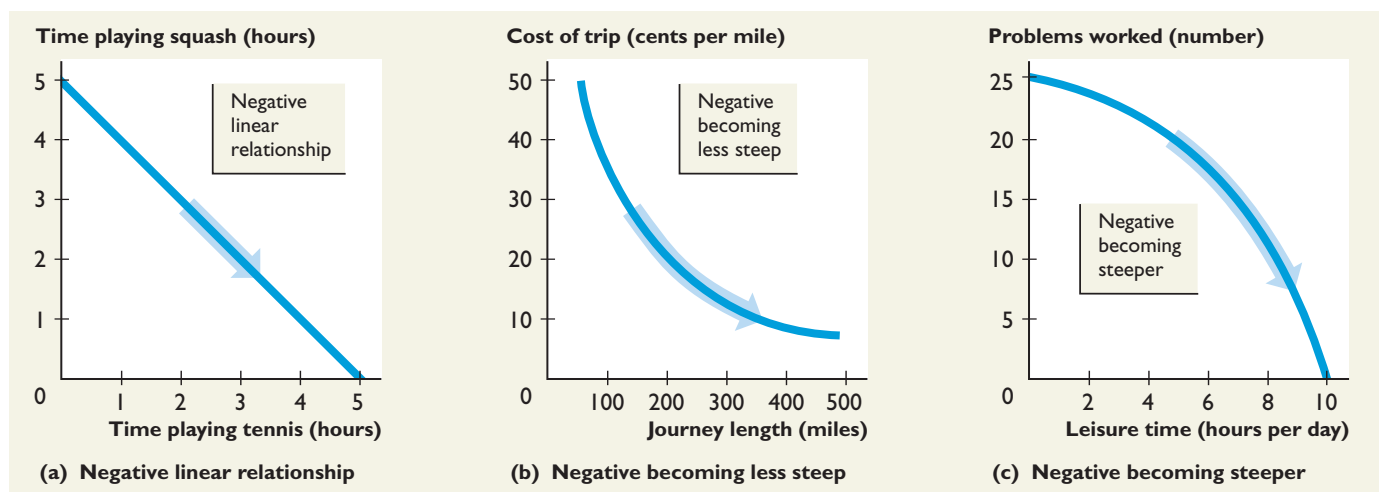
Negative relationship or inverse relationship

A relationship between two variables that move in opposite directions.

FIGURE A1.4

Negative (Inverse) Relationships

MyEconLab Animation



Part (a) shows that as the time playing tennis increases, the time playing squash decreases along a straight line.

Part (b) shows that as the journey length increases, the cost of the trip falls along a curve that becomes less steep.

Part (c) shows that as leisure time increases, the number of problems worked decreases along a curve that becomes steeper.

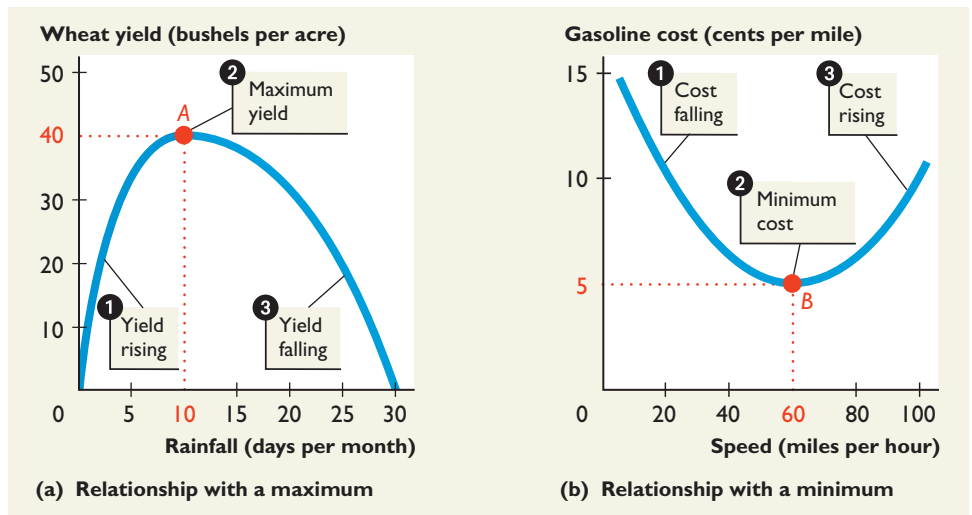
FIGURE A1.5

Maximum and Minimum Points

MyEconLab Animation

In part (a), as the rainfall increases, the curve ① slopes upward as the yield per acre rises, ② is flat at point A, the maximum yield, and then ③ slopes downward as the yield per acre falls.

In part (b), as the speed increases, the curve ① slopes downward as the cost per mile falls, ② is flat at the minimum point B, and then ③ slopes upward as the cost per mile rises.



Part (a) shows a relationship that starts out sloping upward, reaches a maximum, and then slopes downward. Part (b) shows a relationship that begins sloping downward, falls to a minimum, and then slopes upward.

Finally, there are many situations in which, no matter what happens to the value of one variable, the other variable remains constant. Sometimes we want to show two variables that are unrelated in a graph. Figure A1.6 shows two graphs in which the variables are unrelated.

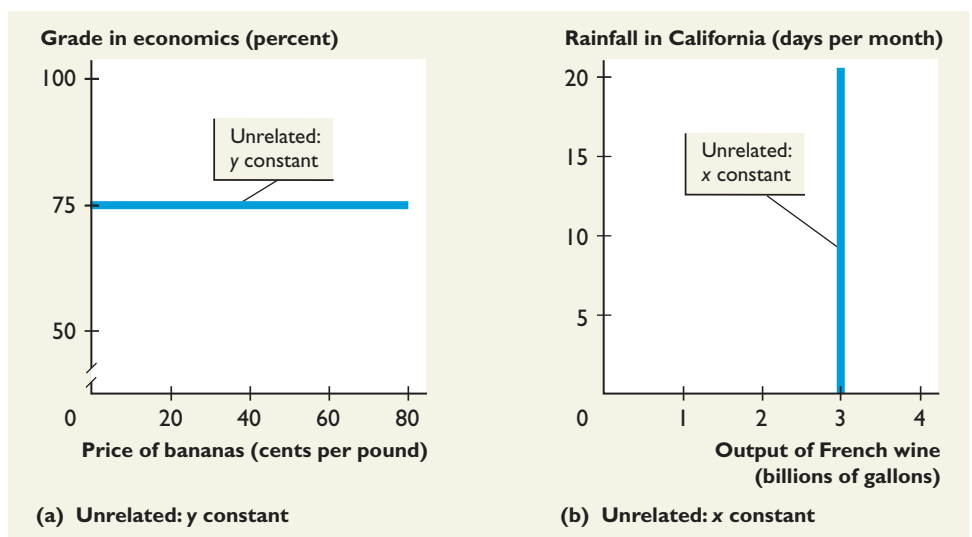
FIGURE A1.6

Variables That Are Unrelated

MyEconLab Animation

In part (a), as the price of bananas increases, the student's grade in economics remains at 75 percent. These variables are unrelated, and the curve is horizontal.

In part (b), the vineyards of France produce 3 billion gallons of wine no matter what the rainfall is in California. These variables are unrelated, and the curve is vertical.



The Slope of a Relationship

We can measure the influence of one variable on another by the slope of the relationship. The **slope** of a relationship is the change in the value of the variable measured on the y -axis divided by the change in the value of the variable measured on the x -axis. We use the Greek letter Δ (delta) to represent “change in.” So Δy means the change in the value of y , and Δx means the change in the value of x . The slope of the relationship is

$$\Delta y \div \Delta x$$

If a large change in y is associated with a small change in x , the slope is large and the curve is steep. If a small change in y is associated with a large change in x , the slope is small and the curve is flat.

Figure A1.7 shows how to calculate slope. The slope of a straight line is the same regardless of where on the line you calculate it—the slope is constant. In part (a), when x increases from 2 to 6, y increases from 3 to 6. The change in x is 4—that is, Δx is 4. The change in y is 3—that is, Δy is 3. The slope of that line is $3/4$. In part (b), when x increases from 2 to 6, y decreases from 6 to 3. The change in y is *minus* 3—that is, Δy is -3 . The change in x is plus 4—that is, Δx is 4. The slope of the curve is $-3/4$.

In part (c), we calculate the slope at a point on a curve. To do so, place a ruler on the graph so that it touches point A and no other point on the curve, then draw a straight line along the edge of the ruler. The slope of this straight line is the slope of the curve at point A . This slope is $3/4$.

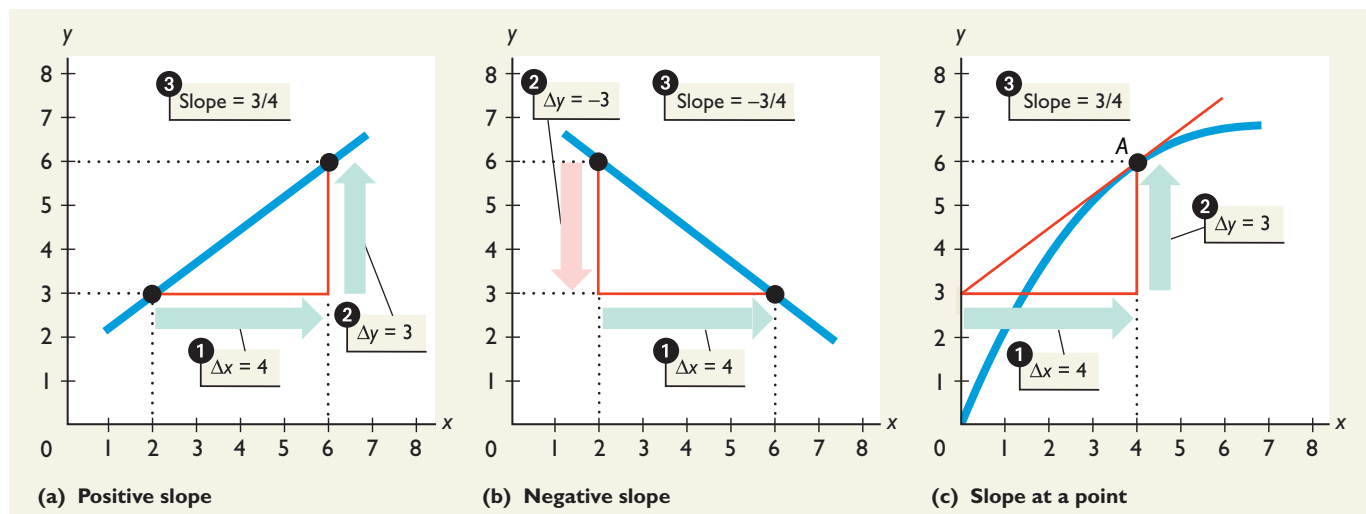
Slope

The change in the value of the variable measured on the y -axis divided by the change in the value of the variable measured on the x -axis.

FIGURE A1.7

Calculating Slope

MyEconLab Animation



In part (a), ① when Δx is 4, ② Δy is 3, so ③ the slope ($\Delta y \div \Delta x$) is $3/4$.

In part (b), ① when Δx is 4, ② Δy is -3 , so ③ the slope ($\Delta y \div \Delta x$) is $-3/4$.

In part (c), the slope of the curve at point A equals the slope of the red line. ① When Δx is 4, ② Δy is 3, so ③ the slope ($\Delta y \div \Delta x$) is $3/4$.

■ Relationships Among More Than Two Variables

All the graphs that you have studied so far plot the relationship between two variables as a point formed by the x and y values. But most of the relationships in economics involve relationships among many variables, not just two. For example, the amount of ice cream consumed depends on the price of ice cream and the temperature. If ice cream is expensive and the temperature is low, people eat much less ice cream than when ice cream is inexpensive and the temperature is high. For any given price of ice cream, the quantity consumed varies with the temperature; and for any given temperature, the quantity of ice cream consumed varies with its price.

Figure A1.8 shows a relationship among three variables. The table shows the number of gallons of ice cream consumed per day at various temperatures and ice cream prices. How can we graph these numbers?

To graph a relationship that involves more than two variables, we use the *ceteris paribus* assumption.

Ceteris Paribus

The Latin phrase *ceteris paribus* means “other things remaining the same.” Every laboratory experiment is an attempt to create *ceteris paribus* and isolate the relationship of interest. We use the same method to make a graph.

Figure A1.8(a) shows an example. This graph shows what happens to the quantity of ice cream consumed when the price of ice cream varies while the temperature remains constant. The curve labeled 70°F shows the relationship between ice cream consumption and the price of ice cream if the temperature is 70°F. The numbers used to plot that curve are those in the first and fourth columns of the table in Figure A1.8. For example, if the temperature is 70°F, 10 gallons are consumed when the price is \$2.75 a scoop and 18 gallons are consumed when the price is \$2.25 a scoop. The curve labeled 90°F shows the relationship between consumption and the price when the temperature is 90°F.

We can also show the relationship between ice cream consumption and temperature while the price of ice cream remains constant, as shown in Figure A1.8(b). The curve labeled \$2.75 shows how the consumption of ice cream varies with the temperature when the price of ice cream is \$2.75 a scoop. The numbers used to plot that curve are those in the fourth row of the table in Figure A1.8. For example, at \$2.75 a scoop, 10 gallons are consumed when the temperature is 70°F and 20 gallons are consumed when the temperature is 90°F. A second curve shows the relationship when the price of ice cream is \$2.00 a scoop.

Figure A1.8(c) shows the combinations of temperature and price that result in a constant consumption of ice cream. One curve shows the combinations that result in 10 gallons a day being consumed, and the other shows the combinations that result in 7 gallons a day being consumed. A high temperature and a high price lead to the same consumption as a lower temperature and a lower price. For example, 10 gallons of ice cream are consumed at 90°F and \$3.25 a scoop, at 70°F and \$2.75 a scoop, and at 50°F and \$2.50 a scoop.

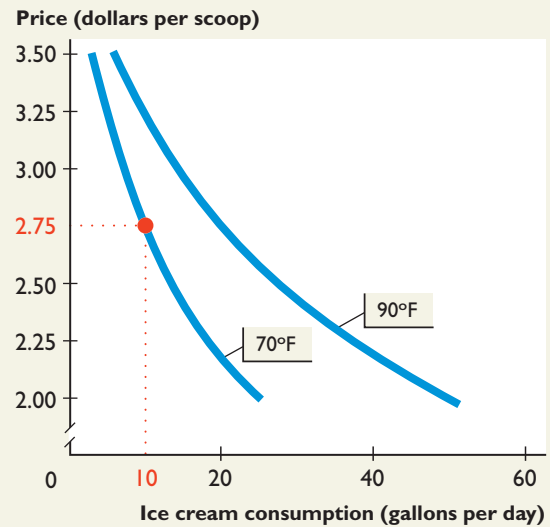
With what you’ve learned about graphs in this Appendix, you can move forward with your study of economics. There are no graphs in this textbook that are more complicated than the ones you’ve studied here.

FIGURE A1.8

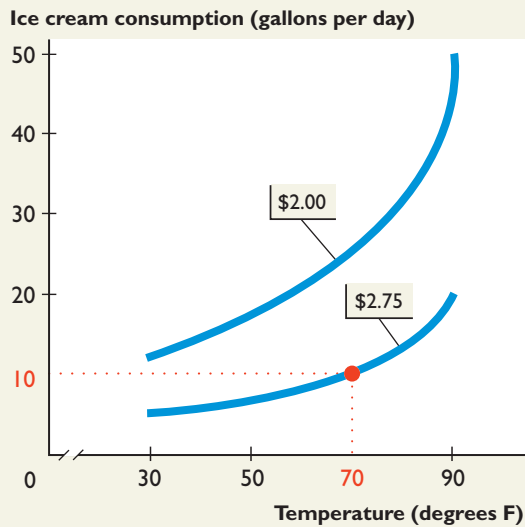
Graphing a Relationship Among Three Variables

MyEconLab Animation

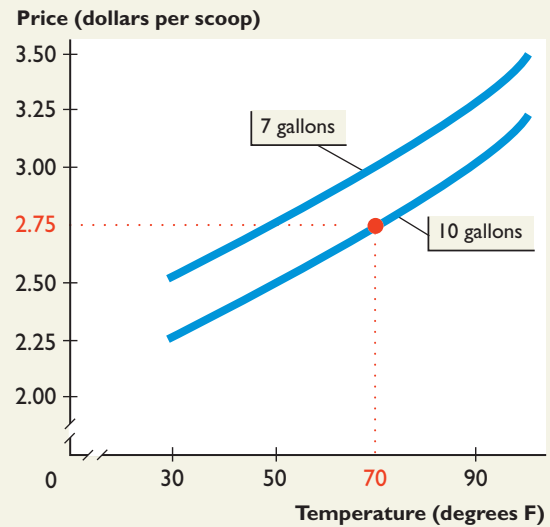
| Price (dollars per scoop) | Ice cream consumption (gallons per day) | | | |
|------------------------------|--|------|-----------|------|
| | 30°F | 50°F | 70°F | 90°F |
| 2.00 | 12 | 18 | 25 | 50 |
| 2.25 | 10 | 12 | 18 | 37 |
| 2.50 | 7 | 10 | 13 | 27 |
| 2.75 | 5 | 7 | 10 | 20 |
| 3.00 | 3 | 5 | 7 | 14 |
| 3.25 | 2 | 3 | 5 | 10 |
| 3.50 | 1 | 2 | 3 | 6 |



(a) Price and consumption at a given temperature



(b) Temperature and consumption at a given price



(c) Temperature and price at a given consumption

The table tells us how many gallons of ice cream are consumed at different prices and different temperatures. For example, if the price is \$2.75 a scoop and the temperature is 70°F, 10 gallons of ice cream are consumed. This set of values is highlighted in the table and each part of the figure.

Part (a) shows the relationship between price and consumption when temperature is held constant. One curve holds temperature at 90°F, and the other at 70°F.

Part (b) shows the relationship between temperature and consumption when price is held constant. One curve holds the price at

\$2.75 a scoop, and the other at \$2.00 a scoop.

Part (c) shows the relationship between temperature and price when consumption is held constant. One curve holds consumption at 10 gallons a day, and the other at 7 gallons a day.

MyEconLab

You can work these problems in Chapter 1 Study Plan and get instant feedback.

TABLE 1

| | A | B | C | D |
|---|------|-----|----|-------|
| 1 | 2000 | 943 | 18 | 19 |
| 2 | 2002 | 803 | 15 | 51 |
| 3 | 2004 | 767 | 33 | 139 |
| 4 | 2006 | 620 | 23 | 586 |
| 5 | 2008 | 385 | 13 | 1,033 |
| 6 | 2010 | 226 | 9 | 1,162 |

TABLE 2

| Price (dollars per ride) | Balloon rides (number per day) | | |
|--------------------------------|-----------------------------------|------|------|
| | 50°F | 70°F | 90°F |
| 5 | 32 | 50 | 40 |
| 10 | 27 | 40 | 32 |
| 15 | 18 | 32 | 27 |
| 20 | 10 | 27 | 18 |

Your instructor can assign these problems as homework, a quiz, or a test in [MyEconLab](#).

TABLE 3

| Price (dollars per cup) | Hot chocolate (number per week) | | |
|-------------------------------|------------------------------------|------|------|
| | 50°F | 70°F | 90°F |
| 2.00 | 40 | 30 | 20 |
| 2.50 | 30 | 20 | 10 |
| 3.00 | 20 | 10 | 0 |
| 3.50 | 10 | 0 | 0 |

APPENDIX CHECKPOINT

Study Plan Problems

The spreadsheet in Table 1 provides data on the U.S. economy: Column A is the year; the other columns are quantities sold in millions per year of compact discs (column B), music videos (column C), and singles downloads (column D). Use this spreadsheet to work Problems 1 and 2.

1. Draw a scatter diagram to show the relationship between the quantities sold of compact discs and music videos. Describe the relationship.
2. Draw a time-series graph of the quantity of compact discs sold. Say in which year or years the quantity sold (a) was highest, (b) was lowest, (c) increased the most, and (d) decreased the most. If the data show a trend, describe it.
3. The following data shows the relationship between two variables x and y .

| | | | | | | |
|-----|----|----|----|----|----|---|
| x | 0 | 1 | 2 | 3 | 4 | 5 |
| y | 32 | 31 | 28 | 23 | 16 | 7 |

Is the relationship between x and y positive or negative? Calculate the slope of the relationship when x equals 2 and when x equals 4. How does the slope change as the value of x increases?

4. Table 2 provides data on the price of a balloon ride, the temperature, and the number of rides a day. Draw graphs to show the relationship between
 - The price and the number of rides, when the temperature is 70°F.
 - The number of rides and the temperature, when the price is \$15 a ride.

Instructor Assignable Problems

Use the following information in Table 1 to work Problems 1 and 2.

1. Draw a scatter diagram to show the relationship between quantities sold of music videos and singles downloads. Describe the relationship.
2. Draw a time-series graph of the quantity of music videos sold. Say in which year or years the quantity sold (a) was highest, (b) was lowest, (c) decreased the most, and (d) decreased the least. If the data show a trend, describe it.

Use the following data on the relationship between two variables x and y to work Problems 3 and 4.

| | | | | | | |
|-----|---|---|---|---|----|----|
| x | 0 | 1 | 2 | 3 | 4 | 5 |
| y | 0 | 1 | 4 | 9 | 16 | 25 |

3. Is the relationship between x and y positive or negative? Explain.
4. Calculate the slope of the relationship when x equals 2 and x equals 4. How does the slope change as the value of x increases?
5. Table 3 provides data on the price of hot chocolate, the temperature, and the number of cups a week. Draw graphs to show the relationship between
 - The price and the number of cups of hot chocolate, when the temperature is constant.
 - The temperature and the number of cups of hot chocolate, when the price is constant.



Who makes the iPhone?

The U.S. and Global Economies



CHAPTER CHECKLIST

When you have completed your study of this chapter, you will be able to

- 1 Describe what, how, and for whom goods and services are produced in the United States.
- 2 Describe what, how, and for whom goods and services are produced in the global economy.
- 3 Use the circular flow model to provide a picture of how households, firms, and governments interact in the U.S. economy and how the U.S. and other economies interact in the global economy.

2.1 WHAT, HOW, AND FOR WHOM?

Walk around a shopping mall and pay close attention to the range of goods and services that are being offered for sale. Go inside some of the shops and look at the labels to see where various items are manufactured. The next time you travel on an interstate highway, look at the large trucks and pay attention to the names and products printed on their sides and the places in which the trucks are registered. Open the Yellow Pages and flip through a few sections. Notice the huge range of goods and services that businesses are offering.

You've just done a sampling of *what* goods and services are produced and consumed in the United States today.

■ What Do We Produce?

We place the goods and services produced into four large groups:

- Consumption goods and services
- Capital goods
- Government goods and services
- Export goods and services

Consumption goods and services

Goods and services that are bought by individuals and used to provide personal enjoyment and contribute to a person's quality of life.

Capital goods

Goods that are bought by businesses to increase their productive resources.

Government goods and services

Goods and services that are bought by governments.

Export goods and services

Goods and services that are produced in one country and sold in other countries.

Consumption goods and services are items that are bought by individuals and used to provide personal enjoyment and contribute to a person's quality of life. They include items such as housing, SUVs, bottled water and ramen noodles, chocolate bars and Po' Boy sandwiches, movies, downhill skiing lessons, and doctor and dental services.

Capital goods are goods that are bought by businesses to increase their productive resources. They include items such as auto assembly lines, shopping malls, airplanes, and oil tankers.

Government goods and services are items that are bought by governments. Governments purchase missiles and weapons systems, travel services, Internet services, police protection, roads, and paper and paper clips.

Export goods and services are items that are produced in one country and sold in other countries. U.S. export goods and services include the airplanes produced by Boeing that Singapore Airlines buys, the computers produced by Dell that Europeans buy, and licenses sold by U.S. film companies to show U.S. movies in European movie theaters.

Of the four groups of goods and services that we've just defined, consumption goods and services have the largest share and a share that doesn't fluctuate much. The volume of capital goods produced fluctuates as the economy cycles from boom to recession. Goods and services bought by governments are close to a fifth of total production and export goods around one tenth.

Breaking the goods and services down into smaller categories, health services is the largest category, with 17 percent of the value of total production. Real estate services come next at 12 percent. The main component of this item is the services of rental and owner-occupied housing. Education is the next largest service, followed by retail and wholesale trades and transportation and storage.

The categories of goods production are smaller than those of services. The largest category of goods—construction—accounts for only 4 percent of the value of total production, and the next three—utilities, food, and chemicals—each accounts for 2 percent or less.



EYE on the U.S. ECONOMY

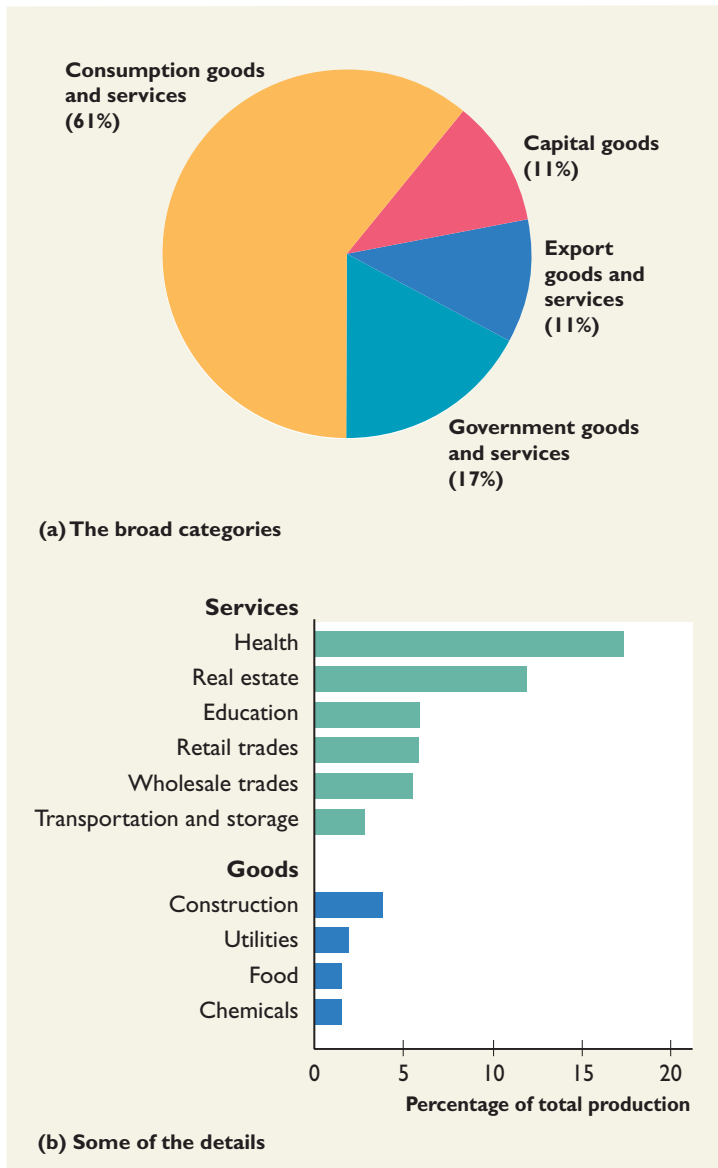
What We Produce

In 2011, consumption goods and services accounted for 61 percent of total production, both capital goods and export goods and services accounted for 11 percent, and government goods and services for 17 percent.

Health-care and real estate services, education, retail and wholesale

trades, and transportation and storage are the six largest services produced. Construction, utilities, food, and chemicals are the largest categories of goods produced.

The production of services greatly exceeds goods production and is growing faster.



Health-care services ...



education services ...



retail trades ...



and chemicals are among the largest categories of goods and services produced.

SOURCE OF DATA: Bureau of Economic Analysis.

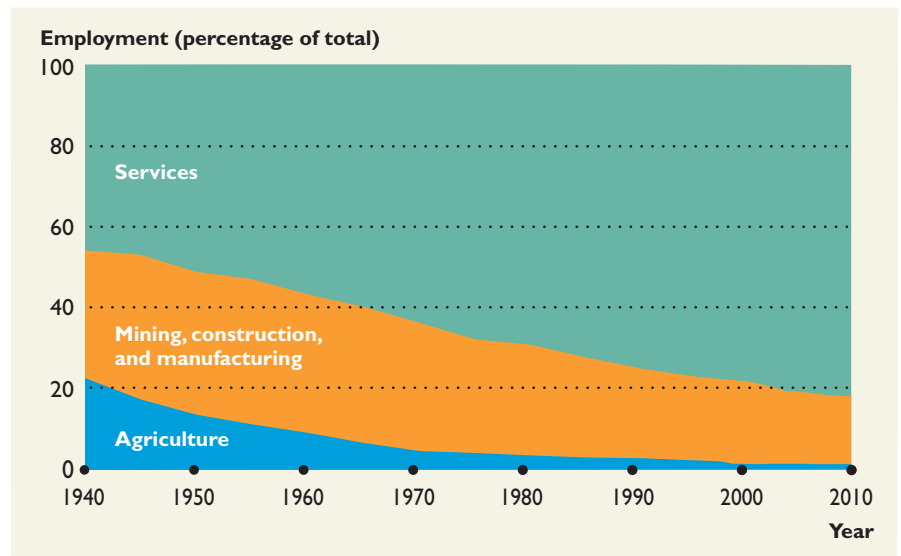


EYE on the PAST

Changes in What We Produce

Seventy years ago, one American in four worked on a farm. That number has shrunk to one in thirty-five. The number of people who produce goods—in mining, construction, and manufacturing—has also shrunk, from one in three to one in five. In contrast, the number of people who produce services has expanded from one in two to almost four in five. These changes in employment reflect changes in what we produce—services.

We hear a lot about globalization and American manufacturing jobs going overseas, but the expansion of service jobs and shrinking of manufacturing jobs is not new. It has been going on over the past 60 years and is likely to continue.



SOURCE OF DATA: U.S. Census Bureau, *Statistical Abstract of the United States*, 1999 and 2010.

Factors of production

The productive resources that are used to produce goods and services—land, labor, capital, and entrepreneurship.

Land

The “gifts of nature,” or *natural resources*, that we use to produce goods and services.

How Do We Produce?

Goods and services are produced by using productive resources. Economists call the productive resources **factors of production**. Factors of production are grouped into four categories:

- Land
- Labor
- Capital
- Entrepreneurship

Land

In economics, **land** includes all the “gifts of nature” that we use to produce goods and services. Land is what, in everyday language, we call *natural resources*. It includes land in the everyday sense, minerals, energy, water, air, and wild plants, animals, birds, and fish. Some of these resources are renewable, and some are non-renewable. The U.S. Geological Survey maintains a national inventory of the quantity and quality of natural resources and monitors changes to that inventory.

The United States covers almost 2 billion acres. About 45 percent of the land is forest, lakes, and national parks. In 2009, almost 50 percent of the land was used for agriculture and 5 percent was urban, but urban land use is growing and agricultural land use is shrinking.

Our land surface and water resources are renewable, and some of our mineral resources can be recycled. But many mineral resources can be used only once. They are nonrenewable resources. Of these, the United States has vast known reserves of coal but much smaller known reserves of oil and natural gas.

Labor

Labor is the work time and work effort that people devote to producing goods and services. Labor includes the physical and mental efforts of all the people who work on farms and construction sites and in factories, shops, and offices. The Census Bureau and Bureau of Labor Statistics measure the quantity of labor at work every month.

In the United States in April 2011, 153 million people had jobs or were available for work. Some worked full time, some worked part time, and some were unemployed but looking for an acceptable vacant job. The total amount of time worked during 2011 was about 250 billion hours.

The quantity of labor increases as the adult population increases. The quantity of labor also increases if a larger percentage of the population takes jobs. During the past 50 years, a larger proportion of women have taken paid work and this trend has increased the quantity of labor. At the same time, a slightly smaller proportion of men have taken paid work and this trend has decreased the quantity of labor.

The *quality* of labor depends on how skilled people are. A laborer who can push a hand cart but can't drive a truck is much less productive than one who can drive. An office worker who can use a computer is much more productive than one who can't. Economists use a special name for human skill: human capital.

Human capital is the knowledge and skill that people obtain from education, on-the-job training, and work experience.

You are building your own human capital right now as you work on your economics course and other subjects. Your human capital will continue to grow when you get a full-time job and become better at it. Human capital improves the *quality* of labor and increases the quantity of goods and services that labor can produce.

Capital

Capital consists of the tools, instruments, machines, buildings, and other items that have been produced in the past and that businesses now use to produce goods and services. Capital includes hammers and screwdrivers, computers, auto assembly lines, office towers and warehouses, dams and power plants, airplanes, shirt factories, and shopping malls.

Capital also includes inventories of unsold goods or of partly finished goods on a production line. And capital includes what is sometimes called *infrastructure capital*, such as highways and airports.

Capital, like human capital, makes labor more productive. A truck driver can produce vastly more transportation services than the pusher of a hand cart; the Interstate highway system enables us to produce vastly more transportation services than was possible on the old highway system that preceded it.

The Bureau of Economic Analysis in the U.S. Department of Commerce keeps track of the total value of capital in the United States and how it grows over time. Today, the value of capital in the U.S. economy is around \$50 trillion.

Financial Capital Is Not Capital

In everyday language, we talk about money, stocks, and bonds as being capital. These items are *financial capital*, and they are not productive resources. They enable people to provide businesses with financial resources, but they are *not* used to produce goods and services. They are not capital.

Labor

The work time and work effort that people devote to producing goods and services.

Human capital

The knowledge and skill that people obtain from education, on-the-job training, and work experience.

Capital

Tools, instruments, machines, buildings, and other items that have been produced in the past and that businesses now use to produce goods and services.



EYE on the U.S. ECONOMY

Changes in How We Produce in the Information Economy

The information economy consists of the jobs and businesses that produce and use computers and equipment powered by computer chips. This information economy is highly visible in your daily life.

The pairs of images here illustrate two examples. In each pair, a new technology enables capital to replace labor.

The top pair of pictures illustrate the replacement of bank tellers (labor) with ATMs (capital). Although the ATM was invented almost 40 years ago, when it made its first appearance, it was located only inside banks and was not able to update customers' accounts. It is only in the last decade that ATMs have spread to corner stores and enable us to get cash and check our bank balance from almost anywhere in the world.

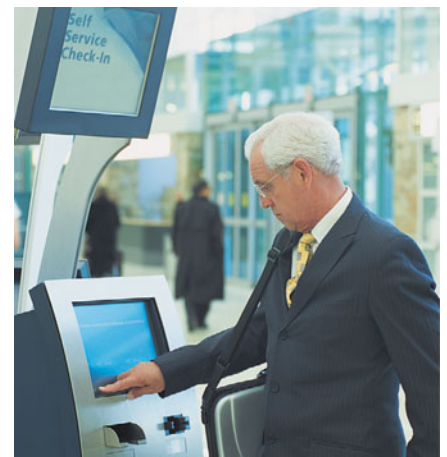
The bottom pair of pictures illustrate a more recent replacement of labor with capital: self-check-in. Air passengers today issue their own boarding pass, often at their own computer before leaving home. For international



flights, some of these machines now even check passport details.

The number of bank teller and airport check-in clerk jobs is shrinking,

but these new technologies are creating a whole range of new jobs for people who make, program, install, and repair the vast number of machines.



Entrepreneurship

Entrepreneurship

The human resource that organizes labor, land, and capital to produce goods and services.

Entrepreneurship is the human resource that organizes land, labor, and capital to produce goods and services. Entrepreneurs are creative and imaginative. They come up with new ideas about what and how to produce, make business decisions, and bear the risks that arise from these decisions. If their ideas work out, they earn a profit. If their ideas turn out to be wrong, they bear the loss.

The quantity of entrepreneurship is hard to describe or measure. During some periods, there appears to be a great deal of imaginative entrepreneurship around. People such as Sam Walton, who created Wal-Mart, one of the world's largest retailers; Bill Gates, who founded the Microsoft empire; and Mark Zuckerberg, who founded Facebook, are examples of extraordinary entrepreneurial talent. But these highly visible entrepreneurs are just the tip of an iceberg that consists of hundreds of thousands of people who run businesses, large and small.

■ For Whom Do We Produce?

Who gets the goods and services depends on the incomes that people earn. A large income enables a person to buy large quantities of goods and services. A small income leaves a person with a small quantity of goods and services.

People earn their incomes by selling the services of the factors of production they own. **Rent** is paid for the use of land, **wages** are paid for the services of labor, **interest** is paid for the use of capital, and entrepreneurs receive a **profit** (or incur a **loss**) for running their businesses. What are the shares of these four factor incomes in the United States? Which factor receives the largest share?

Figure 2.1(a) answers these questions. It shows that wages were 69 percent of total income in 2010 and rent, interest, and profit were 31 percent of total income. These percentages remain remarkably constant over time. We call the distribution of income among the factors of production the *functional distribution of income*.

Figure 2.1(b) shows the *personal distribution of income*—the distribution of income among households. Some households, like that of Carlos Rodriguez, earn many million of dollars a year. These households are in the richest 20 percent who earn 51 percent of total income. Households at the other end of the scale, like those of fast-food servers, are in the poorest 20 percent who earn only 3 percent of total income. The distribution of income has been changing and becoming more unequal. The rich have become richer. But it isn't the case, on the whole, that the poor have become poorer. They just haven't become richer as fast as the rich have.

Rent

Income paid for the use of land.

Wages

Income paid for the services of labor.

Interest

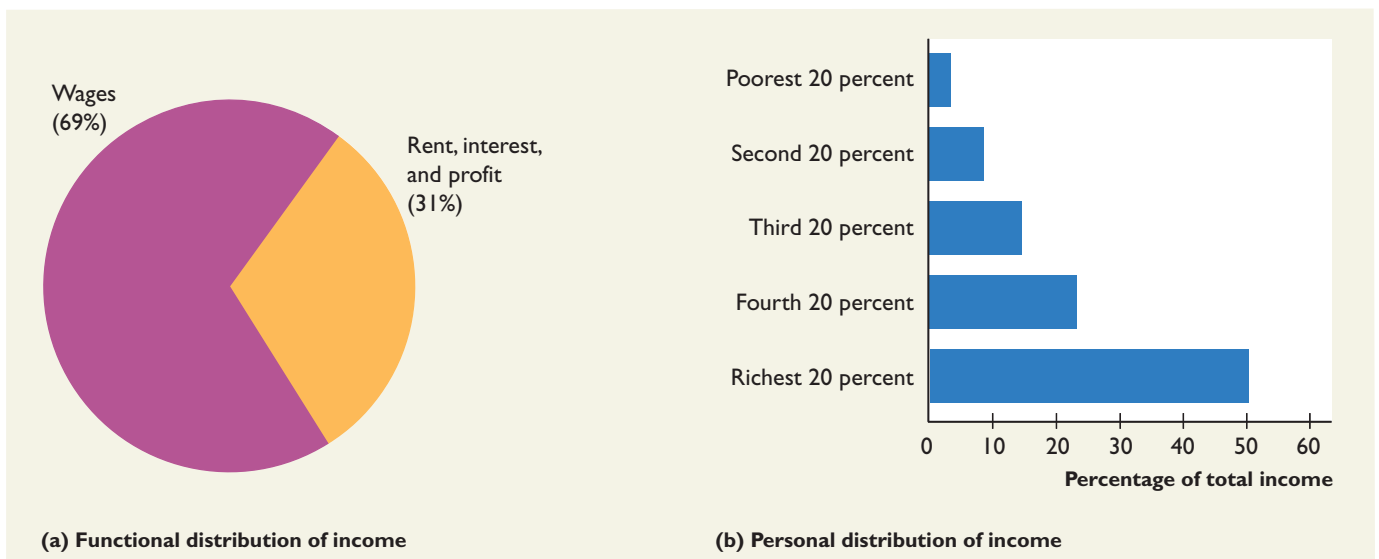
Income paid for the use of capital.

Profit (or loss)

Income earned by an entrepreneur for running a business.

■ **FIGURE 2.1**
For Whom in 2010?

MyEconLab Animation



SOURCES OF DATA: Bureau of Economic Analysis, *National Income and Product Accounts*, Table 1.10 and U.S. Census Bureau, *Income, Poverty, and Health Insurance in the United States: 2010*, Current Population Reports P60-235, 2010.

In 2010, wages (the income from labor) were 69 percent of total income. Rent, interest, and profit (the income from the services of land, capital, and entrepreneurship) totaled the remaining 31 percent.

In 2010, the 20 percent of the population with the highest incomes received 51 percent of total income. The 20 percent with the lowest incomes received only 3 percent of total income.

MyEconLab

You can work these problems in Study Plan 2.1 and get instant feedback.

CHECKPOINT 2.1

Describe what, how, and for whom goods and services are produced in the United States.

Practice Problems

1. Name the four broad categories of goods and services that we use in economics. Provide an example of each (different from those in the chapter) and say what percentage of total production each accounted for in 2011.
2. Name the four factors of production and the incomes they earn.
3. Distinguish between the functional distribution of income and the personal distribution of income.
4. In the United States, which factor of production earned the largest share of income in 2010 and what percentage did it earn?

In the News

What microloans miss

The 2006 Nobel Peace Prize winner Muhammad Yunus has said that “all people are entrepreneurs” and that microloans will pull poor people out of poverty. Only 14 percent of Americans are entrepreneurs while almost 40 percent of Peruvians are.

Source: James Surowiecki, *The New Yorker*, March 17, 2008

With only 14 percent of Americans earning their income from entrepreneurship, from what factor of production do most Americans earn their income? What is that income called? Why might so many people in Peru be entrepreneurs?

Solutions to Practice Problems

1. The four categories are consumption goods and services, capital goods, government goods and services, and export goods and services. A shirt is a consumption good and a haircut is a consumption service. An oil rig is a capital good, police protection is a government service, and a computer chip sold to Ireland is an export good. Of total production in 2011, consumption goods and services were 61 percent; capital goods, 11 percent; government goods and services, 17 percent; and export goods and services, 11 percent.
2. The factors of production are land, labor, capital, and entrepreneurship. Land earns rent; labor earns wages; capital earns interest; and entrepreneurship earns profit or incurs a loss.
3. The functional distribution of income shows the percentage of total income received by each factor of production. The personal distribution of income shows how total income is shared among households.
4. Labor is the factor of production that earns the largest share of income in the United States. In 2010, labor earned 69 percent of total income.

Solution to In the News

Most Americans earn their income from labor and the income they earn is called a wage. Peru is a poor country in which jobs are more limited than in the United States. So to earn an income, many people are self-employed and work as small entrepreneurs.

2.2 THE GLOBAL ECONOMY

We're now going to look at *what*, *how*, and *for whom* goods and services get produced in the global economy. We'll begin with a brief overview of the people and countries that form the global economy.

■ The People

Visit the Web site of the U.S. Census Bureau and go to the population clocks to find out how many people there are today in both the United States and the entire world.

On the day these words were written, June 5, 2011, the U.S. clock recorded a population of 311,495,726. The world clock recorded a global population of 6,923,027,156. The U.S. clock ticks along showing a population increase of one person every 12 seconds. The world clock spins faster, adding 30 people in the same 12 seconds.

■ The Countries

The world's 7 billion (and rising) population lives in 176 countries, which the International Monetary Fund classifies into two broad groups of economies:

- Advanced economies
- Emerging market and developing economies

Advanced Economies

Advanced economies are the richest 29 countries (or areas). The United States, Japan, Italy, Germany, France, the United Kingdom, and Canada belong to this group. So do four new industrial Asian economies: Hong Kong, South Korea, Singapore, and Taiwan. The other advanced economies include Australia, New Zealand, and most of the rest of Western Europe. Almost 1 billion people (15 percent of the world's population) live in the advanced economies.

Emerging Market and Developing Economies

Emerging market economies are the 28 countries in Central and Eastern Europe and Asia that were, until the early 1990s, part of the Soviet Union or one of its satellites. Russia is the largest of these economies. Others include the Czech Republic, Hungary, Poland, Ukraine, and Mongolia.

Almost 500 million people live in these countries—only about half of the number in the advanced economies. But these countries are important because they are emerging (hence the name) from a system of state-owned production, central economic planning, and heavily regulated markets to a system of free enterprise and unregulated markets.

Developing economies are the 119 countries in Africa, Asia, the Middle East, Europe, and Central and South America that include China, India, Indonesia, and Brazil. These economies have not yet achieved high average incomes for their people. Average incomes in these economies vary a great deal, but in all cases, these average incomes are much lower than those in the advanced economies, and in some cases, they are extremely low. More than 5 billion people—almost four out of every five people—live in developing economies.

■ What in the Global Economy?

First, let's look at the big picture. Imagine that each year the global economy produces an enormous pie. In 2011, the pie was worth about \$70 trillion! To give this number some meaning, if the pie were shared equally among the world's 6.9 billion people, each of us would get a slice worth a bit more than \$10,145.

Where Is the Global Pie Baked?

Figure 2.2 shows us where in the world the pie is baked. The advanced economies produce 53 percent—20 percent in the United States, 15 percent in the Euro area, and 18 percent in the other advanced economies. The emerging market economies produce another 8 percent. These economies, which produce 61 percent of the world's output (by value) are home to only 20 percent of the world's population.

Most of the rest of the global pie comes from Asia. China produces 13 percent of the total and other developing Asian economies produce 10 percent. The developing countries of Africa and the Middle East produce 7 percent, and the Western Hemisphere—Mexico and South America—produces the rest.

The sizes of the slices in the global production pie are gradually changing—the U.S. share is shrinking and China's share is expanding.

Unlike the slices of an apple pie, those of the global pie have different fillings. Some slices have more oil, some more food, some more clothing, some more housing services, some more autos, and so on. Let's look at some of these different fillings, and at some similarities too.

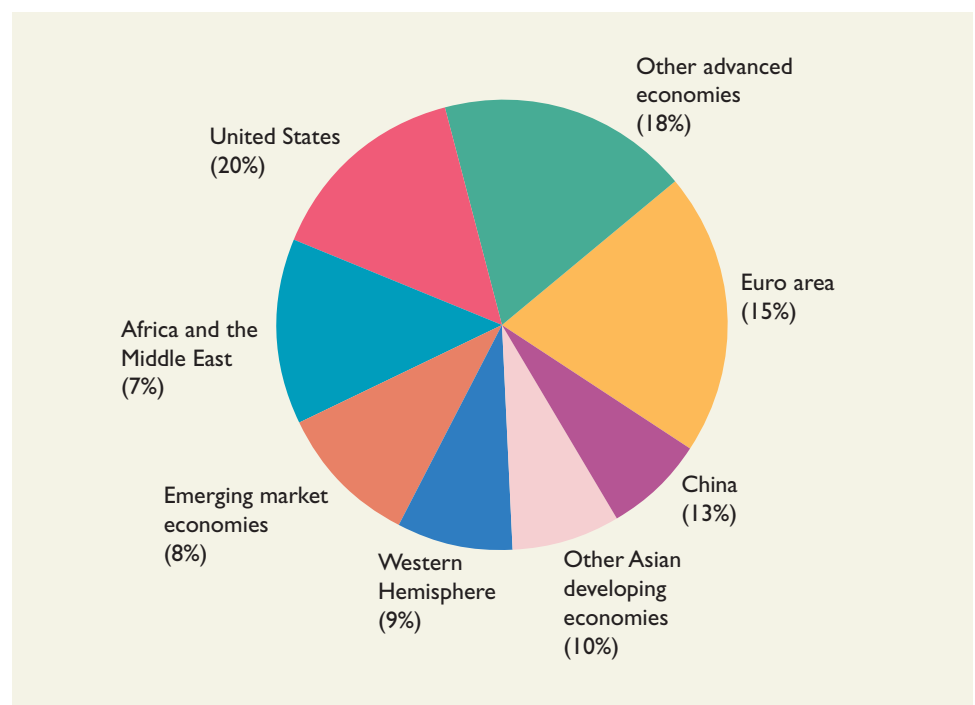
■ FIGURE 2.2

What in the Global Economy in 2010

MyEconLab Animation

If we show the value of production in the world economy as a pie, the United States produces a slice that is 20 percent of the total. The Euro zone and other advanced economies produce 33 percent of the total.

Most of the rest of the global pie comes from Asia. China produces a slice that is 13 percent of the total, and the rest of the developing Asian economies produce 10 percent. The developing countries of Africa, the Middle East, and the Western Hemisphere produce 16 percent, and the emerging market economies produce the rest.



SOURCE OF DATA: International Monetary Fund, World Economic Outlook Database, April 2011.



EYE on the iPhone

Who Makes the iPhone?

Apple designed and markets the iPhone but it doesn't make it. Apple wants to get the iPhone manufactured at the lowest possible cost. It achieves this goal by assigning the task to more than 30 companies on 3 continents who employ thousands of workers. The table identifies some of the companies and the costs of the components they make.

Apple and these firms make decisions and pay their workers, investors, and raw material suppliers to influence *what, how, and for whom* goods and services are produced.

4Gbyte iPhone costs and producers

| Item | Cost | Producer (incomplete list) | Country |
|------------------------------|---------------|------------------------------|----------------|
| Processing chips | 31.40 | Taiwan Semiconductor | Taiwan |
| | | United Microelectronics Corp | Taiwan |
| | | Samsung | Korea |
| | | Marvell | United States |
| Memory chips | 45.80 | Micron | United States |
| | | Intel, SST | United States |
| Bluetooth | 19.10 | Cambridge Silicon Radio | United Kingdom |
| Printed circuit board | 36.05 | Cheng Uei, Entery | Taiwan |
| | | Cyntec | Taiwan |
| Phone interface | 19.25 | Infineon Technology | Germany |
| Camera module | 11.00 | Largan Precision | Taiwan |
| | | Altus-Tech, Primax, Lite On | Taiwan |
| | | National Semiconductor | United States |
| Display | 33.50 | Novatek | Taiwan |
| | | Sanyo, Epson, Sharp, TMD | Japan |
| Touch screen controller | 1.15 | Balda | Germany |
| | | Broadcom | United States |
| Battery and power management | 8.60 | Delta Electronics | Taiwan |
| Case | 8.50 | Catcher, Foxconn Tech | Taiwan |
| Assembly | 15.50 | Foxconn Quanta | Taiwan |
| Royalties | 15.98 | | |
| Total cost | 245.83 | | |

Some Differences in What Is Produced

What is produced in the developing economies contrasts sharply with that of the advanced economies. Manufacturing is the big story. Developing economies have large and growing industries producing textiles, footwear, sports gear, toys, electronic goods, furniture, steel, and even automobiles and airplanes.

Food production is a small part of the U.S. and other advanced economies and a large part of the developing economies such as Brazil, China, and India. But the advanced economies produce about one third of the world's food. How come? Because *total* production is much larger in the advanced economies than in the developing economies, and a small percentage of a big number can be greater than a large percentage of a small number!

Some Similarities in What Is Produced

If you were to visit a shopping mall in Canada, England, Australia, Japan, or any of the other advanced economies, you would wonder whether you had left the United States. You would see Starbucks, Burger King, Pizza Hut, Domino's Pizza, KFC, Kmart, Wal-Mart, Target, the United Colors of Benetton, Gap, Tommy Hilfiger, Tie Rack, the upscale Louis Vuitton and Burberry, and a host of other familiar names. And, of course, you would see McDonald's golden arches. You would see them in any of the 119 countries in which one or more of McDonald's 30,000 restaurants are located.

The similarities among the advanced economies go beyond the view from main street and the shopping mall. The structure of *what* is produced is similar in these economies. As percentages of the total economy, agriculture and manufacturing are small and shrinking whereas services are large and expanding.



McDonald's in Shanghai.

■ How in the Global Economy?

Goods and services are produced using land, labor, capital, and entrepreneurial resources, and the combinations of these resources used are chosen to produce at the lowest possible cost. Energy production illustrates this point.

Energy is produced from oil, coal, natural gas, waterfalls and dams, nuclear reactors, windmills, and solar panels. Each of these sources of power uses different combinations of land (which includes natural resources), labor, and capital.

Figure 2.3 shows some interesting facts about energy use and production. Some 80 percent of the energy we use is in the form of electricity. The other 20 percent is for transportation—part (a). Most of the world’s electricity is generated using coal (33 percent), natural gas (29 percent), and oil (21 percent), and only 1 percent is generated using wind and solar power —part (b). And almost all the world’s transportation is powered by oil (gasoline and diesel), and only 2 percent is powered by ethanol—part (c).

Each country or region has its own blend of land, labor, and capital. But there are some interesting common patterns and crucial differences between the advanced and developing economies that we’ll now examine.

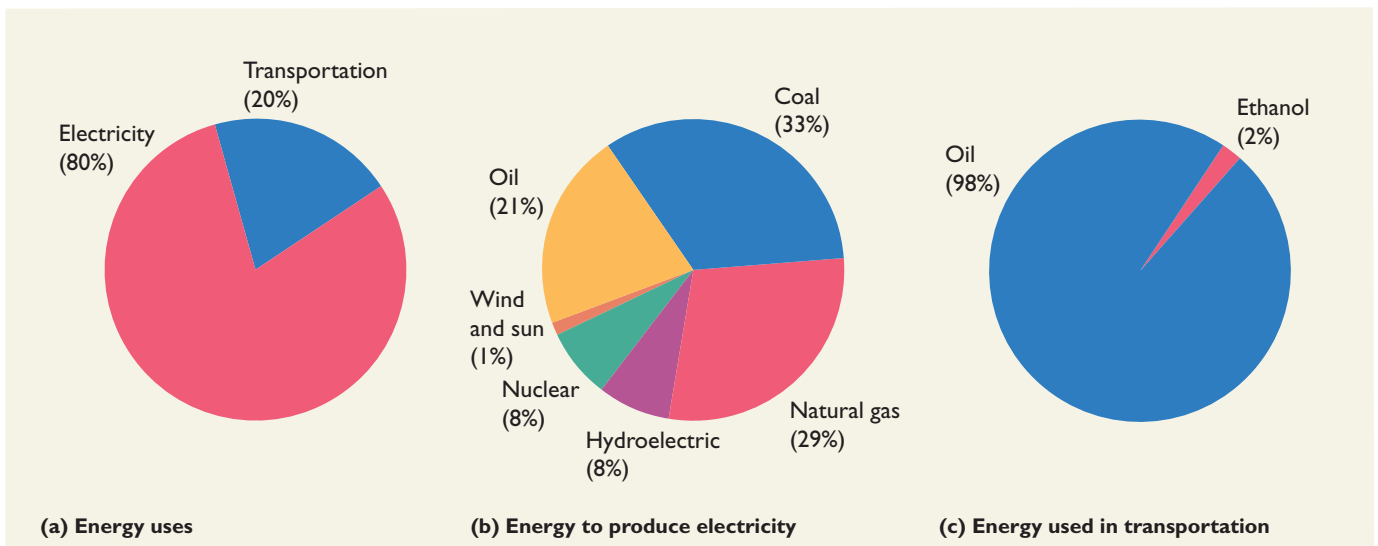
Human Capital Differences

The proportion of the population with a degree or that has completed high school is small in developing economies. And in the poorest of the developing economies, many children even miss out on basic primary education. They just don’t go to school at all. On-the-job training and experience are also much less extensive in the developing economies than in the advanced economies.

■ FIGURE 2.3

How Energy is Used and Produced in the Global Economy

MvEconLab Animation



SOURCES OF DATA: Energy Information Administration and BP Review of World Energy, June 2011.

Energy is used to generate electricity (80 percent) and for transportation (20 percent) shown in part (a).

Most electricity is produced using coal, natural gas, and oil. Only 9 percent comes from water, wind, and sun power—in part (b).

Almost all transportation is powered by oil (gasoline and diesel) and only 2 percent is powered by ethanol—in part (c).

Physical Capital Differences

The major feature of an advanced economy that differentiates it from a developing economy is the amount of capital available for producing goods and services. The differences begin with the basic transportation system. In the advanced economies, a well-developed highway system connects all the major cities and points of production. You can see this difference most vividly by opening a road atlas of North America and contrasting the U.S. interstate highway system with the sparse highways of Mexico. You would see a similar contrast if you flipped through a road atlas of Western Europe and Africa.

But it isn't the case that the developing economies have no highways. In fact, some of them have the newest and the best. But the new and best are usually inside and around the major cities. The smaller centers and rural areas of developing economies often have some of the worst roads in the world.

The contrast in vehicles is perhaps even greater than that in highways. You're unlikely to run across a horse-drawn wagon in an advanced economy, but in a developing economy, animal power can still be found, and trucks are often old and unreliable.

The contrasts in the transportation system are matched by those on farms and in factories. In general, the more advanced the economy, the greater are the amount and sophistication of the capital equipment used in production. But again, the contrast is not all black and white. Some factories in India, China, and other parts of Asia use the very latest technologies. Furniture manufacture is an example. To make furniture of a quality that Americans are willing to buy, firms in Asia use machines like those in the furniture factories of North Carolina.

Again, it is the extensiveness of the use of modern capital-intensive technologies that distinguishes a developing economy from an advanced economy. All the factories in the advanced economies are capital intensive compared with only some in the developing economies.

The differences in human and physical capital between advanced and developing economies have a big effect on who gets the goods and services.

■ For Whom in the Global Economy?

Who gets the world's goods and services depends on the incomes that people earn. So how are incomes distributed across the world?

Personal Distribution of Income

You saw earlier (on p. 37) that in the United States, the lowest-paid 20 percent of the population receives 3 percent of total income and the highest-paid 20 percent receives 51 percent of total income. The personal distribution of income in the world economy is much more unequal. According to World Bank data, the lowest-paid 20 percent of the world's population receives 2 percent of world income, and the highest-paid 20 percent receives about 70 percent of world income.

International Distribution

Much of the greater inequality at the global level arises from differences in average incomes among countries. Figure 2.4 shows some of these differences. It shows the dollar value of what people can afford each day on average. You can see that in the United States, that number is \$129 a day—an average person in the United States can buy goods and services that cost \$129. This amount is around



Beijing has a highway system to match that of any advanced country. But away from the major cities, many of China's roads are unpaved and driving on them is slow and sometimes hazardous.

five times the world average. Canada is close to the United States at \$126 a day and Japan at \$116 a day. The United Kingdom and Euro zone have average incomes of around 80 percent of that of the United States. Income levels fall off quickly as we move farther down the graph, with Africa achieving an average income of only \$4 a day and India only \$3 a day.

As people have lost well-paid manufacturing jobs and found lower-paid service jobs, inequality has increased in the United States and in most other advanced economies. Inequality is also increasing in the developing economies. People with skills enjoy rapidly rising incomes but the incomes of the unskilled are falling.

A Happy Paradox and a Huge Challenge

Despite the increase in inequality inside most countries, inequality across the entire world has decreased during the past 20 years. And most important, according to Xavier Sala-i-Martin, an economics professor at Columbia University, extreme poverty has declined. Professor Sala-i-Martin estimates that between 1976 and 1998, the number of people who earn \$1 a day or less fell by 235 million and the number who earn \$2 a day or less fell by 450 million. This happy situation arises because in China, the largest nation, incomes have increased rapidly and lifted millions from extreme poverty. Incomes are growing quickly in India too.

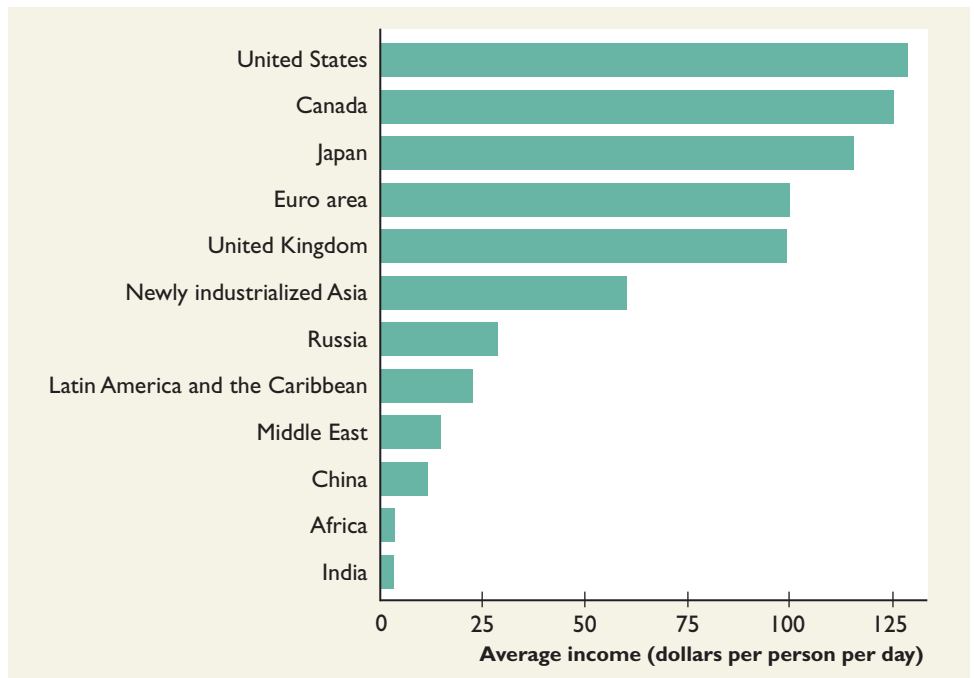
Lifting Africa from poverty is today’s big challenge. In 1960, 11 percent of the world’s poor lived in Africa, but in 1998, 66 percent did. Between 1976 and 1998, the number of people in Africa who earn \$1 a day or less rose by 175 million, and the number who earn \$2 a day or less rose by 227 million.

FIGURE 2.4

For Whom in the Global Economy in 2010

MyEconLab Animation

In 2010, the average income per person per day in the United States was \$129. It was \$126 in Canada and \$99 in the United Kingdom. It was \$116 in Japan and \$100 in the Euro area. The number falls off rapidly to \$29 in Russia, \$12 in China, \$4 in Africa, and \$3 in India.



SOURCE OF DATA: International Monetary Fund, World Economic Outlook Database, April 2011.



EYE on YOUR LIFE

The U.S. and Global Economies in Your Life

You've encountered a lot of facts and trends about what, how, and for whom goods and services are produced in the U.S. economy and the global economy. How can you use this information? You can use it in two ways:

1. To inform your choice of career
2. To inform your stand on the politics of protecting U.S. jobs

Career Choices

As you think about your future career, you are now better informed about some of the key trends. You know that manufacturing is shrinking. The U.S. economy is what is sometimes called a *post-industrial economy*. Industries that provided the backbone of the economy in previous generations have fallen to barely a fifth of

the economy today, and the trend continues. It is possible that by the middle of the current century, manufacturing will be as small a source of jobs as agriculture is today.

So, a job in a manufacturing business is likely to lead to some tough situations and possibly the need for several job changes over a working life.

As manufacturing shrinks, so services expand, and this expansion will continue. The provision of health care, education, communication, wholesale and retail trades, and entertainment are all likely to expand in the future and be sources of increasing employment and rising wages. A job in a service-oriented business is more likely to lead to steady advances in income.

Political Stand on Job Protection

As you think about the stand you will take on the political question of protecting U.S. jobs, you are better informed about the basic facts and trends. When you hear that manufacturing jobs are disappearing to China, you will be able to place that news in historical perspective. You might reasonably be concerned, especially if you or a member of your family has lost a job. But you know that trying to reverse or even halt this process is flying in the face of stubborn historical trends.

In later chapters, you will learn that there are good economic reasons to be skeptical about any form of protection and placing limits on competition.

CHECKPOINT 2.2

Describe what, how, and for whom goods and services are produced in the global economy.

MyEconLab

You can work these problems in Study Plan 2.2 and get instant feedback.

Practice Problems

1. Describe what, how, and for whom goods and services are produced in developing economies.
2. A Clinton Foundation success story is that it loaned \$23,000 to Rwandan coffee growers to support improvements to coffee washing stations and provided technical support. What was the source of the success?

Solutions to Practice Problems

1. In developing countries, agriculture is the largest percentage, manufacturing is an increasing percentage, and services are a small percentage of total production. Most production does not use modern capital-intensive technologies, but some industries do. People who work in factories have rising incomes while those who work in rural industries are left behind.
2. Rwandan coffee growers improved their knowledge of coffee farming, which increased their human capital. The improvements to washing stations was a change in physical capital that allowed farmers to increase the quantity of washed coffee.

Circular flow model

A model of the economy that shows the circular flow of expenditures and incomes that result from decision makers' choices and the way those choices interact to determine what, how, and for whom goods and services are produced.

Households

Individuals or groups of people living together.

Firms

The institutions that organize the production of goods and services.

Market

Any arrangement that brings buyers and sellers together and enables them to get information and do business with each other.

Goods markets

Markets in which goods and services are bought and sold.

Factor markets

Markets in which the services of factors of production are bought and sold.

2.3 THE CIRCULAR FLOWS

We can organize the data you've just studied using the **circular flow model**—a model of the economy that shows the circular flow of expenditures and incomes that result from decision makers' choices and the way those choices interact to determine what, how, and for whom goods and services are produced. Figure 2.5 shows the circular flow model.

■ Households and Firms

Households are individuals or groups of people living together. The 118 million households in the United States own the factors of production—land, labor, capital, and entrepreneurship—and choose the quantities of these resources to provide to firms. Households also choose the quantities of goods and services to buy.

Firms are the institutions that organize the production of goods and services. The 20 million firms in the United States choose the quantities of the factors of production to hire and the quantities of goods and services to produce.

■ Markets

Households choose the quantities of the factors of production to provide to firms, and firms choose the quantities of the services of the factors of production to hire. Firms choose the quantities of goods and services to produce, and households choose the quantities of goods and services to buy. How are these choices coordinated and made compatible? The answer is: by markets.

A **market** is any arrangement that brings buyers and sellers together and enables them to get information and do business with each other. An example is the market in which oil is bought and sold—the world oil market. The world oil market is not a place. It is the network of oil producers, oil users, wholesalers, and brokers who buy and sell oil. In the world oil market, decision makers do not meet physically. They make deals by telephone, fax, and the Internet.

Figure 2.5 identifies two types of markets: goods markets and factor markets. Goods and services are bought and sold in **goods markets**; and the services of factors of production are bought and sold in **factor markets**.

■ Real Flows and Money Flows

When households choose the quantities of services of land, labor, capital, and entrepreneurship to offer in factor markets, they respond to the incomes they receive—rent for land, wages for labor, interest for capital, and profit for entrepreneurship. When firms choose the quantities of factor services to hire, they respond to the rent, wages, interest, and profits they must pay to households.

Similarly, when firms choose the quantities of goods and services to produce and offer for sale in goods markets, they respond to the amounts that they receive from the expenditures that households make. And when households choose the quantities of goods and services to buy, they respond to the amounts they must pay to firms.

Figure 2.5 shows the flows that result from these choices made by households and firms. The flows shown in orange are *real flows*: the flows of the factors of production that go from households through factor markets to firms and of the goods and services that go from firms through goods markets to households. The flows in the opposite direction are *money flows*: the flows of payments made in exchange

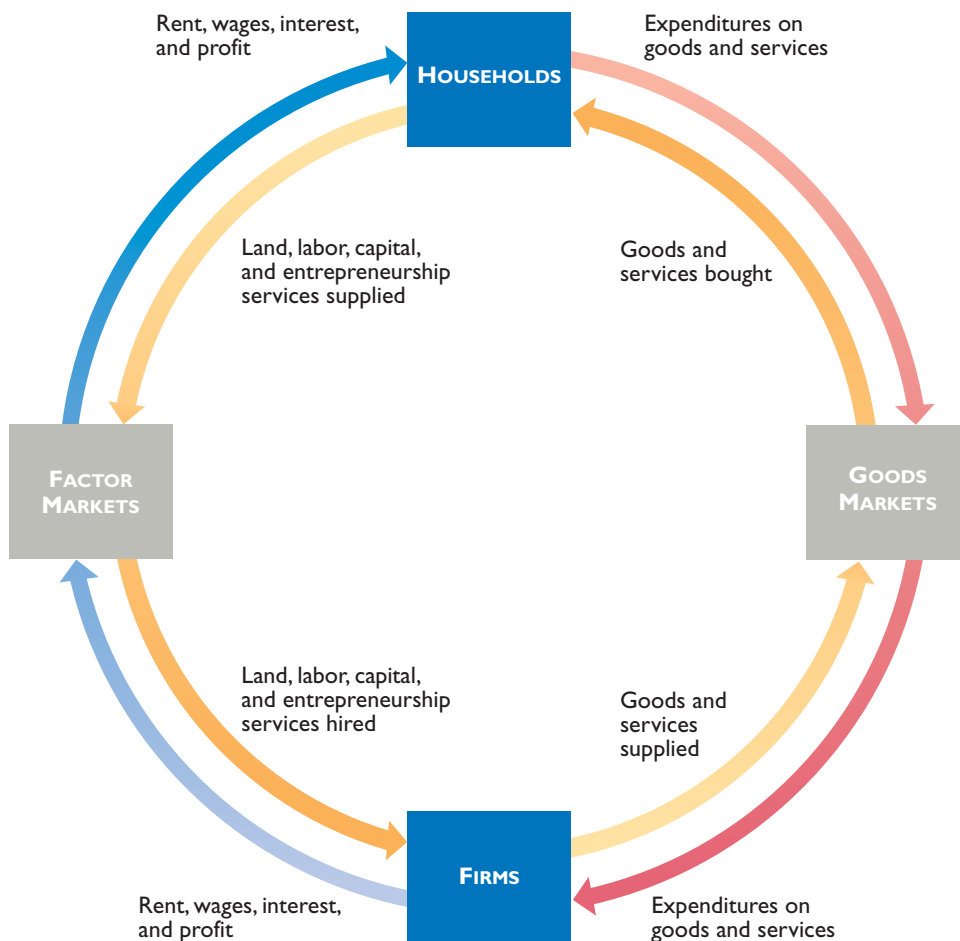
for the services of factors of production (shown in blue) and of expenditures on goods and services (shown in red).

Lying behind these real flows and money flows are millions of individual choices about what to consume and what and how to produce. These choices result in buying plans by households and selling plans by firms in goods markets. And the choices result in selling plans by households and buying plans by firms in factor markets that interact to determine the prices that people pay and the incomes they earn, and so determine for whom goods and services are produced. You'll learn in Chapter 4 how markets coordinate the buying plans and selling plans of households and firms and make them compatible.

Firms produce most of the goods and services that we consume, but governments provide some of the services that we enjoy. Governments also play a big role in modifying for whom goods and services are produced by changing the personal distribution of income. We're now going to look at the role of governments in the U.S. economy and add them to the circular flow model.

FIGURE 2.5
The Circular Flow Model

MyEconLab Animation



The orange flows are the services of factors of production that go from households through factor markets to firms and the goods and services that go from firms through goods markets to households. These flows are *real* flows.

The blue flow is the income earned by the factors of production, and the red flow is the expenditures on goods and services. These flows are *money* flows.

The choices that generate these real and money flows determine *what, how, and for whom* goods and services are produced.

■ Governments

More than 86,000 organizations operate as governments in the United States. Some are tiny like the Yuma, Arizona, school district and some are enormous like the U.S. federal government. We divide governments into two levels:

- Federal government
- State and local government

Federal Government

The federal government's major expenditures provide

1. Good and services
2. Social Security and welfare payments
3. Transfers to state and local governments

The goods and services provided by the federal government include the legal system, which protects property and enforces contracts, and national defense. Social Security and welfare benefits, which include income for retired people and programs such as Medicare and Medicaid, are transfers from the federal government to households. Federal government transfers to state and local governments are payments designed to provide more equality across the states and regions.

The federal government finances its expenditures by collecting a variety of taxes. The main taxes paid to the federal government are

1. Personal income taxes
2. Corporate (business) income taxes
3. Social Security taxes

In 2010, the federal government spent \$3.5 trillion—about 24 percent of the total value of all the goods and services produced in the United States in that year. The taxes they raised were less than this amount—the government had a deficit.

State and Local Government

The state and local governments' major expenditures are to provide

1. Goods and services
2. Welfare benefits

The goods and services provided by state and local governments include the state courts and police, schools, roads, garbage collection and disposal, water supplies, and sewage management. Welfare benefits provided by state governments include unemployment benefits and other aid to low-income families.

State and local governments finance these expenditures by collecting taxes and receiving transfers from the federal government. The main taxes paid to state and local governments are

1. Sales taxes
2. Property taxes
3. State income taxes

In 2007-08, state and local governments spent \$2.1 trillion or 17 percent of the total value of all the goods and services produced in the United States.

■ Governments in the Circular Flow

Figure 2.6 adds governments to the circular flow model. As you study this figure, first notice that the outer circle is the same as in Figure 2.5. In addition to these flows, governments buy goods and services from firms. The red arrows that run from governments through the goods markets to firms show this expenditure.

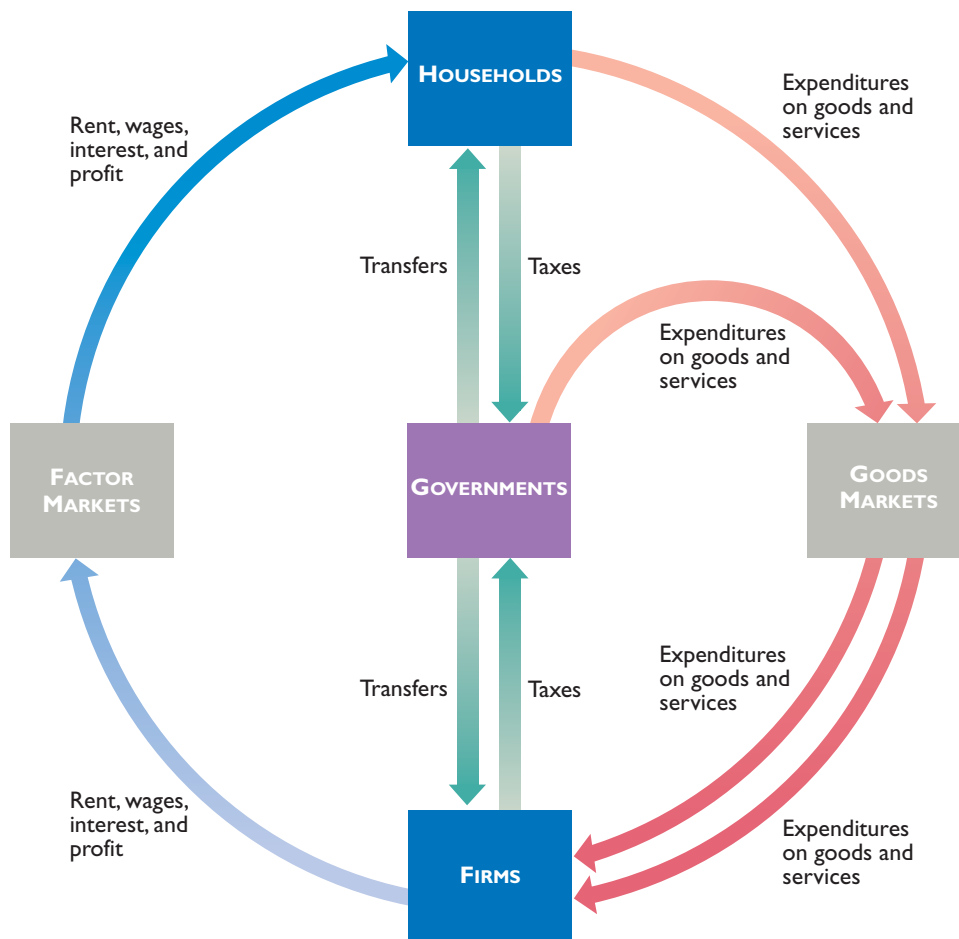
Households and firms pay taxes to governments. The green arrows running directly from households and firms to governments show these flows. Also, governments make money payments to households and firms. The green arrows running directly from governments to households and firms show these flows. Taxes and transfers are direct transactions with governments and do not go through the goods markets and factor markets.

Not part of the circular flow and not visible in Figure 2.6, governments provide the legal framework within which all transactions occur. For example, governments operate the courts and legal system that enable contracts to be written and enforced.

■ **FIGURE 2.6**

Governments in the Circular Flow

MyEconLab Animation



The green flows from households and firms to governments are taxes, and the green flows from governments to households and firms are money transfers.

The red flow from governments through the goods markets to firms is the expenditure on goods and services by governments.

■ Federal Government Expenditures and Revenue

What are the main items of expenditure by the federal government on goods and services and transfers? And what are its main sources of tax revenue? Figure 2.7 answers these questions.

Three items of expenditure are similar in magnitude—and large. They are Social Security benefits, Medicare and Medicaid, and national defense and homeland security. The combined total of these items is 64 percent of the government’s expenditures. Other transfers to persons, which includes unemployment benefits, are also large. The “Others” category covers a wide range of items and includes transfers to state governments, NASA’s space program, and the National Science Foundation’s funding of research in the universities.

The interest payment on the national debt is another significant item. The **national debt** is the total amount that the federal government has borrowed to make expenditures that exceed tax revenue—to run a government budget deficit. The national debt is a bit like a large credit card balance, and paying the interest on the national debt is like paying the minimum required monthly payment.

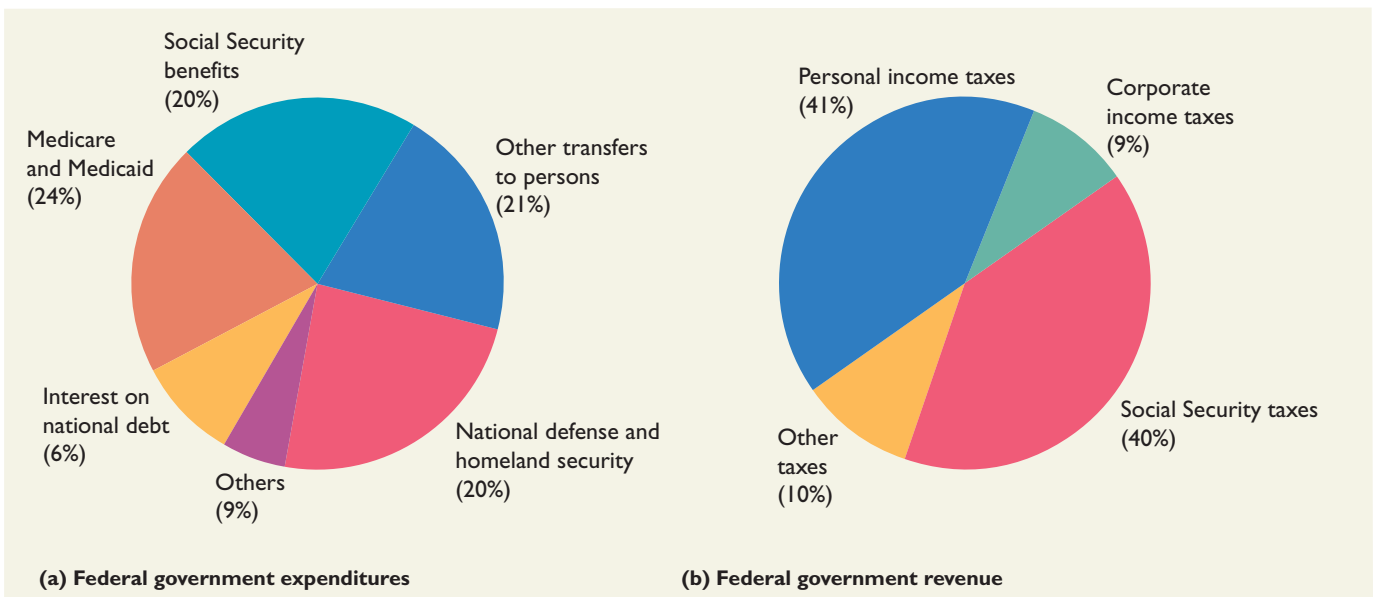
Most of the tax revenue of the federal government comes from personal income taxes and Social Security taxes. Corporate income taxes and other taxes are a small part of the federal government’s revenue.

National debt

The total amount that the federal government has borrowed to make expenditures that exceed tax revenue—to run a government budget deficit.

■ **FIGURE 2.7**
Federal Government Expenditures and Revenue

MyEconLab Animation



SOURCE OF DATA: Budget of the United States Government, Historical Tables, Table 2.1 and Table 3.1, 2010 data.

Social Security benefits, Medicare and Medicaid, and national defense and homeland security absorb 64 percent of the federal government’s expenditures. Interest on the national debt is also a significant item.

Most of the federal government’s revenue comes from personal income taxes and Social Security taxes. Corporate income taxes and other taxes are a small part of total revenue.

■ State and Local Government Expenditures and Revenue

What are the main items of expenditure by the state and local governments on goods and services and transfers? And what are the main sources of state and local government revenue? Figure 2.8 answers these questions.

You can see that education is by far the largest part of the expenditures of state and local governments. This item covers the cost of public schools, colleges, and universities. It absorbs 34 percent of total expenditures—approximately \$826 billion, or \$2,650 per person.

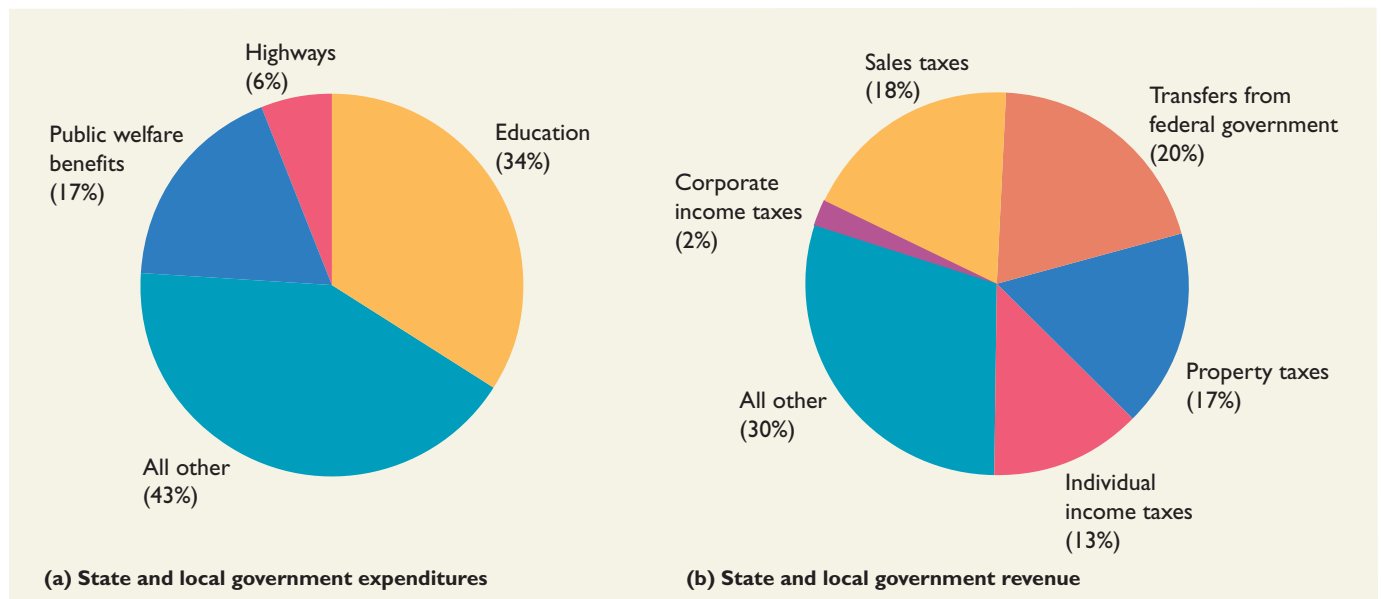
Public welfare benefits are the second largest item and they take 17 percent of total expenditures. Highways are the next largest item, and they account for 6 percent of total expenditures. The remaining 43 percent is spent on other local public goods and services such as police services, garbage collection and disposal, sewage management, and water supplies.

Sales taxes and transfers from the federal government bring in similar amounts—about 18 percent and 20 percent of total revenue, respectively. Property taxes account for 17 percent of total revenue. Individual income taxes account for 13 percent, and corporate income taxes account for 2 percent. The remaining revenue comes from other taxes such as those on gasoline, cigarettes, and beer and wine.

■ **FIGURE 2.8**

State and Local Government Expenditures and Revenue

MyEconLab Animation



SOURCES OF DATA: *Economic Report of the President 2009*, Table B-86, 2007–2008 data.

The largest slices of state and local government expenditures are education (34 percent of total expenditure), public welfare benefits (17 percent), and highways (6 percent).

Most of the state and local government revenue comes from sales taxes (18 percent of total revenue), property taxes (17 percent), and transfers from the federal government (20 percent).

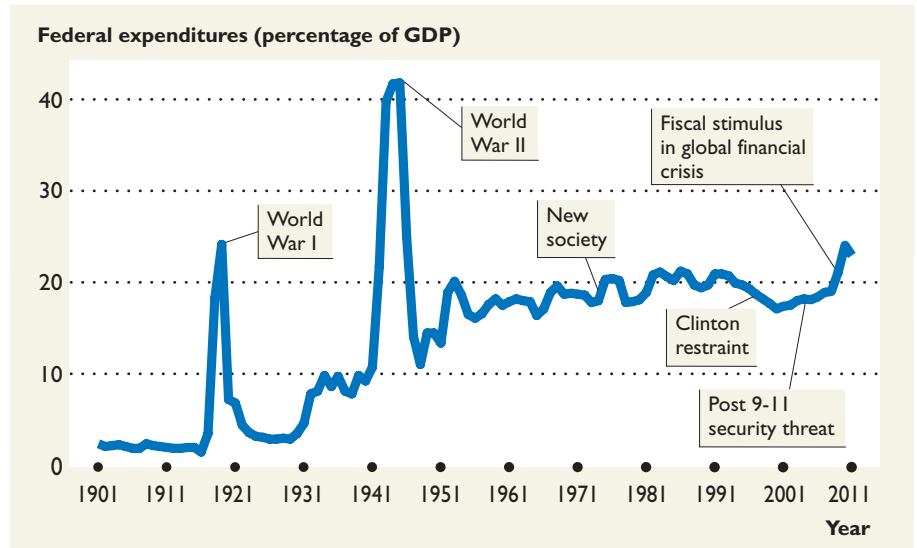


EYE on the PAST

Growing Government

One hundred years ago, the federal government spent 2 cents out of each dollar earned. Today, the federal government spends 23 cents. Government grew during the two world wars and during the 1960s and 1970s as social programs expanded.

Only during the 1980s and 1990s did big government begin to shrink in a process begun by Ronald Reagan and continued by Bill Clinton. But 9/11 saw the start of a new era of growing government, and fiscal stimulus and bailouts to cope with the global financial crisis sent spending soaring.



SOURCE OF DATA: Budget of the United States Government, Historical Tables, Table 1.1.

■ Circular Flows in the Global Economy

Households and firms in the U.S. economy interact with households and firms in other economies in two main ways: They buy and sell goods and services and they borrow and lend. We call these two activities:

- International trade
- International finance

International Trade

Many of the goods that you buy were not made in the United States. Your iPod, Wii games, Nike shoes, cell phone, T-shirt, and bike were made somewhere in Asia or possibly Europe or South or Central America. The goods and services that we buy from firms in other countries are U.S. *imports*.

Much of what is produced in the United States doesn't end up being sold here. Boeing, for example, sells most of the airplanes it makes to foreign airlines. And the banks of Wall Street sell banking services to Europeans and Asians. The goods and services that we sell to households and firms in other countries are U.S. *exports*.

International Finance

When firms or governments want to borrow, they look for the lowest interest rate available. Sometimes, that is outside the United States. Also, when the value of our imports exceeds the value of our exports, we must borrow from the rest of the world.

Firms and governments in the rest of the world behave in the same way. They look for the lowest interest rate at which to borrow and the highest at which to lend. They might borrow from or lend to Americans.

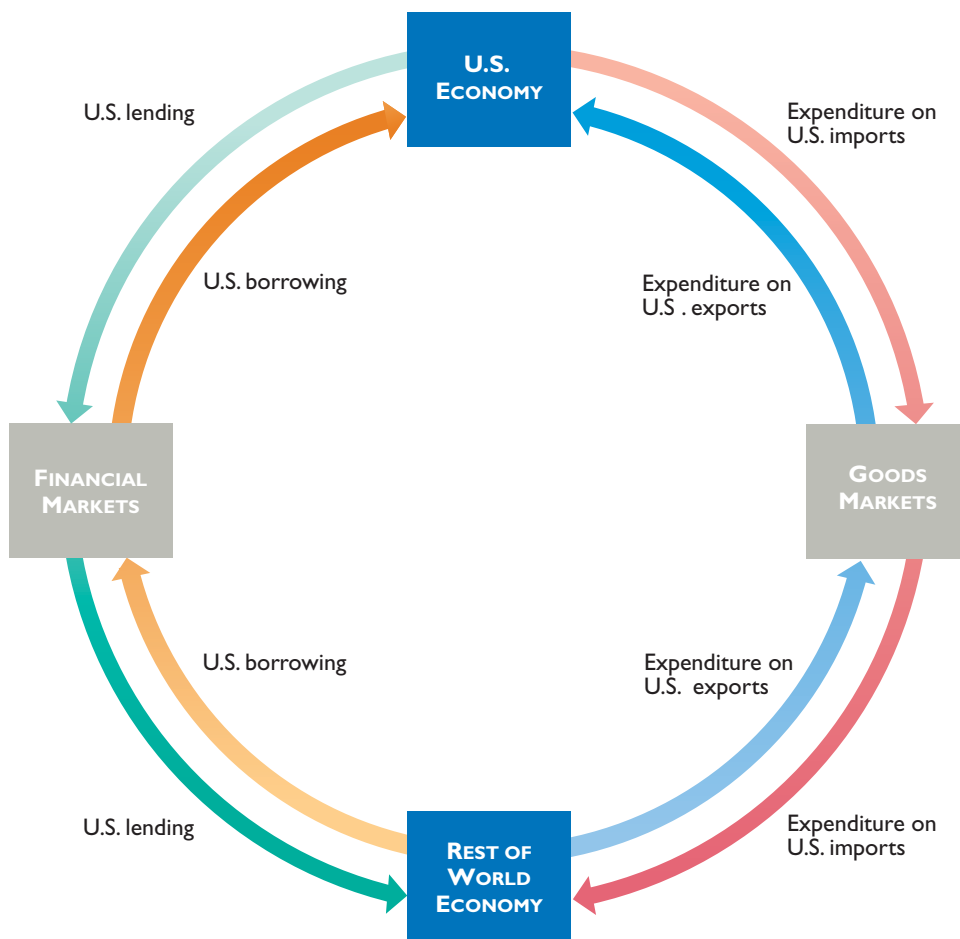
Figure 2.9 shows the flows through goods markets and financial markets in the global economy. Households and firms in the U.S. economy interact with those in the rest of the world (other economies) in goods markets and financial markets.

The red flow shows the expenditure by Americans on imports of goods and services, and the blue flow shows the expenditure by the rest of the world on U.S. exports (other countries' imports). The green flow shows U.S. lending to the rest of the world, and the orange flow shows U.S. borrowing from the rest of the world.

It is these international trade and international finance flows that tie nations together in the global economy and through which global booms and slumps are transmitted.

FIGURE 2.9
Circular Flows in the Global Economy

MyEconLab Animation



Households and firms in the U.S. economy interact with those in the rest of the world (other economies) in goods markets and financial markets.

The red flow shows the expenditure by Americans on imports of goods and services, and the blue flow shows the expenditure by the rest of the world on U.S. exports (other countries' imports).

The green flow shows U.S. lending to the rest of the world, and the orange flow shows U.S. borrowing from the rest of the world.



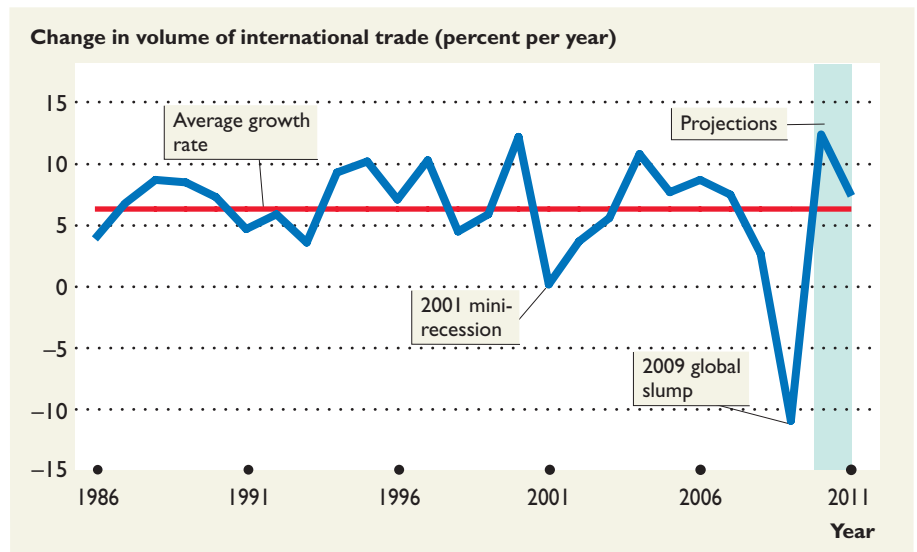
EYE on the GLOBAL ECONOMY

The Ups and Downs in International Trade

International trade has expanded rapidly during the past 25 years. At an average growth rate of close to 7 percent a year, world trade has doubled every decade.

In 2001, a mini-recession in the United States slowed world trade growth to a crawl.

But the 2001 slowdown looks mild compared to the collapse in world trade during the 2009 global economic slump. Despite the slump in 2009, world trade was back to a normal level in 2010 and 2011.



SOURCE OF DATA: International Monetary Fund, World Economic Outlook Database, April 2011.

MyEconLab

You can work these problems in Study Plan 2.3 and get instant feedback.

CHECKPOINT 2.3

Use the circular flow model to provide a picture of how households, firms, and governments interact in the U.S. economy and how the U.S. and other economies interact in the global economy.

Practice Problems

1. Describe the flows in the circular flow model in which consumption expenditure, purchases of new national defense equipment, and payments for labor services appear. Through which market does each of these flows pass?
2. Of the flows that run between households, firms, and governments in the circular flow model, which ones are real flows and which are money flows?

Solutions to Practice Problems

1. Consumption expenditure flows from households to firms through the goods market. Purchases of national defense flow from governments to firms through the goods market. Payments for labor services flow from firms to households through the factor market.
2. The real flows are the services of factors of production that go from households to firms through factor markets and the goods and services that go from firms to households and from firms to governments through goods markets. The money flows are factor incomes, household and government expenditures on goods and services, taxes, and transfers.

CHAPTER SUMMARY

Key Points

- 1. Describe what, how, and for whom goods and services are produced in the United States.**
 - Consumption goods and services represent 61 percent of total production; capital goods represent 11 percent.
 - Goods and services are produced by using the four factors of production: land, labor, capital, and entrepreneurship.
 - The incomes people earn (rent for land, wages for labor, interest for capital, and profit for entrepreneurship) determine who gets the goods and services produced.
- 2. Describe what, how, and for whom goods and services are produced in the global economy.**
 - Sixty-one percent of the world's production (by value) comes from the advanced industrial countries and the emerging market economies.
 - Production in the advanced economies uses more capital (both machines and human), but some developing economies use the latest capital and technologies.
 - The global distribution of income is more unequal than the U.S. distribution. Poverty has fallen in Asia but has increased in Africa.
- 3. Use the circular flow model to provide a picture of how households, firms, and governments interact in the U.S. economy and how the U.S. and other economies interact in the global economy.**
 - The circular flow model of the U.S. economy shows the real flows of factors of production and goods and the corresponding money flows of incomes and expenditures.
 - Governments in the circular flow receive taxes, make transfers, and buy goods and services.
 - The circular flow model of the global economy shows the flows of U.S. exports and imports and the international financial flows that result from lending to and borrowing from other countries.

Key Terms

| | | |
|------------------------------------|-----------------------------------|----------------------|
| Capital, 35 | Factors of production, 34 | Labor, 35 |
| Capital goods, 32 | Firms, 46 | Land, 34 |
| Circular flow model, 46 | Goods markets, 46 | Market, 46 |
| Consumption goods and services, 32 | Government goods and services, 32 | National debt, 50 |
| Entrepreneurship, 36 | Households, 46 | Profit (or loss), 37 |
| Export goods and services, 32 | Human capital, 35 | Rent, 37 |
| Factor markets, 46 | Interest, 37 | Wages, 37 |

MyEconLab

You can work these problems in Chapter 2 Study Plan and get instant feedback.

CHAPTER CHECKPOINT

Study Plan Problems and Applications

1. Explain which of the following items are *not* consumption goods and services:
 - A chocolate bar
 - A ski lift
 - A golf ball
2. Explain which of the following items are *not* capital goods:
 - An auto assembly line
 - A shopping mall
 - A golf ball
3. Explain which of the following items are *not* factors of production:
 - Vans used by a baker to deliver bread
 - 1,000 shares of Amazon.com stock
 - Undiscovered oil in the Arctic Ocean
4. Which of the four factors of production earns the highest percentage of total U.S. income? Define that factor of production. What is the income it earns called?
5. With more job training and more scholarships to poor American students, which special factor of production is likely to grow faster than in the past?
6. Define the factor of production called capital. Give three examples of capital, different from those in the chapter. Distinguish between the factor of production capital and financial capital.
7. A Job Creation through Entrepreneurship Act, debated in the House of Representatives in 2009, would award grants to small business owners, some of which would be aimed at women, Native Americans, and veterans. The Act would provide \$189 million in 2010 and \$531 million between 2010 and 2014. Explain how you would expect this Act to influence *what, how, and for whom* goods and services are produced in the United States.
8. Indicate on a graph of the circular flow model, the real or money flow in which the following items belong:
 - You pay your tuition.
 - The University of Texas buys some Dell computers.
 - A student works at FedEx Kinko's.
 - Donald Trump rents a Manhattan building to a hotel.
 - You pay your income tax.
9. **For-profit colleges may face aid cuts**

The Obama administration proposes a new rule: Federal aid to for-profit colleges will be cut if students in vocational programs graduate with worthless degrees. Millions of low-income students are borrowing heavily to attend colleges and too many of them are dropping out, and failing to get a job.

Source: *USA Today*, June 2, 2011

How do you think the personal distribution of income would change if all graduates could obtain a well-paying job that uses their knowledge gained in college?

Instructor Assignable Problems and Applications



Your instructor can assign these problems as homework, a quiz, or a test in [MyEconLab](#).

1. Buzz surrounds Apple's iPhone. Can you explain:
 - Why doesn't Apple manufacture the iPhone at its own factory in the United States?
 - Why doesn't Apple offer a cheaper version of the iPhone with no camera?
 - In view of the cost of producing an iPhone (in the table on p. 41), why do you think the price of an iPhone is so high? What other costs must be incurred to bring the iPhone to market other than the cost of manufacturing it?
2. The global economy has three cell phone users for every fixed line user. Two in every three cell phone users lives in a developing nation and the growth rate is fastest in Africa. In 2000, 1 African in 50 had a cell phone; in 2009, it was 14 in 50. Describe the changes in *what*, *how*, and *for whom* telecommunication services the global economy produces.
3. Which of the entries in List 1 are consumption goods and services and which are government goods? Explain your choice.
4. Which of the entries in List 1 are capital goods? Explain your choice.
5. Which of the entries in List 1 are factors of production? Explain your choice.
6. In the African nation of Senegal, to enroll in school a child needs a Birth Certificate that costs \$25. This price is several weeks' income for many families. Explain how this requirement is likely to affect the growth of human capital in Senegal.
7. **China's prosperity brings income gap**
The Asian Development Bank [ADB] reports that China has the largest gap between the rich and the poor in Asia. Ifzal Ali, the ADB's chief economist, claims it is not that the rich are getting richer and the poor are getting poorer, but that the rich are getting richer faster than the poor.

Source: *Financial Times*, August 9, 2007

Explain how the distribution of personal income in China can be getting more unequal even though the poorest 20 percent are getting richer.

8. Compare the scale of agricultural production in the advanced and developing economies. In which is the percentage higher? In which is the total amount produced greater?
9. On a graph of the circular flow model, indicate in which real or money flow each entry in List 2 belongs.

Use the following information to work Problems 10 and 11.

Poor India makes millionaires at fastest pace

India, with the world's largest population of poor people, also paradoxically created millionaires at the fastest pace in the world. Millionaires increased by 22.7 percent to 123,000. In contrast, the number of Indians living on less than a dollar a day is 350 million and those living on less than \$2 a day is 700 million. In other words, there are 7,000 very poor Indians for every millionaire.

Source: *The Times of India*, June 25, 2008

10. How is the personal distribution of income in India changing?
11. Why might incomes of \$1 a day and \$2 a day underestimate the value of the goods and services that these households actually consume?

LIST 1

- An interstate highway
- An airplane
- A school teacher
- A stealth bomber
- A garbage truck
- A pack of bubble gum
- President of the United States
- A strawberry field
- A movie
- An ATM

LIST 2

- General Motors pays its workers wages.
- IBM pays a dividend to its stockholders.
- You buy your groceries.
- Chrysler buys robots.
- Southwest rents some aircraft.
- Nike pays Roger Federer for promoting its sports shoes.

MyEconLab

You can work this quiz in Chapter 2 Study Plan and get instant feedback.

Multiple Choice Quiz

1. Which of the following classifications is correct?
 - A. City streets are consumption goods because they wear out with use.
 - B. Stocks are capital goods because when people buy and sell them they make a profit.
 - C. The coffee maker in the coffee shop at an airport is a consumption good because people buy the coffee it produces.
 - D. White House security is a government service because it is paid for by the government.
2. Which of the following statements about U.S. production is correct?
 - A. Government goods and services and export goods and services each account for the same percentage of total production.
 - B. Capital goods account for a larger percentage of total production than do consumption goods and services.
 - C. Most of U.S. production is consumption goods and services.
 - D. Most of what the United States produces is goods not services.
3. Which of the following items is *not* a factor of production?
 - A. An oil rig in the Gulf of Mexico
 - B. A ski jump in Utah
 - C. A bank loan to a farmer
 - D. An orange grove in Florida
4. What is human capital?
 - A. Immigrant labor
 - B. Someone who operates heavy equipment
 - C. Your professor's knowledge of the economy
 - D. A car assembly line robot
5. Which of the following statements is correct?
 - A. Labor earns wages and entrepreneurship earns bonuses
 - B. Land earns interest and capital earns rent
 - C. Entrepreneurship earns interest and capital earns profit
 - D. Capital earns interest and labor earns wages
6. How are goods and services produced in the global economy?
 - A. Developing countries use less human capital but just as much physical capital as advanced economies.
 - B. Emerging economies use more capital-intensive technology than do developing economies.
 - C. Human capital in all economies is similar.
 - D. Advanced economies use less capital than developing economies.
7. In the circular flow model, which of the following items is a real flow?
 - A. The flow of government expenditures to firms for the goods bought
 - B. The flow of income from firms to households for the services of the factors of production hired
 - C. The flow of U.S. borrowing from the rest of the world
 - D. The flow of labor services from households to firms



Is wind power free?

The Economic Problem

When you have completed your study of this chapter, you will be able to

- 1 Explain and illustrate the concepts of scarcity, production efficiency, and tradeoff using the production possibilities frontier.
- 2 Calculate opportunity cost.
- 3 Explain what makes production possibilities expand.
- 4 Explain how people gain from specialization and trade.

3

CHAPTER CHECKLIST

3.1 PRODUCTION POSSIBILITIES

Every working day in mines, factories, shops, and offices and on farms and construction sites across the United States, we produce a vast array of goods and services. In the United States in 2011, 250 billion hours of labor equipped with \$50 trillion worth of capital produced \$15 trillion worth of goods and services.

Although our production capability is enormous, it is limited by our available resources and by technology. At any given time, we have fixed quantities of the factors of production and a fixed state of technology. Because our wants exceed our resources, we must make choices. We must rank our wants and decide which to satisfy and which to leave unsatisfied. In using our scarce resources, we make rational choices. And to make a rational choice, we must determine the costs and benefits of the alternatives.

Your first task in this chapter is to learn about an economic model of scarcity, choice, and opportunity cost—a model called the production possibilities frontier.

■ Production Possibilities Frontier

The **production possibilities frontier** is the boundary between the combinations of goods and services that can be produced and the combinations that cannot be produced, given the available factors of production—land, labor, capital, and entrepreneurship—and the state of technology.

Although we produce millions of different goods and services, we can visualize the limits to production most easily if we imagine a simpler world that produces just two goods. Imagine an economy that produces only DVDs and cell phones. All the land, labor, capital, and entrepreneurship available gets used to produce these two goods.

Land can be used for movie studios and DVD factories or cell-phone factories. Labor can be trained to work as movie actors, camera and sound crews, movie producers and DVD makers or as cell-phone makers. Capital can be used for making movies, making and coating disks, and transferring images to disks, or for the equipment that makes cell phones. Entrepreneurs can put their creative talents to managing movie studios and running electronics businesses that make DVDs or to running cell-phone businesses. In every case, the more resources that are used to produce DVDs, the fewer are left to produce cell phones.

Suppose that if no factors of production are allocated to producing cell phones, the maximum number of DVDs that can be produced is 15 million a year. So one production possibility is no cell phones and 15 million DVDs. Another possibility is to allocate sufficient resources to produce 1 million cell phones a year. But these resources must be taken from DVD factories. Suppose that the economy can now produce only 14 million DVDs a year. As resources are moved from producing DVDs to producing cell phones, the economy produces more cell phones but fewer DVDs.

The table in Figure 3.1 illustrates these two combinations of cell phones and DVDs as possibilities *A* and *B*. Suppose that *C*, *D*, *E*, and *F* are other combinations of the quantities of these two goods that the economy can produce. Possibility *F* uses all the resources to produce 5 million cell phones a year and allocates no resources to producing DVDs. These six possibilities are alternative combinations of the quantities of the two goods that the economy can produce by *using all of its resources, given the technology*.

Production possibilities frontier

The boundary between the combinations of goods and services that can be produced and the combinations that cannot be produced, given the available factors of production and the state of technology.

The graph in Figure 3.1 illustrates the production possibilities frontier, *PPF*, for cell phones and DVDs. Each point on the graph labeled *A* through *F* represents the possibility in the table identified by the same letter. For example, point *B* represents the production of 1 million cell phones and 14 million DVDs. These quantities also appear in the table as possibility *B*.

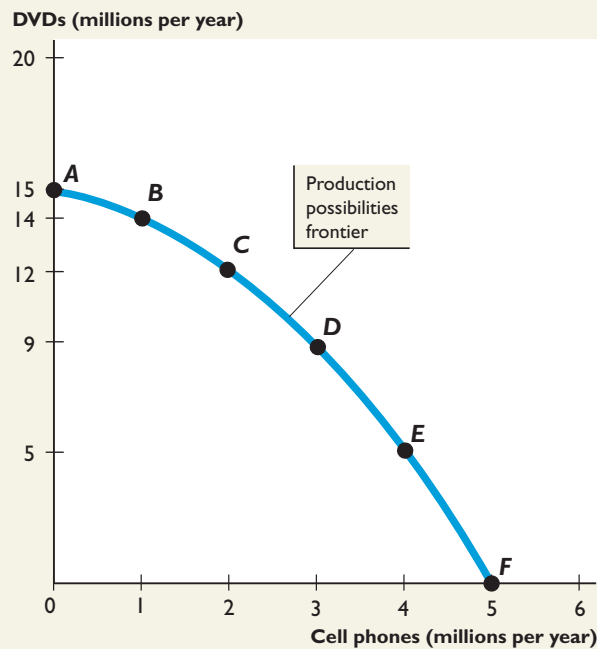
The *PPF* shows the limits to production *with the available resources and technology*. If either resources or technology change, the *PPF* shifts. More resources or better technology shift it outward and a loss of resources shifts it inward.

The *PPF* is a valuable tool for illustrating the effects of scarcity and its consequences. The *PPF* puts three features of production possibilities in sharp focus. They are the distinctions between

- Attainable and unattainable combinations
- Efficient and inefficient production
- Tradeoffs and free lunches

FIGURE 3.1
The Production Possibilities Frontier

MyEconLab Animation



The table and the graph show the production possibilities frontier for cell phones and DVDs.

Point *A* tells us that if the economy produces no cell phones, the maximum quantity of DVDs it can produce is 15 million a year. Each point *A*, *B*, *C*, *D*, *E*, and *F* on the graph represents the possibility in the table identified by the same letter. The line passing through these points is the production possibilities frontier.

| | | | | | | |
|------------------------|----------|----------|----------|----------|----------|----------|
| Cell phones (millions) | 0 | 1 | 2 | 3 | 4 | 5 |
| DVDs (millions) | 15 | 14 | 12 | 9 | 5 | 0 |
| Possibility | <i>A</i> | <i>B</i> | <i>C</i> | <i>D</i> | <i>E</i> | <i>F</i> |

Attainable and Unattainable Combinations

Because the *PPF* shows the *limits* to production, it separates attainable combinations from unattainable ones. The economy can produce combinations of cell phones and DVDs that are smaller than those on the *PPF*, and it can produce any of the combinations *on* the *PPF*. These combinations of cell phones and DVDs are attainable. But it is impossible to produce combinations that are larger than those on the *PPF*. These combinations are unattainable.

Figure 3.2 emphasizes the attainable and unattainable combinations. Only the points on the *PPF* and inside it (in the orange area) are attainable. The combinations of cell phones and DVDs beyond the *PPF* (in the white area), such as the combination at point *G*, are unattainable. These points illustrate combinations that cannot be produced with the current resources and technology. The *PPF* tells us that the economy can produce 4 million cell phones and 5 million DVDs at point *E* or 2 million cell phones and 12 million DVDs at point *C*. But the economy cannot produce 4 million cell phones and 12 million DVDs at point *G*.

Production efficiency

A situation in which the economy is getting all that it can from its resources and cannot produce more of one good or service without producing less of something else.

Efficient and Inefficient Production

Production efficiency occurs when the economy is getting all that it can from its resources. When production is efficient it is not possible to produce more of one good or service without producing less of something else. For production to be efficient, there must be full employment—not just of labor but of all the available factors of production—and each resource must be assigned to the task that it performs comparatively better than other resources can.

FIGURE 3.2

Attainable and Unattainable Combinations

MyEconLab Animation

The production possibilities frontier, *PPF*, separates attainable combinations from unattainable ones. The economy can produce at any point *inside* the *PPF* (the orange area) or at any point *on* the frontier. Any point outside the production possibilities frontier, such as point *G*, is unattainable.

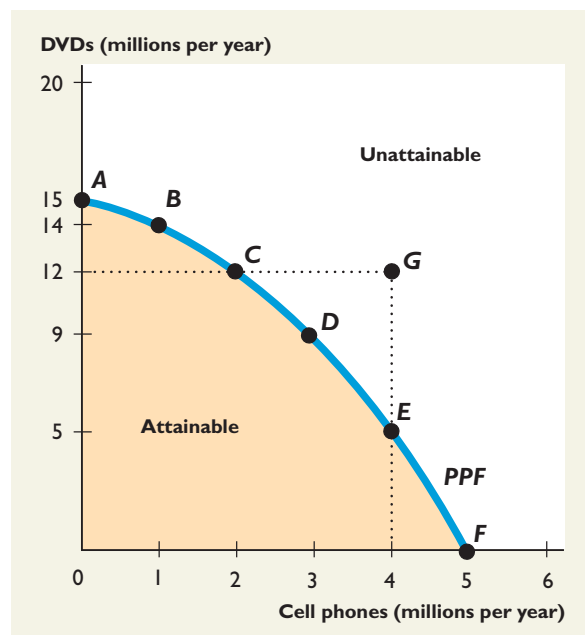


Figure 3.3 illustrates the distinction between efficient and inefficient production. With *inefficient* production, the economy might be producing 3 million cell phones and 5 million DVDs at point *H*. With an *efficient* use of the economy's resources, it is possible to produce at a point on the *PPF* such as point *D* or *E*. At point *D*, there are more DVDs and the same quantity of cell phones as at point *H*. And at point *E*, there are more cell phones and the same quantity of DVDs as at point *H*. At points *D* and *E*, production is efficient.

Tradeoffs and Free Lunches

A **tradeoff** is an exchange—giving up one thing to get something else. You trade off income for a better grade when you decide to cut back on the hours you spend on your weekend job and allocate the time to extra study. The Ford Motor Company faces a tradeoff when it cuts the production of trucks and uses the resources saved to produce more hybrid SUVs. The federal government faces a tradeoff when it cuts NASA's space exploration program and allocates more resources to homeland security. As a society, we face a tradeoff when we decide to cut down a forest and destroy the habitat of the spotted owl.

The production possibilities frontier illustrates the idea of a tradeoff. The *PPF* in Figure 3.3 shows how. If the economy produces at point *E* and people want to produce more DVDs, they must forgo some cell phones. In the move from point *E* to point *D*, people trade off cell phones for DVDs.

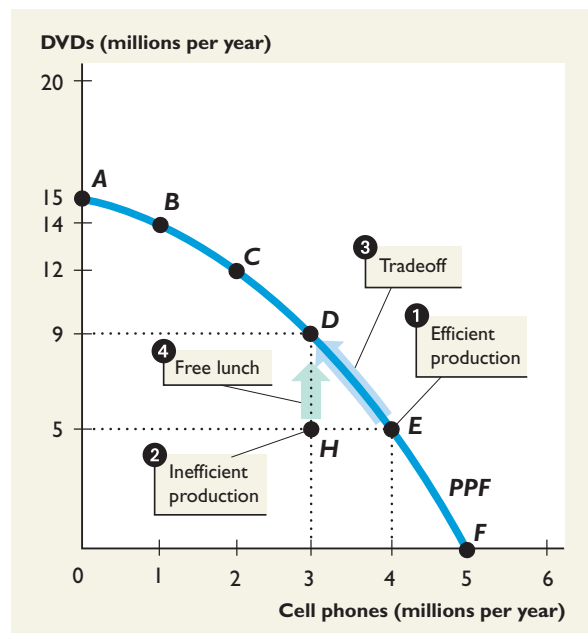
Economists often express the central idea of economics—that choices involve tradeoff—with the saying “There is no such thing as a free lunch.” A *free lunch* is a gift—getting something without giving up something else. What does the

Tradeoff

An exchange—giving up one thing to get something else.

FIGURE 3.3
Efficient and Inefficient Production, Tradeoffs, and Free Lunches

MyEconLab Animation



- 1 When production occurs at a point on the *PPF*, such as point *E*, resources are used efficiently.
- 2 When production occurs at a point inside the *PPF*, such as point *H*, resources are used inefficiently.
- 3 When production is efficient—on the *PPF*—the economy faces a tradeoff. To move from point *E* to point *D* requires that some cell phones be given up for more DVDs.
- 4 When production is inefficient—inside the *PPF*—there is a free lunch. To move from point *H* to point *D* does not involve a tradeoff.

famous saying mean? Suppose some resources are not being used or are not being used efficiently. Isn't it then possible to avoid a tradeoff and get a free lunch?

The answer is yes. You can see why in Figure 3.3. If production is taking place *inside* the *PPF* at point *H*, then it is possible to move to point *D* and increase the production of DVDs by using currently unused resources or by using resources in their most productive way. Nothing is forgone to increase production—there is a free lunch.

When production is efficient—at a point on the *PPF*—choosing to produce more of one good involves a tradeoff. But if production is inefficient—at a point inside the *PPF*—there is a free lunch. More of some goods and services can be produced without producing less of any others.

So “there is no such thing as a free lunch” means that when resources are used efficiently, every choice involves a tradeoff. Because economists view people as making rational choices, they expect that resources will be used efficiently. That is why they emphasize the tradeoff idea and deny the existence of free lunches. We might *sometimes* get a free lunch, but we *almost always* face a tradeoff.



EYE on YOUR LIFE

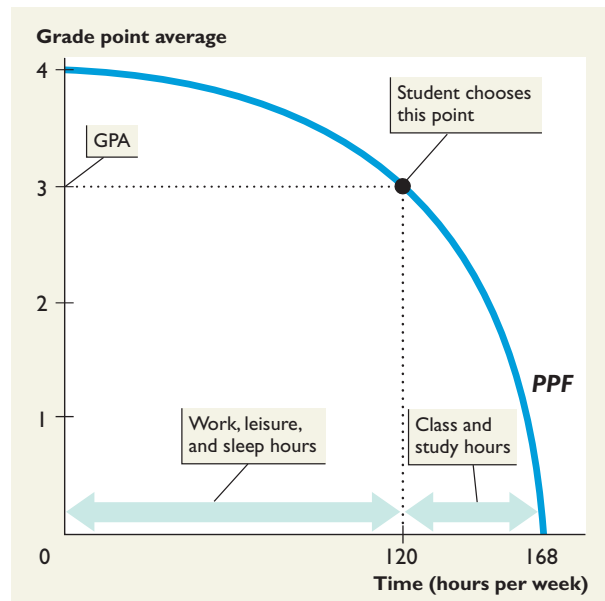
Your Production Possibilities Frontier

Two “goods” that concern you a great deal are your grade point average (GPA) and the amount of time you have available for leisure or earning an income. You face a tradeoff. To get a higher GPA you must give up leisure or income. Your forgone leisure or forgone income is the opportunity cost of a higher GPA. Similarly, to get more leisure or more income, you must accept a lower grade. A lower grade is the opportunity cost of increased leisure or increased income.

The figure illustrates a student's *PPF*. Any point on or beneath the *PPF* is attainable and any point above the *PPF* is unattainable. A student who wastes time or doesn't study efficiently ends up with a lower GPA than the highest attainable from the time spent studying. But a student who works efficiently achieves a point *on* the *PPF* and achieves production efficiency.

The student in the figure allocates the scarce 168 hours a week between studying (class and study hours) and other activities (work, leisure, and sleep hours). The student attends class

and studies for 48 hours each week and works or has fun (and sleeps) for the other 120 hours. With this allocation of time, and studying efficiently, the student's GPA is 3.



CHECKPOINT 3.1

Explain and illustrate the concepts of scarcity, production efficiency, and tradeoff using the production possibilities frontier.

Practice Problems

- Table 1 sets out the production possibilities of a small Pacific island economy. Draw the economy's *PPF*.

Figure 1 shows an economy's *PPF* and identifies some production points. Use this figure to work Problems 2 to 4.

- Which points are attainable? Explain why.
- Which points are efficient and which points are inefficient? Explain why.
- Which points illustrate a tradeoff? Explain why.

In the News

Loss of honeybees is less but still a threat

Honeybees are crucial for the pollination of almonds in California's Central Valley. During 2008, 30 percent of U.S. honeybees died.

Source: *USA Today*, May 20, 2009

Explain how this loss of honeybees affected the Central Valley's *PPF*.

Solutions to Practice Problems

- The *PPF* is the boundary between attainable and unattainable combinations of goods. Figure 2 shows the economy's *PPF*. The graph plots each row of the table as a point with the corresponding letter.
- Attainable points:** Any point on the *PPF* is attainable and any point below (inside) the *PPF* is attainable. Points outside the *PPF* (*F* and *G*) are unattainable. In Figure 1, the attainable points are *A*, *B*, *C*, *D*, and *E*.
- Efficient points:** Production is efficient when it is not possible to produce more of one good without producing less of another good. To be efficient, a point must be attainable, so points *F* and *G* can't be efficient. Points inside the *PPF* can't be efficient because more goods can be produced, so *D* and *E* are not efficient. The only efficient points are those on the *PPF*—*A*, *B*, and *C*.
Inefficient points: Inefficiency occurs when resources are misallocated or unemployed. Such points are *inside* the *PPF*. These points are *D* and *E*.
- Tradeoff:** Begin by recalling that a tradeoff is an exchange—giving up something to get something else. A tradeoff occurs when moving along the *PPF* from one point to another point. So moving from any point on the *PPF*, point *A*, *B*, or *C*, to another point on the *PPF* illustrates a tradeoff.

Solution to In the News

Honeybees are a resource used in the production of almonds. At the start of 2008, Central Valley farmers were at a point on their *PPF*. A 30 percent drop in honeybees reduced the quantity of almonds produced by about 30 percent. With no change in the quantity of other crops produced, the Central Valley *PPF* shifted inward.

MyEconLab

You can work these problems in Study Plan 3.1 and get instant feedback.

TABLE 1

| Possibility | Fish (pounds) | Berries (pounds) |
|-------------|---------------|------------------|
| A | 0 | and 20 |
| B | 1 | and 18 |
| C | 2 | and 15 |
| D | 3 | and 11 |
| E | 4 | and 6 |
| F | 5 | and 0 |

FIGURE 1

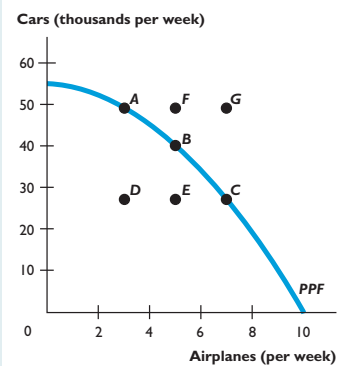
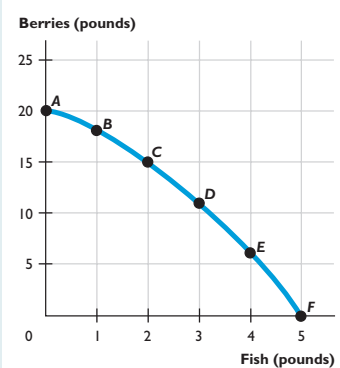


FIGURE 2



3.2 OPPORTUNITY COST

You've seen that moving from one point to another on the *PPF* involves a tradeoff. But what are the terms of the tradeoff? *How much* of one item must be forgone to obtain an additional unit of another item—a large amount or a small amount? The answer is given by opportunity cost—the best thing you must give up to get something (see p. 9). We can use the *PPF* to calculate opportunity cost.

■ The Opportunity Cost of a Cell Phone

The opportunity cost of a cell phone is the number of DVDs forgone to get an additional cell phone. It is calculated as the number of DVDs forgone divided by the number of cell phones gained.

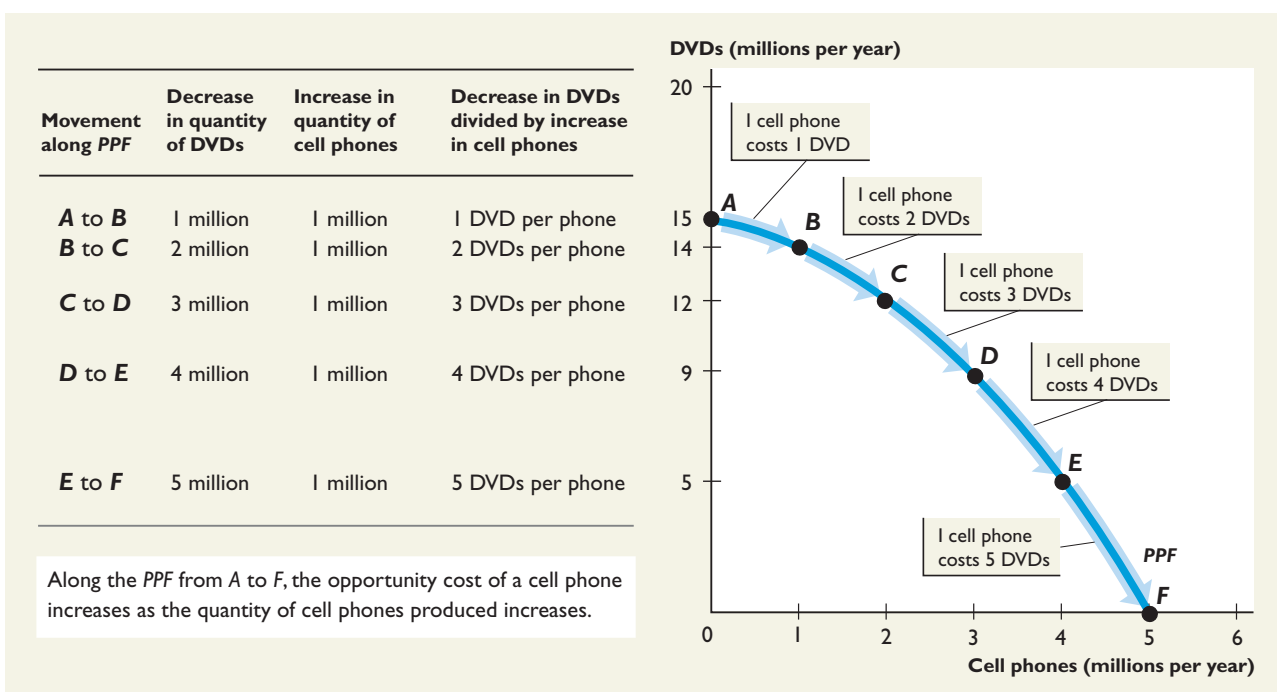
Figure 3.4 illustrates the calculation. At point *A*, the quantities produced are zero cell phones and 15 million DVDs; and at point *B*, the quantities produced are 1 million cell phones and 14 million DVDs. To gain 1 million cell phones by moving from point *A* to point *B*, 1 million DVDs are forgone, so the opportunity cost of 1 cell phone is 1 DVD.

At point *C*, the quantities produced are 2 million cell phones and 12 million DVDs. To gain 1 million cell phones by moving from point *B* to point *C*, 2 million DVDs are forgone. Now the opportunity cost of 1 cell phone is 2 DVDs.

If you repeat these calculations, moving from *C* to *D*, *D* to *E*, and *E* to *F*, you will obtain the opportunity costs shown in the table and the graph.

FIGURE 3.4
Calculating the Opportunity Cost of a Cell Phone

MyEconLab Animation



Opportunity Cost and the Slope of the PPF

Look at the numbers that we've just calculated for the opportunity cost of a cell phone and notice that they follow a striking pattern. The opportunity cost of a cell phone increases as the quantity of cell phones produced increases.

The magnitude of the *slope* of the PPF measures the opportunity cost. Because the PPF in Figure 3.4 is bowed outward, its slope changes and gets steeper as the quantity of cell phones produced increases.

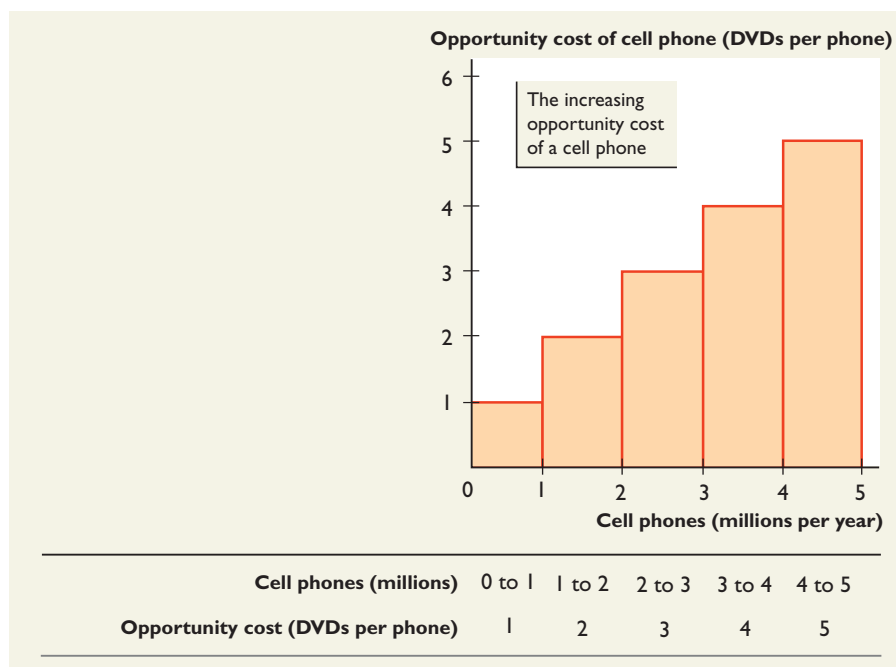
When a small quantity of cell phones is produced—between points *A* and *B*—the PPF has a gentle slope and the opportunity cost of a cell phone is low. A given increase in the quantity of cell phones costs a small decrease in the quantity of DVDs. When a large quantity of cell phones is produced—between points *E* and *F*—the PPF is steep and the opportunity cost of a cell phone is high. A given increase in the quantity of cell phones costs a large decrease in the quantity of DVDs. Figure 3.5 shows the increasing opportunity cost of a cell phone.

Opportunity Cost Is a Ratio

The opportunity cost of a cell phone is the *ratio* of DVDs forgone to cell phones gained. Similarly, the opportunity cost of a DVD is the *ratio* of cell phones forgone to DVDs gained. So the opportunity cost of a DVD is equal to the inverse of the opportunity cost of a cell phone. For example, moving along the PPF in Figure 3.4 from *C* to *D* the opportunity cost of a cell phone is 3 DVDs. Moving along the PPF in the opposite direction, from *D* to *C*, the opportunity cost of a DVD is 1/3 of a cell phone.

FIGURE 3.5
The Opportunity Cost of a Cell Phone

MyEconLab Animation



Because the PPF in Figure 3.4 is bowed outward, the opportunity cost of a cell phone increases as the quantity of cell phones produced increases.



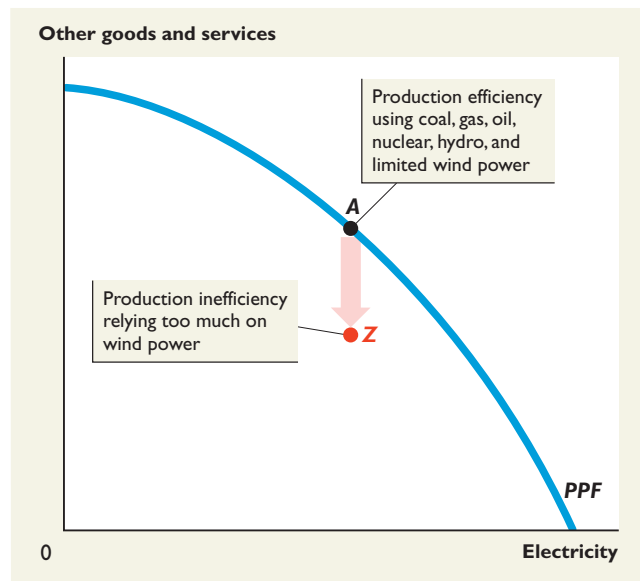
EYE on the ENVIRONMENT

Is Wind Power Free?

Wind power is not free. To use it, we must give up huge amounts of other goods and services to build wind turbines and transmission lines.

Wind turbines can produce electricity only when there is wind, which turns out, at best, to be 40 percent of the time and, on average, about 25 percent of the time. Also some of the best wind farm locations are a long way from major population centers, so transmission lines would be long and power transmission losses large.

If we produced 55 percent of our electricity using South Dakota wind power, we would be operating inside the PPF at a point such as Z.



■ Increasing Opportunity Costs Are Everywhere

Just about every production activity that you can think of has increasing opportunity cost. We allocate the most skillful farmers and the most fertile land to producing food, and we allocate the best doctors and the least fertile land to producing health-care services. Some resources are equally productive in both activities. If we shift these equally productive resources away from farming to hospitals, we get an increase in health care at a low opportunity cost. But if we keep increasing health-care services, we must eventually build hospitals on the most fertile land and get the best farmers to become hospital porters. The production of food drops drastically and the increase in the production of health-care services is small. The opportunity cost of a unit of health-care services rises. Similarly, if we shift resources away from health care toward farming, we must eventually use more skilled doctors and nurses as farmers and more hospitals as hydroponic tomato factories. The decrease in the production of health-care services is large, but the increase in food production is small. The opportunity cost of a unit of food rises.

■ Your Increasing Opportunity Cost

Flip back to the PPF in *Eye on Your Life* on page 64 and think about its implications for your opportunity cost of a higher grade.

What is the opportunity cost of spending time with your friends in terms of the grade you might receive on your exam? What is the opportunity cost of a higher grade in terms of the activities you give up to study? Do you face increasing opportunity costs in these activities?



EYE on the U.S. ECONOMY

Guns Versus Butter

Guns versus butter is the classic economic tradeoff. “Guns” stand for defense goods and services and “butter” stands for food and more generally for all other goods and services. Recently, the U.S. economy has been producing more guns and less butter.

Figure 1 shows the fluctuations in the quantity of defense goods and services produced. (The quantity is measured by expenditure on defense using the prices in 2005 to remove the effects of price changes.) The quantity of defense goods and services produced increases in times of war and decreases in times of peace.

Figure 2 illustrates the recent changes in the production of defense goods and services using the PPF.

During the late 1980s and the 1990s, the PPF was PPF_0 . President Reagan raised the stakes in the Cold War between the United States and the (former) Soviet Union by a big expansion of military expenditure and we were at point A. By the mid-1990s, the Soviet Union had collapsed and we enjoyed a peace dividend by moving along PPF_0 to B.

During the next decade, production possibilities expanded from PPF_0 to PPF_1 . Defense production and the production of other goods and services increased, and in 2001 we operated at point C. Then, in response to the attacks of September 11, 2001, defense spending increased again and by 2011 we had moved along PPF_1 to point D.

Defense goods and services (billions of 2005 dollars)

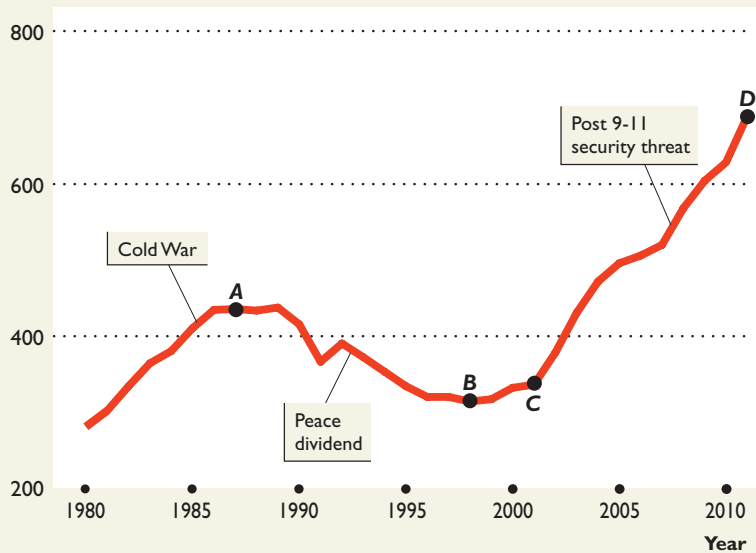


Figure 1 The quantity of defense goods produced

Other goods and services

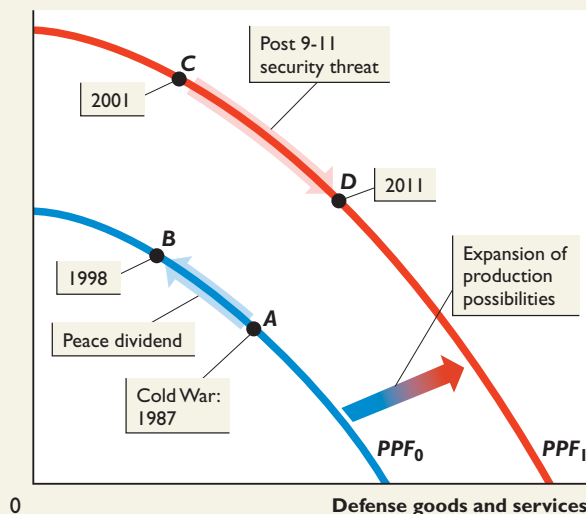


Figure 2 The guns versus butter tradeoff

SOURCE OF DATA: Budget of the United States Government and Bureau of Economic Analysis.

MyEconLab

You can work these problems in Study Plan 3.2 and get instant feedback.

TABLE 1

| Possibility | Fish (pounds) | and | Berries (pounds) |
|-------------|---------------|-----|------------------|
| A | 0 | and | 36 |
| B | 4.0 | and | 35 |
| C | 7.5 | and | 33 |
| D | 10.5 | and | 30 |
| E | 13.0 | and | 26 |
| F | 15.0 | and | 21 |
| G | 16.5 | and | 15 |
| H | 17.5 | and | 8 |
| I | 18.0 | and | 0 |

CHECKPOINT 3.2

Calculate opportunity cost.

Practice Problems

Table 1 shows Robinson Crusoe's production possibilities.

1. What is his opportunity cost of a pound of berries when Crusoe increases the quantity of berries from 21 pounds to 26 pounds and production is efficient? Does this opportunity cost increase as he produces more berries?
2. If Crusoe is producing 10 pounds of fish and 21 pounds of berries, what is his opportunity cost of an extra pound of berries? And what is his opportunity cost of an extra pound of fish? Explain your answers.

In the News

Obama drives up miles-per-gallon requirements

Emissions from all new vehicles must be cut from 354 grams to 250 grams. To meet this new standard, the price of a new vehicle will rise by \$1,300.

Source: *USA Today*, May 20, 2009

Calculate the opportunity cost of reducing the emission level by 1 gram.

Solutions to Practice Problems

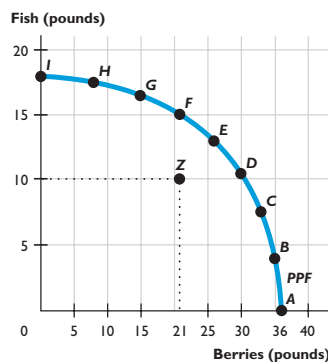
1. If Crusoe's production is efficient, he is producing at a point *on* his *PPF*. His opportunity cost of an extra pound of berries is the quantity of fish he must give up to get the berries. It is calculated as the decrease in the quantity of fish divided by the increase in the quantity of berries as he moves along his *PPF* in the direction of producing more berries.

To increase the quantity of berries from 21 pounds to 26 pounds (from row *F* to row *E* of Table 1), production of fish decreases from 15 pounds to 13 pounds. To gain 5 pounds of berries, Crusoe must forgo 2 pounds of fish. The opportunity cost of 1 pound of berries is the 2 pounds of fish forgone divided by 5 pounds of berries gained— $2/5$ of a pound of fish.

Crusoe's opportunity cost of berries increases as he produces more berries. To see why, move Crusoe from row *E* to row *D* in Table 1. His production of berries increases by 4 pounds and his production of fish falls by 2.5 pounds. His opportunity cost of 1 pound of berries increases to $5/8$ of a pound of fish.

2. Figure 1 graphs the data in Table 1 and shows Crusoe's *PPF*. If Crusoe is producing 10 pounds of fish and 21 pounds of berries, he is producing at point *Z*. Point *Z* is a point *inside* Crusoe's *PPF*. When Crusoe produces 21 pounds of berries, he has enough time available to produce 15 pounds of fish at point *F* on his *PPF*. To produce more fish, Crusoe can move from *Z* toward *F* on his *PPF* and forgo no berries. His opportunity cost of a pound of fish is zero.

FIGURE 1



Solution to In the News

By spending \$1,300 extra on a new car, you forgo \$1,300 of other goods. With a new car, your emissions fall from 354 grams to 250 grams, a reduction of 104 grams. The opportunity cost of a 1-gram reduction in emissions is \$1,300 of other goods divided by 104 grams, or \$12.50 of other goods.

3.3 ECONOMIC GROWTH

Economic growth is the sustained expansion of production possibilities. Our economy grows when we develop better technologies for producing goods and services; improve the quality of labor by education, on-the-job training, and work experience; and acquire more machines to help us produce.

To study economic growth, we must change the two goods and look at the production possibilities for a consumption good and a capital good. A cell phone is a consumption good and a cell-phone factory is a capital good. By using today's resources to produce cell-phone factories, the economy can expand its future production possibilities. The greater the production of new capital—number of new cell-phone factories—the greater is the expansion of production possibilities.

Figure 3.6 shows how the *PPF* can expand. If no new factories are produced (at point *L*), production possibilities do not expand and the *PPF* stays at its original position. By producing fewer cell phones and using resources to produce 2 new cell-phone factories (at point *K*), production possibilities expand and the *PPF* rotates outward to the new *PPF*.

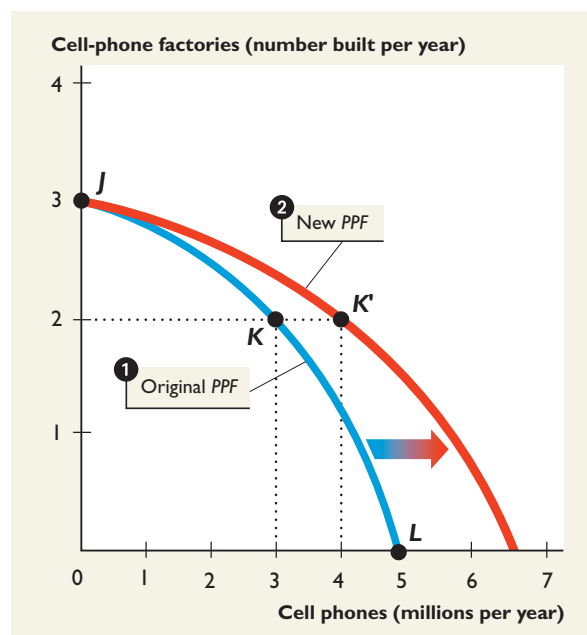
But economic growth is *not* free. To make it happen, consumption must decrease. The move from *L* to *K* in Figure 3.6 means forgoing 2 million cell phones now. The opportunity cost of producing more cell-phone factories is producing fewer cell phones today.

Also, economic growth is no magic formula for abolishing scarcity. Economic growth shifts the *PPF* outward, but on the new *PPF* we continue to face opportunity costs. To keep producing capital, current consumption must be less than its maximum possible level.

Economic growth
The sustained expansion of production possibilities.

FIGURE 3.6
Expanding Production Possibilities

MyEconLab Animation



- 1 If firms allocate no resources to producing cell-phone factories and produce 5 million cell phones a year at point *L*, the *PPF* doesn't change.
- 2 If firms decrease cell-phone production to 3 million a year and produce 2 cell-phone factories, at point *K*, production possibilities will expand. After a year, the *PPF* shifts outward to the new *PPF* and production can move to point *K'*.



EYE on the GLOBAL ECONOMY

Hong Kong's Rapid Economic Growth

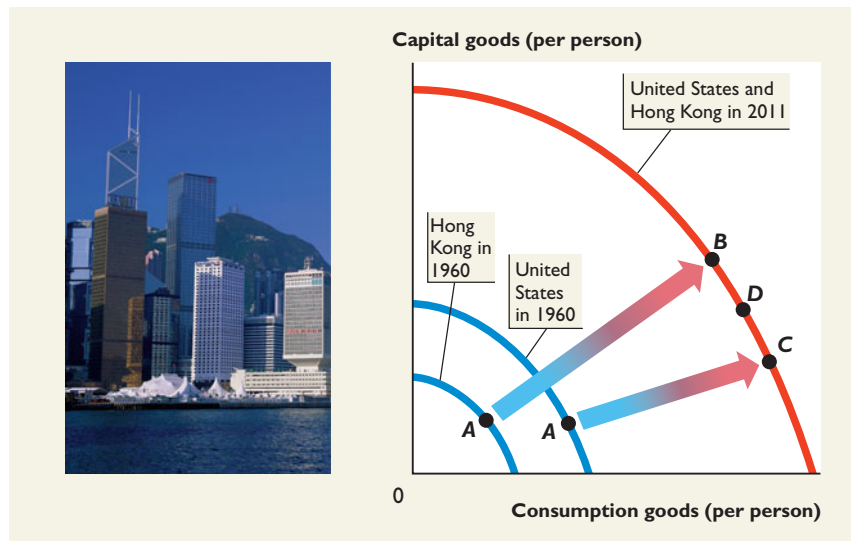
Hong Kong's production possibilities per person were 25 percent of those of the United States in 1960. By 2011, they had grown to become equal to U.S. production possibilities per person. Hong Kong grew faster than the United States because it allocated more of its resources to accumulating capital and less to consumption than did the United States.

In 1960, the United States and Hong Kong produced at point A on their respective PPFs. In 2011, Hong Kong was at point B and the United States was at point C.

If Hong Kong continues to produce at a point such as B, it will grow more rapidly than the United States and its PPF will eventually shift out

beyond the PPF of the United States. But if Hong Kong produces at a point

such as D, the pace of expansion of its PPF will slow.



MyEconLab

You can work these problems in Study Plan 3.3 and get instant feedback.

TABLE 1

| Possibility | Education services (graduates) | Consumption goods (units) |
|-------------|--------------------------------|---------------------------|
| A | 1,000 | 0 |
| B | 750 | 1,000 |
| C | 500 | 2,000 |
| D | 0 | 3,000 |

CHECKPOINT 3.3

Explain what makes production possibilities expand.

Practice Problems

- Table 1 shows an economy that produces education services and consumption goods. If the economy currently produces 500 graduates a year and 2,000 units of consumption goods, what is the opportunity cost of one additional graduate?
- How does an economy grow? Explain why economic growth is not free.

Solutions to Practice Problems

- By increasing the number of graduates from 500 to 750, the quantity of consumption goods produced decreases from 2,000 to 1,000 units. The opportunity cost of a graduate is the decrease in consumption goods divided by the increase in the number of graduates. That is, the opportunity cost of a graduate is 1,000 units divided by 250, or 4 units of consumption goods.
- An economy grows if it expands its production possibilities—if it develops better technologies; improves the quality of labor by education, on-the-job training, and work experience; and acquires more machines to use in production. Economic growth occurs when resources are used today to produce better technologies, better quality labor, or more machines. Those resources cannot be used to produce goods and services today, so the cost of economic growth is the goods and services forgone today. Economic growth is not free.

3.4 SPECIALIZATION AND TRADE

When Adam Smith visited a pin factory (see p. 13), he discovered that 10 people, each specializing in a small task, could make 48,000 pins a day. By dividing pin-making into small parts, what he called the *division of labor*, he found that people were 240 times as productive as they would be if each person performed all the tasks needed to make a pin.

You can see the productivity of specialization and the division of labor in many everyday places. One of these is a fast-food restaurant. One person specializes in keeping the kitchen stocked with bread, salad materials, meat, sauces, boxes, and wrappers. One works the grill and another the fry maker. Another specializes in assembling the meals. Yet another takes the customers' orders and handles payment. Another has the job of keeping things clean and hygienic.

Imagine how long you would have to wait for your burger if one person performed all these tasks. You place your order and then wait while your friendly server disappeared into the kitchen and emerged 15 minutes later with your not-so-fast-food order.

The productivity gain from specialization makes some people more productive than others. The server at McDonald's can take orders and payment in less time than the grill operator would take to do the same job. And the grill operator can make more burgers per hour than the server could make.

When one person (or nation) is more productive than another—needs fewer inputs or takes less time to produce a good or perform a production task, we say that person (or nation) has an **absolute advantage**.

You are going to discover another way in which people gain by specializing: by producing the good in which they have a *comparative advantage*.



In an 18th century pin factory ...



... and a 21st century fast-food kitchen, specialization boosts productivity.

Absolute advantage

When one person (or nation) is more productive than another—needs fewer inputs or takes less time to produce a good or perform a production task.



EYE on the U.S. ECONOMY

No One Knows How to Make a Pencil



Not many products in today's world are as simple as a pencil. Yet the story of how the pencil in your hand got there illustrates the astonishing power of specialization and trade.

When you hold a pencil, you're holding cedar grown in Oregon, graphite mined in Sri Lanka, clay from Mississippi, wax from Mexico, rape-seed oil grown in the Dutch East Indies, pumice from Italy, copper from Arizona and zinc from Alaska.

These materials were harvested and mined by thousands of workers

equipped with hundreds of specialized tools, all of which were manufactured by thousands of other workers using hundreds more specialized tools. These tools were in turn made of steel, itself made from iron ore, and from other minerals and materials.

Rail, road, and ocean transportation systems moved all these things to custom-built factories that made graphite "leads," erasers, brass to hold the erasers, paint, and glue.

Finally, all these components were bought by a pencil factory, which, with

its millions of dollar's worth of custom machinery, put them all together.

Millions of people contributed to making that pencil, many of whom don't even know what a pencil is and *not one of whom knows how to make a pencil*. No one directed all these people. Each worker and business went about its self-interested specialized task trading with each other in markets.

Adapted from *I Pencil*, by Leonard Read, Foundation for Economic Education, 1958.

Comparative advantage

The ability of a person to perform an activity or produce a good or service at a lower opportunity cost than anyone else.

Comparative Advantage

A person has a **comparative advantage** in an activity if that person can perform the activity at a lower opportunity cost than anyone else. Notice the contrast between *absolute* advantage and *comparative* advantage. Absolute advantage is about productivity—how long does it take to produce a unit of a good. Comparative advantage is about opportunity cost—how much of some other good must be forgone to produce a unit of a good.

Let’s explore the idea of comparative advantage and make it more concrete by looking at production in two quite different smoothie bars: one operated by Liz and the other operated by Joe.



TABLE 3.1 LIZ’S PRODUCTION POSSIBILITIES

| Item | Minutes to produce 1 | Quantity per hour |
|-----------|----------------------|-------------------|
| Smoothies | 2 | 30 |
| Salads | 2 | 30 |

Liz’s Smoothie Bar

Liz produces smoothies and salads. In Liz’s high-tech bar, she can turn out *either* a smoothie *or* a salad every 2 minutes. If she spends all her time making smoothies, she produces 30 an hour. If she spends all her time making salads, she also produces 30 an hour. If she splits her time equally between the two, she can produce 15 smoothies *and* 15 salads an hour. For each additional smoothie Liz produces, she must decrease her production of salads by one, and for each additional salad Liz produces, she must decrease her production of smoothies by one. So

Liz’s opportunity cost of producing 1 smoothie is 1 salad,

and

Liz’s opportunity cost of producing 1 salad is 1 smoothie.

Liz’s customers buy smoothies and salads in equal quantities, so Liz splits her time equally between the items and produces 15 smoothies and 15 salads an hour.

Joe’s Smoothie Bar

Joe also produces both smoothies and salads. Joe’s bar is smaller than Liz’s, and he has only one blender—a slow, old machine. Even if Joe uses all his resources to produce smoothies, he can produce only 6 an hour. But Joe is pretty good in the salad department, so if he uses all his resources to make salads, he can produce 30 an hour. Joe’s ability to make smoothies and salads is the same regardless of how he splits an hour between the two tasks. He can make a salad in 2 minutes or a smoothie in 10 minutes. For each additional smoothie Joe produces, he must decrease his production of salads by 5. And for each additional salad Joe produces, he must decrease his production of smoothies by 1/5 of a smoothie. So

Joe’s opportunity cost of producing 1 smoothie is 5 salads,

and

Joe’s opportunity cost of producing 1 salad is 1/5 of a smoothie.



TABLE 3.2 JOE’S PRODUCTION POSSIBILITIES

| Item | Minutes to produce 1 | Quantity per hour |
|-----------|----------------------|-------------------|
| Smoothies | 10 | 6 |
| Salads | 2 | 30 |

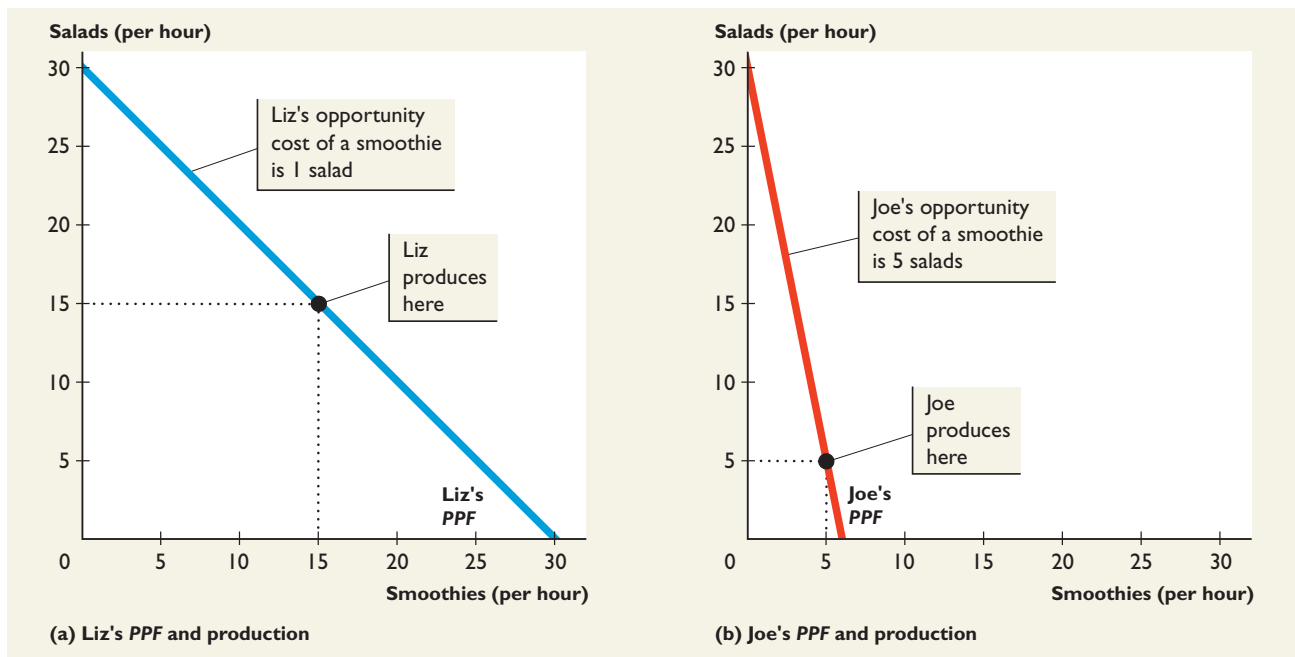
Joe’s customers, like Liz’s, buy smoothies and salads in equal quantities. Joe spends 50 minutes of each hour making smoothies and 10 minutes of each hour making salads. With this division of his time, Joe produces 5 smoothies and 5 salads an hour.

Liz’s and Joe’s PPFs

The *PPFs* in Figure 3.7 illustrate the situation we’ve just described. In part (a), Liz faces a *PPF* that enables her to produce 15 smoothies and 15 salads. In part (b), Joe

FIGURE 3.7
Production Possibilities Frontiers

MyEconLab Animation



Liz can produce 30 smoothies per hour or 30 salads per hour or any other combination along her PPF in part (a). Liz chooses to produce 15 smoothies and 15 salads per hour.

Joe can produce 6 smoothies per hour or 30 salads per hour or any other combination along his PPF in part (b). Joe chooses to produce 5 smoothies and 5 salads per hour.

faces a PPF that enables him to produce 5 smoothies and 5 salads. On Liz's PPF, one smoothie costs one salad. On Joe's PPF, one smoothie costs 5 salads.

Liz's Greater Productivity

You can see from the numbers that describe the two smoothie bars that Liz is three times as productive as Joe—her 15 smoothies and 15 salads an hour are three times Joe's 5 smoothies and 5 salads. Liz is more productive than Joe in producing both smoothies and salads. But Liz has a comparative advantage in only one of the activities.

Liz's Comparative Advantage

In which of the two activities does Liz have a *comparative* advantage? Recall that comparative advantage is a situation in which one person's opportunity cost of producing a good is lower than another person's opportunity cost of producing that same good.

You've seen that Liz's opportunity cost of a smoothie is 1 salad, whereas Joe's opportunity cost of a smoothie is 5 salads. To produce 1 smoothie, Liz must forgo 1 salad, while Joe must forgo 5 salads. So, because Liz forgoes fewer salads to make a smoothie, she has a comparative advantage in producing smoothies.

What about Joe? Doesn't he have a comparative advantage at anything? He does as you're about to see.

Joe's Comparative Advantage

Look at the opportunity costs of producing salads. For Liz, that opportunity cost is 1 smoothie. But for Joe, a salad costs only 1/5 of a smoothie. Because Joe's opportunity cost of a salad is less than Liz's, Joe has a comparative advantage in producing salads.

It is always true that if one person has a comparative advantage in producing a good, others have a comparative advantage in producing some other good.

TABLE 3.3 LIZ AND JOE GAIN FROM TRADE

| (a) Before Trade | Liz | Joe |
|----------------------|---------|---------|
| Smoothies | 15 | 5 |
| Salads | 15 | 5 |
| (b) Specialization | Liz | Joe |
| Smoothies | 30 | 0 |
| Salads | 0 | 30 |
| (c) Trade | | |
| Smoothies | sell 10 | buy 10 |
| Salads | buy 20 | sell 20 |
| (d) After Trade | | |
| Smoothies | 20 | 10 |
| Salads | 20 | 10 |
| (e) Gains from Trade | | |
| Smoothies | +5 | +5 |
| Salads | +5 | +5 |

■ Achieving Gains from Trade

Liz and Joe run into each other one evening in a singles bar. After a few minutes of getting acquainted, Liz tells Joe about her amazingly profitable smoothie business. Her only problem, she tells Joe, is that she wishes she could produce more because potential customers leave when her lines get too long.

Joe isn't sure whether to risk spoiling his chances by telling Liz about his own struggling business. But he takes the risk. When he explains to Liz that he spends 50 minutes of every hour making 5 smoothies and 10 minutes making 5 salads, Liz's eyes pop. "Have I got a deal for you!" she exclaims.

Here's the deal that Liz sketches on a paper napkin. Joe stops making smoothies and allocates all his time to producing salads. Liz stops making salads and allocates all her time to producing smoothies. That is, they both specialize in producing the good in which they have a comparative advantage—see Table 3.3(b). They then trade: Liz sells Joe 10 smoothies and Joe sells Liz 20 salads—the price of a smoothie is 2 salads—see Table 3.3(c).

After the trade, Joe has 10 salads (the 30 he produces minus the 20 he sells to Liz) and the 10 smoothies that he buys from Liz. So Joe doubles the quantities of smoothies and salads he can sell. Liz has 20 smoothies (the 30 she produces minus the 10 she sells to Joe) and the 20 salads she buys from Joe. See Table 3.3(d). From specialization and trade, each gains 5 smoothies and 5 salads—see Table 3.3(e).



EYE on YOUR LIFE

Your Comparative Advantage

What you have learned in this chapter has huge implications for the way you organize your life. It also has implications for the position that you take on the controversial issue of offshore outsourcing.

Just as an economy expands its production possibilities by accumulating capital, so also will you expand your production possibilities by accumulating human capital. That is what you're doing right now in school.

By discovering your comparative

advantage, you will be able to focus on producing the items that make you as well off as possible. Think hard about what you enjoy doing and that you do comparatively better than others. That, most likely, is where your comparative advantage lies.

In today's world, it is a good idea to try to remain flexible so that you can switch jobs if you discover that your comparative advantage has changed.

Looking beyond your own self-interest, are you going to be a voice

that supports or opposes offshore outsourcing?

You've learned in this chapter that regardless of whether outsourcing remains inside the United States, as it does with Liz and Joe at their smoothie bars, or is global like the outsourcing of jobs by U. S. producers to India, both parties gain from trade.

Americans pay less for goods and services and Indians earn higher incomes. But some Americans lose, at least in the short run.

Liz draws a figure (Figure 3.8) to illustrate her idea. The blue PPF is Liz's and the red PPF is Joe's. They are each producing at the points marked A. Liz's proposal is that they each produce at the points marked B. They then trade smoothies and salads.

There is a range of prices at which they might trade. If the price is 5 salads per smoothie (or equivalently, 1/5 smoothies per salad), Liz gets all the gains. If the price is 1 salad per smoothie (1 smoothie per salad), Joe gets all the gains.

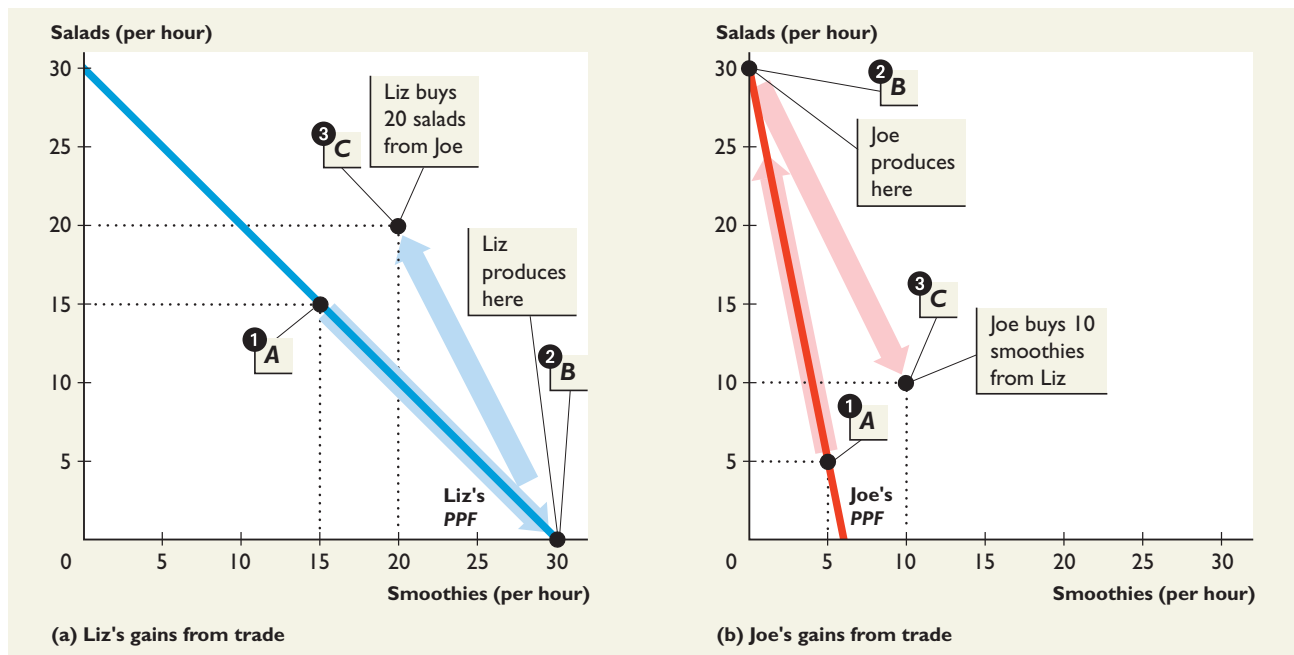
Liz suggests that they trade at a price of 2 salads per smoothie (1/2 a smoothie per salad). This price turns out to give each of them equal gains.

Liz gets salads for 1/2 a smoothie each, which is less than the 1 smoothie that it costs her to produce them. Joe gets smoothies for 2 salads each, which is less than the 5 salads it costs him to produce them. Each moves to the points marked C where Liz has 20 smoothies and 20 salads, 5 of each more than she has producing only for herself. And Joe has 10 smoothies and 10 salads, also 5 more of each than he has producing only for himself. Because of the gains from trade, total production increases by 10 smoothies and 10 salads.

Notice that the points C are *outside* Liz's and Joe's PPFs. This is the magic of the gains from trade. Everyone gains and everyone can enjoy quantities of goods and services that exceed their own ability to produce.

FIGURE 3.8
The Gains from Specialization and Trade

MyEconLab Animation



- 1 Liz and Joe each produce at point A on their respective PPFs. Liz has a comparative advantage in producing smoothies, and Joe has a comparative advantage in producing salads.
- 2 Joe specializes in salads and Liz specializes in smoothies, so they each produce at point B on their respective PPFs.
- 3 They exchange smoothies for salads at a price of 2 salads per smoothie. Each goes to point C—a point *outside* their individual PPFs. They each gain 5 salads and 5 smoothies—the quantities at point C minus the quantities at point A.

MyEconLab

You can work these problems in Study Plan 3.4 and get instant feedback.

TABLE 1 TONY'S PRODUCTION POSSIBILITIES

| Snowboards (per week) | and | Skis (per week) |
|--------------------------|-----|--------------------|
| 25 | and | 0 |
| 20 | and | 10 |
| 15 | and | 20 |
| 10 | and | 30 |
| 5 | and | 40 |
| 0 | and | 50 |

TABLE 2 PATTY'S PRODUCTION POSSIBILITIES

| Snowboards (per week) | and | Skis (per week) |
|--------------------------|-----|--------------------|
| 20 | and | 0 |
| 10 | and | 5 |
| 0 | and | 10 |

CHECKPOINT 3.4

Explain how people gain from specialization and trade.

Practice Problems

Tony and Patty produce skis and snowboards. Tables 1 and 2 show their production possibilities. Each week, Tony produces 5 snowboards and 40 skis and Patty produces 10 snowboards and 5 skis.

1. Who has a comparative advantage in producing snowboards? Who has a comparative advantage in producing skis?
2. If Tony and Patty specialize and trade, what are the gains from trade?

In the News

With big boost from sugar cane, Brazil is satisfying its fuel needs

Brazil is almost self-sufficient in ethanol. Brazilian ethanol is made from sugar and costs 83¢ per gallon whereas U.S. ethanol, made from corn, costs \$1.14 per gallon. The United States does not import ethanol.

Source: *The New York Times*, April 12, 2006

Which country has a comparative advantage in producing ethanol? Explain why both the United States and Brazil can gain from specialization and trade.

Solutions to Practice Problems

1. The person with a comparative advantage in snowboards is the one who has the lower opportunity cost of producing a snowboard. Tony's production possibilities show that to produce 5 more snowboards he must produce 10 fewer skis. So Tony's opportunity cost of a snowboard is 2 skis.

Patty's production possibilities show that to produce 10 more snowboards, she must produce 5 fewer skis. So Patty's opportunity cost of a snowboard is 1/2 a ski. Patty has a comparative advantage in snowboards because her opportunity cost of a snowboard is less than Tony's. Tony's comparative advantage is in skis. For each ski produced, Tony must forgo making 1/2 a snowboard, whereas Patty must forgo making 2 snowboards for a ski. So Tony's opportunity cost of a ski is lower than Patty's.

2. Patty has a comparative advantage in snowboards, so she specializes in snowboards. Tony has a comparative advantage in skis, so he specializes in skis. Patty makes 20 snowboards and Tony makes 50 skis. Before specializing, they made 15 snowboards and 45 skis. By specializing, total output increases by 5 snowboards and 5 skis. They share this gain by trading.

Solution to In the News

The cost of producing a gallon of ethanol is less in Brazil than in the United States, so Brazil has a comparative advantage in producing ethanol. If Brazil specialized in producing ethanol and the United States specialized in producing other goods (for example, movies or food) and the two countries engaged in free trade, each country can gain because it would get to a point outside its own PPF.

CHAPTER SUMMARY

Key Points

1. Explain and illustrate the concepts of scarcity, production efficiency, and tradeoff using the production possibilities frontier.

- The production possibilities frontier, *PPF*, describes the limits to what can be produced by using all the available resources efficiently.
- Points inside and on the *PPF* are attainable. Points outside the *PPF* are unattainable.
- Production at any point on the *PPF* achieves production efficiency. Production at a point inside the *PPF* is inefficient.
- When production is efficient—on the *PPF*—people face a tradeoff. If production is at a point inside the *PPF*, there is a free lunch.

2. Calculate opportunity cost.

- Along the *PPF*, the opportunity cost of x (the item measured on the x -axis) is the decrease in y (the item measured on the y -axis) divided by the increase in x .
- The opportunity cost of Y is the inverse of the opportunity cost of X .
- The opportunity cost of producing a good increases as the quantity of the good produced increases.

3. Explain what makes production possibilities expand.

- Technological change and increases in capital and human capital expand production possibilities.
- The opportunity cost of economic growth is the decrease in current consumption.

4. Explain how people gain from specialization and trade.

- A person has a comparative advantage in an activity if he or she can perform that activity at a lower opportunity cost than someone else.
- People gain by increasing the production of the item in which they have a comparative advantage and trading.

Key Terms

Absolute advantage, 73
 Comparative advantage, 74
 Economic growth, 71

Production efficiency, 62
 Production possibilities frontier, 60
 Tradeoff, 63

MyEconLab

You can work these problems in Chapter 3 Study Plan and get instant feedback.

TABLE 1

| Corn (bushels) | and | Beef (pounds) |
|----------------|-----|---------------|
| 250 | and | 0 |
| 200 | and | 300 |
| 100 | and | 500 |
| 0 | and | 600 |

TABLE 2

| Labor (hours) | Entertainment (units) | or | Good food (units) |
|---------------|-----------------------|----|-------------------|
| 0 | 0 | or | 0 |
| 10 | 20 | or | 30 |
| 20 | 40 | or | 50 |
| 30 | 60 | or | 60 |
| 40 | 80 | or | 65 |
| 50 | 100 | or | 67 |

FIGURE 1

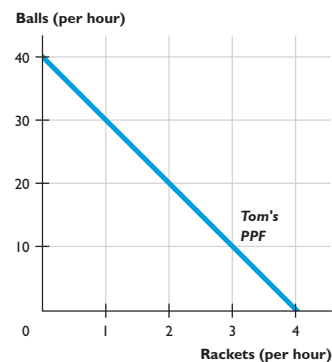
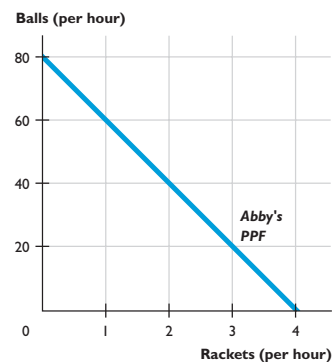


FIGURE 2



CHAPTER CHECKPOINT

Study Plan Problems and Applications

- Table 1 shows the quantities of corn and beef that a farm can produce in a year. Draw a graph of the farm's *PPF*. Mark on the graph:
 - An inefficient combination of corn and beef—label this point *A*.
 - An unattainable combination of corn and beef—label this point *B*.
 - An efficient combination of corn and beef—label this point *C*.

Use the following information to work Problems 2 and 3.

The people of Leisure Island have 50 hours of labor a day that can be used to produce entertainment and good food. Table 2 shows the maximum quantity of *either* entertainment or good food that Leisure Island can produce with different quantities of labor.

- Is an output of 50 units of entertainment and 50 units of good food attainable and efficient? With a production of 50 units of entertainment and 50 units of good food, do the people of Leisure Island face a tradeoff?
- What is the opportunity cost of producing an additional unit of entertainment? Explain how the opportunity cost of producing a unit of entertainment changes as more entertainment is produced.

Use the following information to work Problems 4 and 5.

Malaria can be controlled

The World Health Organization's malaria chief says that it is too costly to try to fully eradicate the disease. He says that by using nets, medicine, and DDT it is possible to eliminate 90 percent of malaria cases. But to eliminate 100 percent of cases would be extremely costly.

Source: *The New York Times*, March 4, 2008

- Make a graph of the production possibilities frontier with malaria control on the *x*-axis and other goods and services on the *y*-axis.
- Describe how the opportunity cost of controlling malaria changes as more resources are used to reduce the number of malaria cases.
- Explain how the following events influence U.S. production possibilities:
 - Some retail workers are re-employed building dams and wind farms.
 - More people take early retirement.
 - Drought devastates California's economy.

Use the following information to work Problems 7 and 8.

Figure 1 shows Tom's production possibilities and Figure 2 shows Abby's production possibilities. Tom uses all his resources and produces 2 rackets and 20 balls an hour. Abby uses all her resources and produces 2 rackets and 40 balls an hour.

- What is Tom's opportunity cost of producing a racket? What is Abby's opportunity cost of a racket? Who has a comparative advantage in producing rackets? Who has a comparative advantage in producing balls?
- If Tom and Abby specialize and trade 15 balls for 1 racket, what are the gains from trade?

Instructor Assignable Problems and Applications

Use the following information to work Problems 1 to 4.

Representatives Waxman of California and Markey of Massachusetts proposed a law to limit greenhouse gas emissions from electricity generation and require electricity producers to generate a minimum percentage of power using renewable fuels, with some rights to emit to be auctioned. The Congressional Budget Office estimated that the government would receive \$846 billion from auctions and would spend \$821 billion on incentive programs and compensation for higher energy prices. Electricity producers would spend \$208 million a year to comply with the new rules. (Think of these dollar amounts as dollars' worth of other goods and services.)

1. Would the Waxman-Markey law achieve production efficiency?
2. Is the \$846 billion that electricity producers would pay for the right to emit greenhouse gasses part of the opportunity cost of producing electricity?
3. Is the \$821 billion that the government would spend on incentive programs and compensation for higher energy prices part of the opportunity cost of producing electricity?
4. Is the \$208 million that electricity producers will spend to comply with the new rules part of the opportunity cost of producing electricity?
5. The people of Foodland have 40 hours of labor a day to bake pizza and bread. Table 1 shows the maximum quantity of *either* pizza *or* bread that Foodland can bake with different quantities of labor. Can Foodland produce 30 pizzas and 30 loaves of bread a day? If it can, is this output efficient, do the people of Foodland face a tradeoff, and what is the opportunity cost of producing an additional pizza?

Use Table 2, which shows a farm's production possibilities, to work Problems 6 and 7.

6. If the farm uses its resources efficiently, what is the opportunity cost of an increase in chicken production from 300 pounds to 500 pounds a year? Explain your answer.
7. If the farm adopted a new technology, which allows it to use fewer resources to fatten chickens, explain how the farm's production possibilities will change. Explain how the opportunity cost of producing a bushel of soybean will be affected.
8. In an hour, Sue can produce 40 caps or 4 jackets and Tessa can produce 80 caps or 4 jackets. Who has a comparative advantage in producing caps? If Sue and Tessa specialize and trade, who will gain?

Use the following information to work Problems 9 to 11.

Cheap broadband's a winner

Inexpensive broadband access has created a new generation of television producers and the Internet is their native medium.

Source: *The New York Times*, December 2, 2007

9. How has inexpensive broadband changed the production possibilities of video entertainment and other goods and services?
10. Sketch a PPF for video entertainment and other goods and services before broadband.
11. Explain how the arrival of inexpensive broadband has changed the PPF.

Your instructor can assign these problems as homework, a quiz, or a test in [MyEconLab](#).

TABLE 1

| Labor (hours) | Pizzas | or | Bread (loaves) |
|---------------|--------|----|----------------|
| 0 | 0 | or | 0 |
| 10 | 30 | or | 10 |
| 20 | 50 | or | 20 |
| 30 | 60 | or | 30 |
| 40 | 65 | or | 40 |

TABLE 2

| Soybean (bushels per year) | and | Chicken (pounds per year) |
|----------------------------|-----|---------------------------|
| 500 | and | 0 |
| 400 | and | 300 |
| 200 | and | 500 |
| 0 | and | 400 |

MyEconLab

You can work this quiz in Chapter 3 Study Plan and get instant feedback.

TABLE 1

| Possibility | Fish (pounds) | and | Berries (pounds) |
|-------------|---------------|-----|------------------|
| A | 0 | and | 40 |
| B | 1 | and | 36 |
| C | 2 | and | 30 |
| D | 3 | and | 22 |
| E | 4 | and | 12 |
| F | 5 | and | 0 |

Multiple Choice Quiz

- Table 1 shows the *PPF* of an island community. Choose the best statement.
 - This community has enough resources to produce 2 pounds of fish and 36 pounds of berries.
 - This community cannot produce 2 pounds of fish and 36 pounds of berries because this combination is inefficient.
 - This community will waste resources if it produces 2 pounds of fish and 22 pounds of berries.
 - This community can produce 2 pounds of fish and 30 pounds of berries but this combination is inefficient.
- Table 1 shows the *PPF* of an island community. Choose the best statement.
 - Suppose that this community produces 3 pounds of fish and 20 pounds of berries. If it decides to gather more berries, it faces a tradeoff.
 - When this community produces 4 pounds of fish and 12 pounds of berries it faces a tradeoff, but it is inefficient.
 - Suppose that this community produces 5 pounds of fish and 0 pounds of berries. If it decides to gather some berries, it will get a free lunch.
 - If this community produces 3 pounds of fish and 22 pounds of berries, production is efficient but to produce more fish it faces a tradeoff.
- Table 1 shows the *PPF* of an island community. This community's opportunity cost of producing 1 pound of fish _____.
 - is the increase in the quantity of berries gathered as the quantity of fish increases by 1 pound
 - increases as the quantity of berries gathered increases
 - is 10 pounds of berries if the quantity of fish increases from 2 to 3 pounds
 - increases as the quantity of fish caught increases
- Table 1 shows the *PPF* of an island community. Choose the best statement.
 - When a drought hits the island, its *PPF* shifts outward.
 - When the islanders discover a better way of catching fish, the island's *PPF* shifts outward.
 - When islanders reduce the time they spend gathering berries, the *PPF* shifts inward.
 - If the islanders decide to spend more time gathering berries but continue to spend the same amount of time fishing, they face a tradeoff.
- Mary makes 10 pies and 20 cakes a day and her opportunity cost of a cake is 2 pies. Tim makes 20 pies and 10 cakes a day and his opportunity cost of a cake is 4 pies. If they specialize in the good in which they have a comparative advantage _____.
 - Mary produces pies
 - Tim produces pies and cakes
 - Mary produces cakes while Tim produces pies
 - Tim produces cakes while Mary produces pies



Why did the price of coffee soar in 2010 and 2011?

Demand and Supply

When you have completed your study of this chapter, you will be able to

- 1 Distinguish between quantity demanded and demand, and explain what determines demand.
- 2 Distinguish between quantity supplied and supply, and explain what determines supply.
- 3 Explain how demand and supply determine price and quantity in a market, and explain the effects of changes in demand and supply.

4

CHAPTER CHECKLIST

COMPETITIVE MARKETS

When you need a new pair of running shoes, want a bagel and a latte, or need to fly home for Thanksgiving, you must find a place where people sell those items or offer those services. The place where you find them is a *market*.

You learned in Chapter 2 that a market is any arrangement that brings buyers and sellers together. A market has two sides: buyers (demanders) and sellers (suppliers). There are markets for *goods* such as apples and hiking boots, for *services* such as haircuts and tennis lessons, for *resources* such as computer programmers and tractors, and for other manufactured *inputs* such as memory chips and auto parts. There are also markets for money such as Japanese yen and for financial securities such as Yahoo! stock. Only imagination limits what can be traded in markets.

Some markets are physical places where buyers and sellers meet and where an auctioneer or a broker helps to determine the prices. Examples of this type of market are the New York Stock Exchange; wholesale fish, meat, and produce markets; and used car auctions.

Some markets are virtual spaces where buyers and sellers never meet face-to-face but connect over telephone lines or the Internet. Examples include currency markets, e-commerce Web sites such as Amazon.com and bananarepublic.com, and auction sites such as eBay.

But most markets are unorganized collections of buyers and sellers. You do most of your trading in this type of market. An example is the market for basketball shoes. The buyers in this \$3-billion-a-year market are the 45 million Americans who play basketball (or who want to make a fashion statement) and are looking for a new pair of shoes. The sellers are the tens of thousands of retail sports equipment and footwear stores. Each buyer can visit several different stores, and each seller knows that the buyer has a choice of stores.

Markets vary in the intensity of competition that buyers and sellers face. In this chapter, we're going to study a *competitive market* that has so many buyers and so many sellers that no single buyer or seller can influence the price.



Markets for running shoes ...



coffee and bagel ...



and airline travel.

4.1 DEMAND

First, we'll study the behavior of buyers in a competitive market. The **quantity demanded** of any good, service, or resource is the amount that people are willing and able to buy during a specified period at a specified price. For example, when spring water costs \$1 a bottle, you decide to buy 2 bottles a day. The 2 bottles a day is your quantity demanded of spring water.

The quantity demanded is measured as an amount *per unit of time*. For example, your quantity demanded of water is 2 bottles *per day*. We could express this quantity as 14 bottles per week, or some other number per month or per year. A particular number of bottles without a time dimension has no meaning.

Many things influence buying plans, and one of them is price. We look first at the relationship between quantity demanded and price. To study this relationship, we keep all other influences on buying plans the same and we ask: How, other things remaining the same, does the quantity demanded of a good change as its price varies? The law of demand provides the answer.

■ The Law of Demand

The **law of demand** states

Other things remaining the same, if the price of a good rises, the quantity demanded of that good decreases; and if the price of a good falls, the quantity demanded of that good increases.

So the law of demand states that when all other things remain the same, if the price of an iPhone falls, people will buy more iPhones; or if the price of a baseball ticket rises, people will buy fewer baseball tickets.

Why does the quantity demanded increase if the price falls, all other things remaining the same?

The answer is that, faced with a limited budget, people always have an incentive to find the best deals available. If the price of one item falls and the prices of all other items remain the same, the item with the lower price is a better deal than it was before, so some people buy more of this item. Suppose, for example, that the price of bottled water fell from \$1 a bottle to 25 cents a bottle while the price of Gatorade remained at \$1 a bottle. Wouldn't some people switch from Gatorade to water? By doing so, they save 75 cents a bottle, which they can spend on other things they previously couldn't afford.

Think about the things that you buy and ask yourself: Which of these items does *not* obey the law of demand? If the price of a new textbook were lower, other things remaining the same (including the price of a used textbook), would you buy more new textbooks? Then think about all the things that you do not now buy but would if you could afford them. How cheap would a PC have to be for you to buy *both* a desktop and a laptop? There is a price that is low enough to entice you!

■ Demand Schedule and Demand Curve

Demand is the relationship between the quantity demanded and the price of a good when all other influences on buying plans remain the same. The quantity demanded is *one* quantity at *one* price. *Demand* is a *list of quantities at different prices* illustrated by a demand schedule and a demand curve.

Quantity demanded

The amount of any good, service, or resource that people are willing and able to buy during a specified period at a specified price.

Demand

The relationship between the quantity demanded and the price of a good when all other influences on buying plans remain the same.

Demand schedule

A list of the quantities demanded at each different price when all the other influences on buying plans remain the same.

Demand curve

A graph of the relationship between the quantity demanded of a good and its price when all the other influences on buying plans remain the same.

A **demand schedule** is a list of the quantities demanded at each different price when *all the other influences on buying plans remain the same*. The table in Figure 4.1 is one person's (Tina's) demand schedule for bottled water. It tells us that if the price of water is \$2.00 a bottle, Tina buys no water. Her quantity demanded is 0 bottles a day. If the price of water is \$1.50 a bottle, her quantity demanded is 1 bottle a day. Tina's quantity demanded increases to 2 bottles a day at a price of \$1.00 a bottle and to 3 bottles a day at a price of 50 cents a bottle.

A **demand curve** is a graph of the relationship between the quantity demanded of a good and its price when all the other influences on buying plans remain the same. The points on the demand curve labeled *A* through *D* represent the rows *A* through *D* of the demand schedule. For example, point *B* on the graph represents row *B* of the demand schedule and shows that the quantity demanded is 1 bottle a day when the price is \$1.50 a bottle. Point *C* on the demand curve represents row *C* of the demand schedule and shows that the quantity demanded is 2 bottles a day when the price is \$1.00 a bottle.

The downward slope of the demand curve illustrates the law of demand. Along the demand curve, when the price of the good *falls*, the quantity demanded *increases*. For example, in Figure 4.1, when the price of a bottle of water falls from \$1.00 to 50 cents, the quantity demanded increases from 2 bottles a day to 3 bottles a day. Conversely, when the price *rises*, the quantity demanded *decreases*. For example, when the price rises from \$1.00 to \$1.50 a bottle, the quantity demanded decreases from 2 bottles a day to 1 bottle a day.

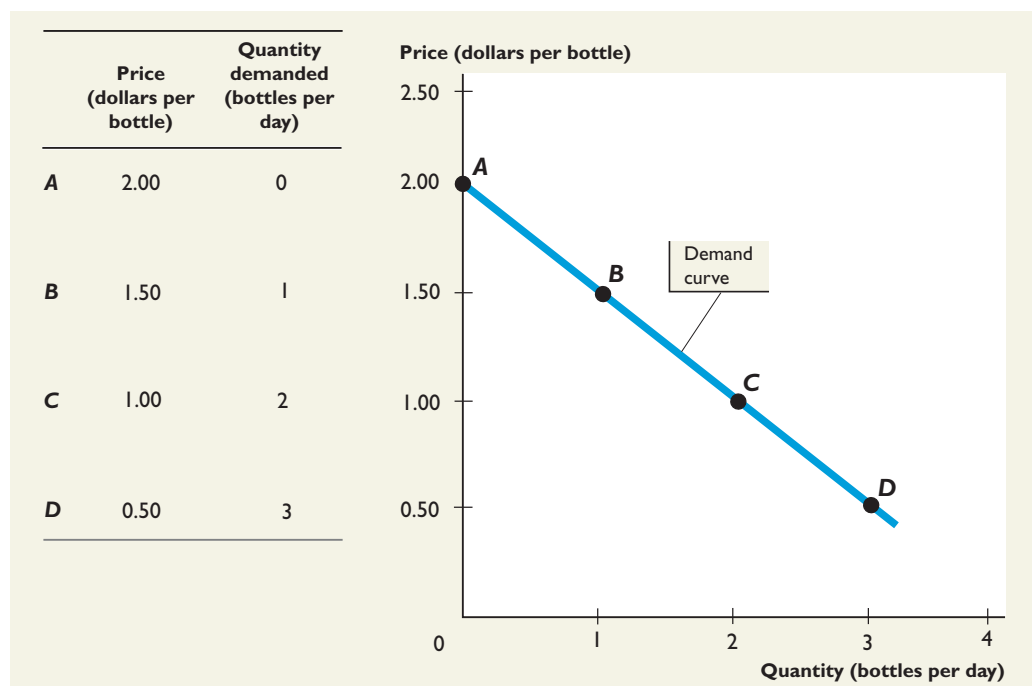
FIGURE 4.1

Demand Schedule and Demand Curve

MyEconLab Animation

The table shows Tina's demand schedule that lists the quantity of water demanded at each price if all other influences on buying plans remain the same. At a price of \$1.50 a bottle, the quantity demanded is 1 bottle a day.

The demand curve shows the relationship between the quantity demanded and price, other things remaining the same. The downward-sloping demand curve illustrates the law of demand. When the price falls, the quantity demanded increases; and when the price rises, the quantity demanded decreases.



Individual Demand and Market Demand

The demand schedule and the demand curve that you’ve just studied are for one person. To study a market, we must determine the market demand.

Market demand is the sum of the demands of all the buyers in a market. To find the market demand, imagine a market in which there are only two buyers: Tina and Tim. The table in Figure 4.2 shows three demand schedules: Tina’s, Tim’s, and the market demand schedule. Tina’s demand schedule is the same as before. It shows the quantity of water demanded by Tina at each different price. Tim’s demand schedule tells us the quantity of water demanded by Tim at each price. To find the quantity of water demanded in the market, we sum the quantities demanded by Tina and Tim. For example, at a price of \$1.00 a bottle, the quantity demanded by Tina is 2 bottles a day, the quantity demanded by Tim is 1 bottle a day, and so the quantity demanded in the market is 3 bottles a day.

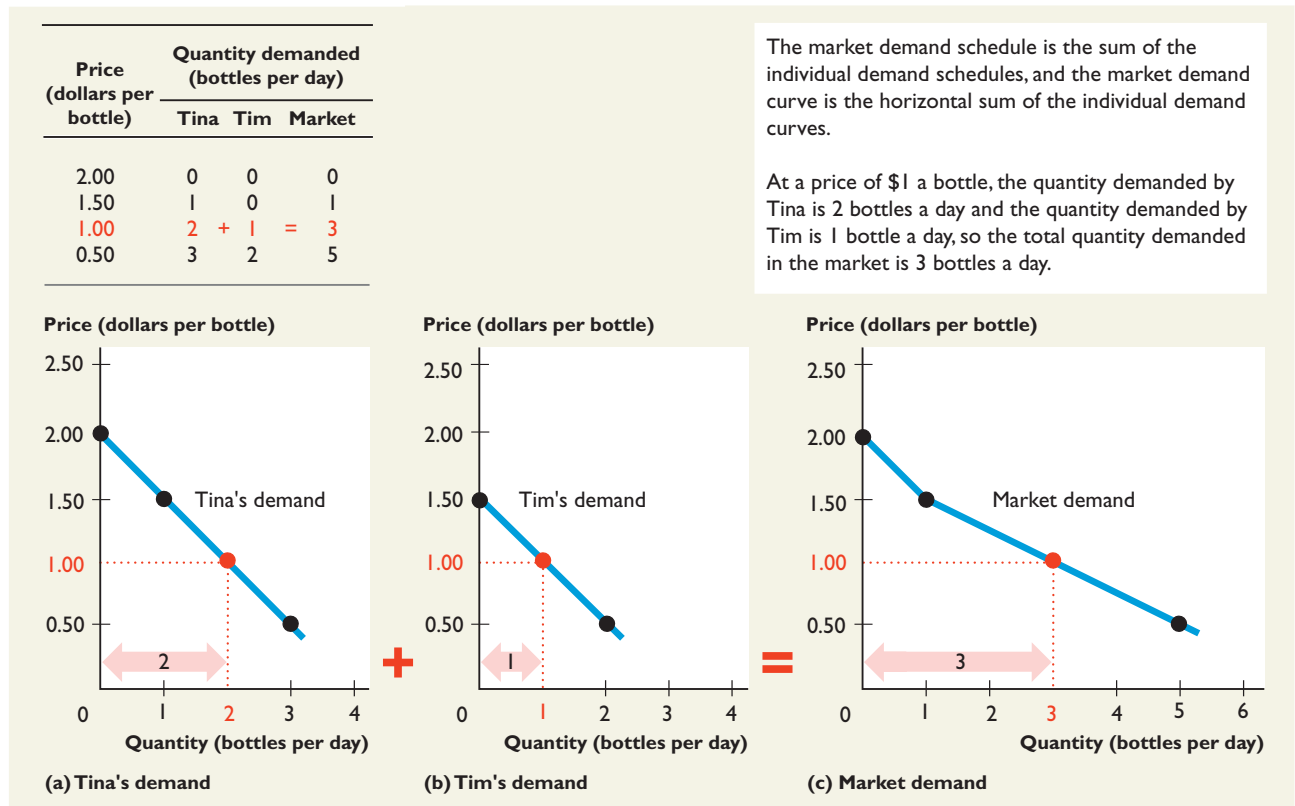
Tina’s demand curve in part (a) and Tim’s demand curve in part (b) are graphs of the two individual demand schedules. The market demand curve in part (c) is a graph of the market demand schedule. At a given price, the quantity demanded on the market demand curve equals the horizontal sum of the quantities demanded on the individual demand curves.

Market demand
The sum of the demands of all the buyers in the market.

FIGURE 4.2

Individual Demand and Market Demand

MyEconLab Animation



Change in demand

A change in the quantity that people plan to buy when any influence on buying plans other than the price of the good changes.

Substitute

A good that can be consumed in place of another good.

Complement

A good that is consumed with another good.

Changes in Demand

The demand curve shows how the quantity demanded changes when the price of the good changes but *all other influences on buying plans remain the same*. When any of these other influences on buying plans change, there is a **change in demand**, which means that there is a new demand schedule and new demand curve. *The demand curve shifts.*

Demand can either increase or decrease and Figure 4.3 illustrates the two cases. Initially, the demand curve is D_0 . When demand decreases, the demand curve shifts leftward to D_1 . On demand curve D_1 , the quantity demanded at each price is smaller. When demand increases, the demand curve shifts rightward to D_2 . On demand curve D_2 the quantity demanded at each price is greater.

The main influences on buying plans that change demand are

- Prices of related goods
- Expected future prices
- Income
- Expected future income and credit
- Number of buyers
- Preferences

Prices of Related Goods

Goods have substitutes and complements. A **substitute** for a good is another good that can be consumed in its place. Chocolate cake is a substitute for cheesecake, and bottled water is a substitute for Gatorade. A **complement** of a good is another good that is consumed with it. Wrist guards are a complement of in-line skates, and bottled water is a complement of fitness center services.

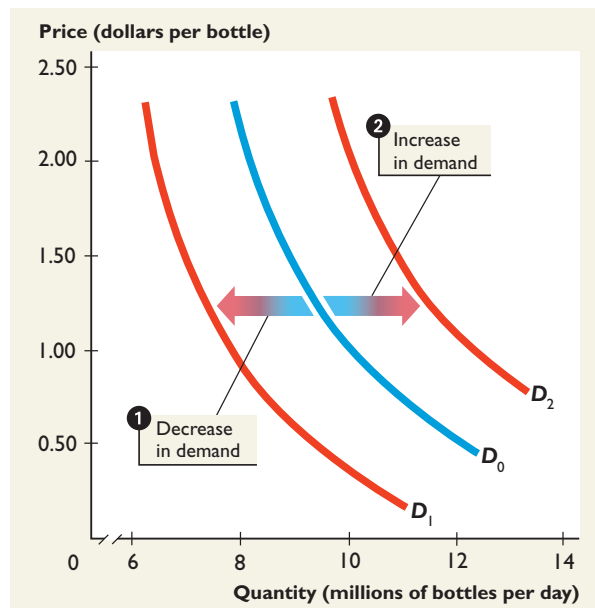
FIGURE 4.3

Changes in Demand

MyEconLab Animation

A change in any influence on buying plans, other than a change in the price of the good itself, changes demand and shifts the demand curve.

- 1 When demand decreases, the demand curve shifts leftward from D_0 to D_1 .
- 2 When demand increases, the demand curve shifts rightward from D_0 to D_2 .



The demand for a good and the price of one of its substitutes move in the *same direction*. The demand for a good *increases* if the price of one of its substitutes *rises* and *decreases* if the price of one of its substitutes *falls*. For example, the demand for cheesecake increases when the price of chocolate cake rises.

The demand for a good and the price of one of its complements move in *opposite directions*. The demand for a good *decreases* if the price of one of its complements *rises* and *increases* if the price of one of its complements *falls*. For example, the demand for wrist guards decreases when the price of in-line skates rises.

Expected Future Prices

A rise in the expected *future* price of a good increases the *current* demand for that good and a fall in the expected *future* price decreases *current* demand. If you expect the price of noodles to rise next week, you buy a big enough stockpile to get you through the next few weeks. Your demand for noodles today has increased. If you expect the price of noodles to fall next week, you buy none now and plan to buy next week. Your demand for noodles today has decreased.

Income

A rise in income brings an increase in demand and a fall in income brings a decrease in demand for a **normal good**. A rise in income brings a *decrease* in demand and a fall in income brings an *increase* in demand for an **inferior good**. For example, if your income increases and you decide to buy more chicken and less pasta, for you, chicken is a normal good and pasta is an inferior good.

Normal good

A good for which demand increases when income increases and demand decreases when income decreases.

Inferior good

A good for which demand decreases when income increases and demand increases when income decreases.

Expected Future Income and Credit

When income is expected to increase in the future, or when credit is easy to get and the cost of borrowing is low, the demand for some goods increases. And when income is expected to decrease in the future, or when credit is hard to get and the cost of borrowing is high, the demand for some goods decreases.

Changes in expected future income and the availability and cost of credit has the greatest effect on the demand for big ticket items such as homes and automobiles. Modest changes in expected future income or credit availability bring large swings in the demand for these items.

Number of Buyers

The greater the number of buyers in a market, the larger is demand. For example, the demand for parking spaces, movies, bottled water, or just about anything is greater in New York City than it is in Boise, Idaho.

Preferences

Tastes or *preferences*, as economists call them, influence demand. When preferences change, the demand for one item increases and the demand for another item (or items) decreases. For example, preferences have changed as people have become better informed about the health hazards of tobacco. This change in preferences has decreased the demand for cigarettes and has increased the demand for nicotine patches. Preferences also change when new goods become available. For example, the development of MP3 technology has decreased the demand for CDs and has increased the demand for Internet service and MP3 players.

Change in the quantity demanded

A change in the quantity of a good that people plan to buy that results from a change in the price of the good with all other influences on buying plans remaining the same.

Change in Quantity Demanded Versus Change in Demand

The influences on buyers' plans that you've just seen bring a *change in demand*. These are all the influences on buying plans *except for the price of the good*. To avoid confusion, when *the price of the good changes* and all other influences on buying plans remain the same, we say there has been a **change in the quantity demanded**.

The distinction between a change in demand and a change in the quantity demanded is crucial for figuring out how a market responds to the forces that hit it. Figure 4.4 illustrates and summarizes the distinction:

- If the price of bottled water *rises* when other things remain the same, the quantity demanded of bottled water *decreases* and there is a *movement up* along the demand curve D_0 . If the price *falls* when other things remain the same, the quantity demanded *increases* and there is a *movement down* along the demand curve D_0 .
- If some influence on buyers' plans other than the price of bottled water changes, there is a change in demand. When the demand for bottled water *decreases*, the demand curve *shifts leftward* to D_1 . When the demand for bottled water *increases*, the demand curve *shifts rightward* to D_2 .

When you are thinking about the influences on demand, try to get into the habit of asking: Does this influence change the quantity demanded or does it change demand? The test is: Did the price of the good change or did some other influence change? If the price changed, then quantity demanded changed. If some other influence changed and the price remained constant, then demand changed.

FIGURE 4.4

Change in Quantity Demanded Versus Change in Demand

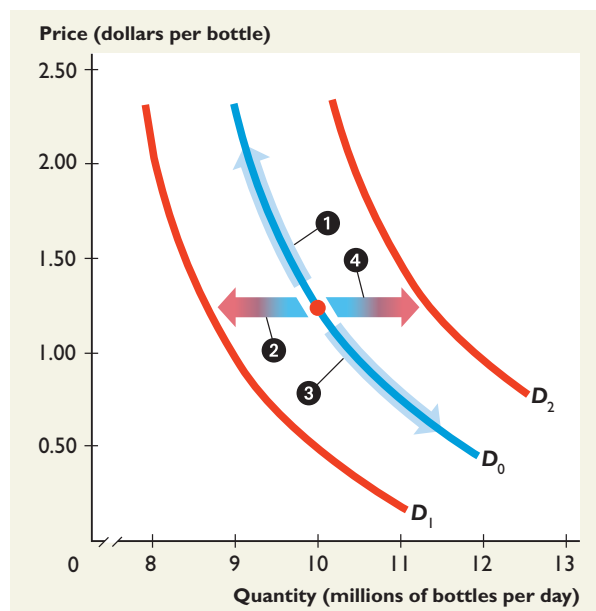
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- 1 **A decrease in the quantity demanded**
If the price of a good rises, *cet. par.*, the quantity demanded decreases. There is a movement up along the demand curve D_0 .

- 2 **A decrease in demand**
Demand decreases and the demand curve shifts leftward (from D_0 to D_1) if

- The price of a substitute falls or the price of a complement rises.
- The price of the good is expected to fall.
- Income decreases.*
- Expected future income or credit decreases.
- The number of buyers decreases.

* Bottled water is a normal good.



- 3 **An increase in the quantity demanded**
If the price of a good falls, *cet. par.*, the quantity demanded increases. There is a movement down along the demand curve D_0 .

- 4 **An increase in demand**
Demand increases and the demand curve shifts rightward (from D_0 to D_2) if

- The price of a substitute rises or the price of a complement falls.
- The price of the good is expected to rise.
- Income increases.
- Expected future income or credit increases.
- The number of buyers increases.

CHECKPOINT 4.1

Distinguish between quantity demanded and demand, and explain what determines demand.

MyEconLab

You can work these problems in Study Plan 4.1 and get instant feedback.

Practice Problems

The following events occur one at a time in the market for cell phones:

- The price of a cell phone falls.
- Everyone believes that the price of a cell phone will fall next month.
- The price of a call made from a cell phone falls.
- The price of a call made from a land-line phone increases.
- The introduction of camera phones makes cell phones more popular.

1. Explain the effect of each event on the demand for cell phones.
2. Use a graph to illustrate the effect of each event.
3. Does any event (or events) illustrate the law of demand?

In the News

Airlines, now flush, fear a downturn

So far this year, airlines have been able to raise fares but still fill their planes.

Source: *The New York Times*, June 10, 2011

Does this news clip imply that the law of demand doesn't work in the real world? Explain why or why not.

Solutions to Practice Problems

1. A fall in the price of a cell phone increases the quantity of cell phones demanded but has no effect on the demand for cell phones. An expected fall in the price of a cell phone next month decreases the demand for cell phones today as people wait for the lower price. A fall in the price of a call from a cell phone increases the demand for cell phones because a cell phone call and a cell phone are complements. A rise in the price of a call from a land-line phone increases the demand for cell phones because a land-line phone and a cell phone are substitutes. With cell phones more popular, the demand for cell phones increases.
2. Figure 1 illustrates the effect of a fall in the price of a cell phone as a movement along the demand curve D . Figure 2 illustrates the effect of an increase in the demand for cell phones as the shift of the demand curve from D_0 to D_1 and a decrease in the demand for cell phones as the shift of the demand curve from D_0 to D_2 .
3. A fall in the price of a cell phone (other things remaining the same) illustrates the law of demand. Figure 1 illustrates the law of demand. The other events change demand and do not illustrate the law of demand.

Solution to In the News

The law of demand states: If the price of an airline ticket rises, other things remaining the same, the quantity demanded of airline tickets will decrease. The demand curve for airline tickets slopes downward. The law of demand does work in the real world. Airlines can still fill their planes because "other things" did not remain the same. Some event increased the demand for air tickets.

FIGURE 1

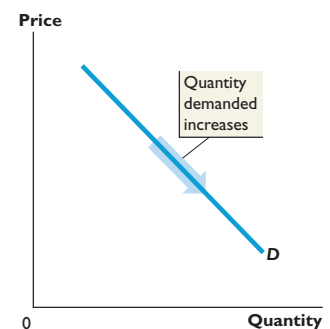
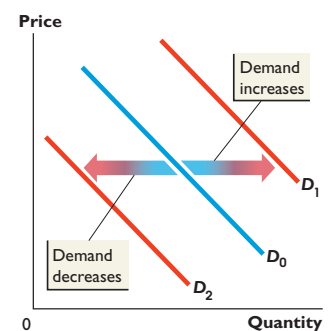


FIGURE 2



Quantity supplied

The amount of any good, service, or resource that people are willing and able to sell during a specified period at a specified price.

4.2 SUPPLY

A market has two sides. On one side are the buyers, or demanders, that we've just studied. On the other side of the market are the sellers, or suppliers. We now study the forces that determine suppliers' plans.

The **quantity supplied** of a good, service, or resource is the amount that people are willing and able to sell during a specified period at a specified price. For example, when the price of spring water is \$1.50 a bottle, a spring owner decides to sell 2,000 bottles a day. The 2,000 bottles a day is the quantity supplied of spring water by this individual producer. (As in the case of demand, the quantity supplied is measured as an amount *per unit of time*.)

Many things influence selling plans, and one of them is the price. We look first at the relationship between quantity supplied of a good and its price. To study this relationship, we keep all other influences on selling plans the same, and we ask: Other things remaining the same, how does the quantity supplied of a good change as its price varies? The law of supply provides the answer.

■ The Law of Supply

The **law of supply** states

Other things remaining the same, if the price of a good rises, the quantity supplied of that good increases; and if the price of a good falls, the quantity supplied of that good decreases.

So the law of supply states that when all other things remain the same, if the price of bottled water rises, spring owners will offer more water for sale; if the price of a flat panel TV falls, Sony Corp. will offer fewer flat panel TVs for sale.

Why, other things remaining the same, does the quantity supplied increase if the price rises and decrease if the price falls? Part of the answer lies in the principle of increasing opportunity cost (see p. 68). Because factors of production are not equally productive in all activities, as more of a good is produced, the opportunity cost of producing it increases. A higher price provides the incentive to bear the higher opportunity cost of increased production. Another part of the answer is that for a given cost, the higher price brings a larger profit, so sellers have greater incentive to increase production.

Think about the resources that you own and can offer for sale to others and ask yourself: Which of these items does *not* obey the law of supply? If the wage rate for summer jobs increased, would you have an incentive to work longer hours and bear the higher opportunity cost of forgone leisure? If the bank offered a higher interest rate on deposits, would you have an incentive to save more and bear the higher opportunity cost of forgone consumption? If the used book dealer offered a higher price for last year's textbooks, would you have an incentive to sell that handy math text and bear the higher opportunity cost of visiting the library (or finding a friend) whenever you needed the book?

■ Supply Schedule and Supply Curve

Supply is the relationship between the quantity supplied and the price of a good when all other influences on selling plans remain the same. The quantity supplied is *one* quantity at *one* price. *Supply* is a *list of quantities at different prices* illustrated by a supply schedule and a supply curve.

Supply

The relationship between the quantity supplied and the price of a good when all other influences on selling plans remain the same.

A **supply schedule** lists the quantities supplied at each different price when all the other influences on selling plans remain the same. The table in Figure 4.5 is one firm's (Agua's) supply schedule for bottled water. It tells us that if the price of water is 50 cents a bottle, Agua plans to sell no water. Its quantity supplied is 0 bottles a day. If the price of water is \$1.00 a bottle, Agua's quantity supplied is 1,000 bottles a day. Agua's quantity supplied increases to 2,000 bottles a day at a price of \$1.50 a bottle and to 3,000 bottles a day at a price of \$2.00 a bottle.

A **supply curve** is a graph of the relationship between the quantity supplied of a good and its price when all the other influences on selling plans remain the same. The points on the supply curve labeled *A* through *D* represent the rows *A* through *D* of the supply schedule. For example, point *C* on the supply curve represents row *C* of the supply schedule and shows that the quantity supplied is 1,000 bottles a day when the price is \$1.00 a bottle. Point *B* on the supply curve represents row *B* of the supply schedule and shows that the quantity supplied is 2,000 bottles a day when the price is \$1.50 a bottle.

The upward slope of the supply curve illustrates the law of supply. Along the supply curve, when the price of the good *rises*, the quantity supplied *increases*. For example, in Figure 4.5, when the price of a bottle of water rises from \$1.50 to \$2.00, the quantity supplied increases from 2,000 bottles a day to 3,000 bottles a day. And when the price *falls*, the quantity supplied *decreases*. For example, when the price falls from \$1.50 to \$1.00 a bottle, the quantity supplied decreases from 2,000 bottles a day to 1,000 bottles a day.

Supply schedule

A list of the quantities supplied at each different price when all the other influences on selling plans remain the same.

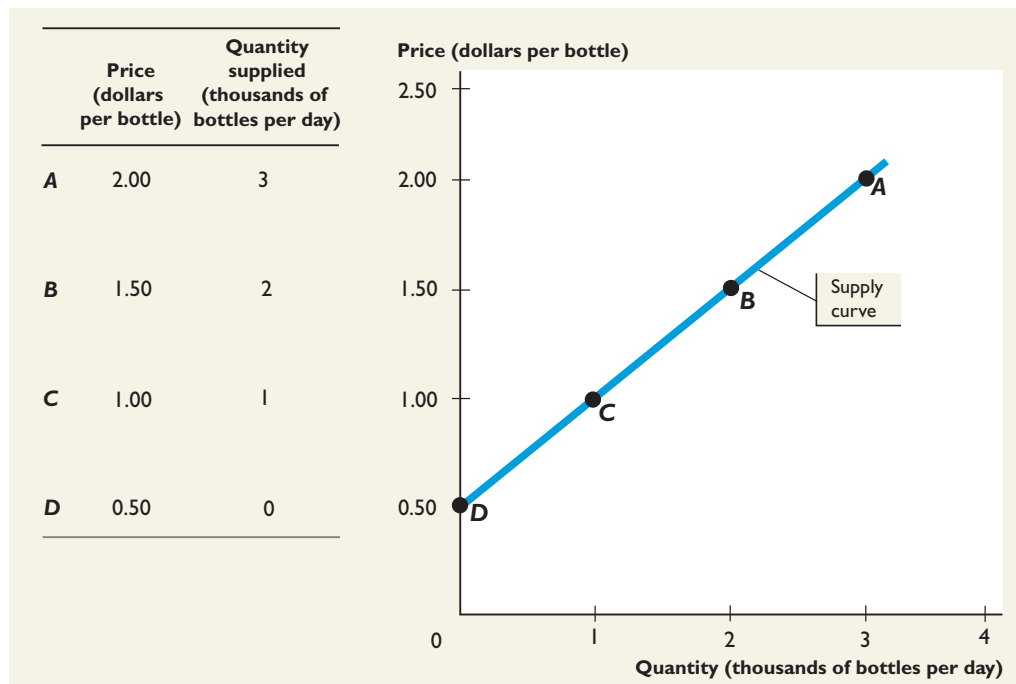
Supply curve

A graph of the relationship between the quantity supplied of a good and its price when all the other influences on selling plans remain the same.

FIGURE 4.5

Supply Schedule and Supply Curve

MyEconLab Animation



The table shows a supply schedule that lists the quantity of water supplied at each price if all other influences on selling plans remain the same. At a price of \$1.50 a bottle, the quantity supplied is 2,000 bottles a day.

The supply curve shows the relationship between the quantity supplied and price, other things remaining the same. The upward-sloping supply curve illustrates the law of supply. When the price rises, the quantity supplied increases; and when the price falls, the quantity supplied decreases.

Market supply
The sum of the supplies of all the sellers in the market.

Individual Supply and Market Supply

The supply schedule and the supply curve that you’ve just studied are for one seller. To study a market, we must determine the market supply.

Market supply is the sum of the supplies of all the sellers in the market. To find the market supply of water, imagine a market in which there are only two sellers: Agua and Prima. The table in Figure 4.6 shows three supply schedules: Agua’s, Prima’s, and the market supply schedule. Agua’s supply schedule is the same as before. Prima’s supply schedule tells us the quantity of water that Prima plans to sell at each price. To find the quantity of water supplied in the market, we sum the quantities supplied by Agua and Prima. For example, at a price of \$1.00 a bottle, the quantity supplied by Agua is 1,000 bottles a day, the quantity supplied by Prima is 2,000 bottles a day, and the quantity supplied in the market is 3,000 bottles a day.

Agua’s supply curve in part (a) and Prima’s supply curve in part (b) are graphs of the two individual supply schedules. The market supply curve in part (c) is a graph of the market supply schedule. At a given price, the quantity supplied on the market supply curve equals the horizontal sum of the quantities supplied on the individual supply curves.

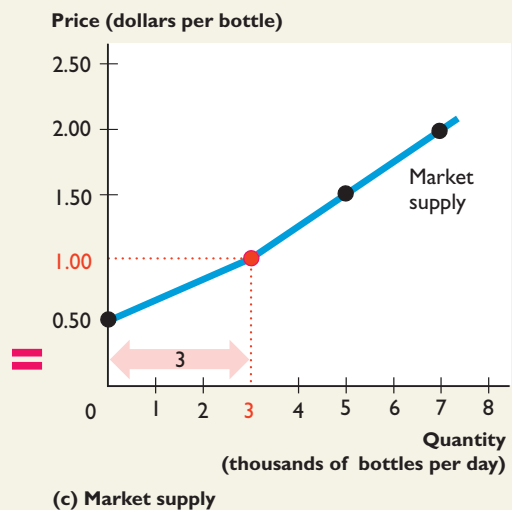
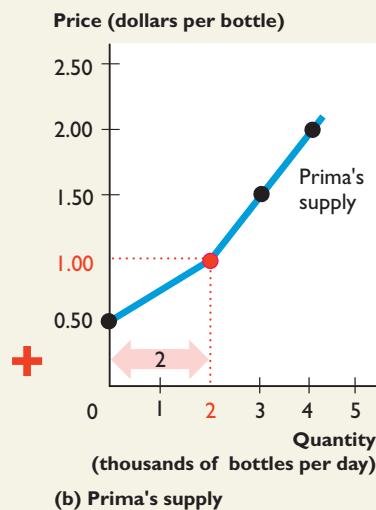
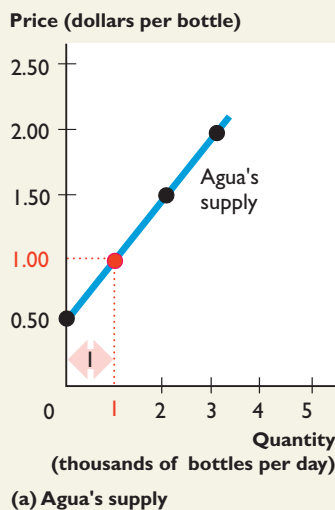
FIGURE 4.6
Individual Supply and Market Supply

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| Price (dollars per bottle) | Quantity supplied (thousands of bottles per day) | | |
|----------------------------------|--|-------|--------|
| | Agua | Prima | Market |
| 2.00 | 3 | 4 | 7 |
| 1.50 | 2 | 3 | 5 |
| 1.00 | 1 | 2 | 3 |
| 0.50 | 0 | 0 | 0 |

The market supply schedule is the sum of the individual supply schedules, and the market supply curve is the horizontal sum of the individual supply curves.

At a price of \$1 a bottle, the quantity supplied by Agua is 1,000 bottles a day and the quantity supplied by Prima is 2,000 bottles a day, so the total quantity supplied in the market is 3,000 bottles a day.



Changes in Supply

The supply curve shows how the quantity supplied changes when the price of the good changes but *all other influences on selling plans remain the same*. When any of these other influences on selling plans change, there is a **change in supply**, which means that there is a new supply schedule and new supply curve. *The supply curve shifts.*

Supply can either increase or decrease, and Figure 4.7 illustrates the two cases. Initially, the supply curve is S_0 . When supply decreases, the supply curve shifts leftward to S_1 . On supply curve S_1 , the quantity supplied at each price is smaller. When supply increases, the supply curve shifts rightward to S_2 . On supply curve S_2 the quantity supplied at each price is greater.

The main influences on selling plans that change supply are

- Prices of related goods
- Prices of resources and other inputs
- Expected future prices
- Number of sellers
- Productivity

Prices of Related Goods

Related goods are either substitutes *in production* or complements *in production*. A **substitute in production** for a good is another good that can be produced in its place. Skinny jeans are substitutes in production for boot cut jeans in a clothing factory.

A **complement in production** of a good is another good that is produced along with it. Cream is a complement in production of skim milk in a dairy.

Change in supply

A change in the quantity that suppliers plan to sell when any influence on selling plans other than the price of the good changes.

Substitute in production

A good that can be produced in place of another good.

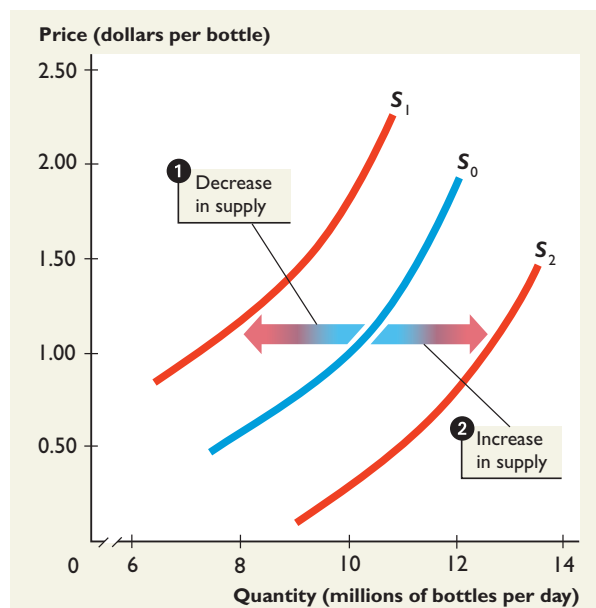
Complement in production

A good that is produced along with another good.

FIGURE 4.7

Changes in Supply

MyEconLab Animation



A change in any influence on selling plans other than a change in the price of the good itself changes supply and shifts the supply curve.

- 1 When supply decreases, the supply curve shifts leftward from S_0 to S_1 .
- 2 When supply increases, the supply curve shifts rightward from S_0 to S_2 .

A Change in the Price of a Substitute in Production The supply of a good *decreases* if the price of one of its substitutes in production *rises*; and the supply of a good *increases* if the price of one of its substitutes in production *falls*. That is, the supply of a good and the price of one of its substitutes in production move in *opposite directions*. For example, a clothing factory can produce cargo pants or button-fly jeans, so these goods are substitutes in production. When the price of button-fly jeans rises, the clothing factory switches production from cargo pants to button-fly jeans, so the supply of cargo pants decreases.

A Change in the Price of a Complement in Production The supply of a good *increases* if the price of one of its complements in production *rises*; and the supply of a good *decreases* if the price of one of its complements in production *falls*. That is, the supply of a good and the price of one of its complements in production move in the *same direction*. For example, when a dairy produces skim milk, it also produces cream, so these goods are complements in production. When the price of skim milk rises, the dairy produces more skim milk, so the supply of cream increases.

Prices of Resources and Other Inputs

Supply changes when the price of a resource or other input used to produce the good changes. The reason is that resource and input prices influence the cost of production. The more it costs to produce a good, the smaller is the quantity supplied of that good at each price (other things remaining the same). For example, if the wage rate of bottling-plant workers rises, it costs more to produce a bottle of water, so the supply of bottled water decreases.

Expected Future Prices

Expectations about future prices influence supply. For example, a severe frost that wipes out Florida's citrus crop doesn't change the production of orange juice today, but it does decrease production later in the year when the current crop would normally have been harvested. Sellers of orange juice will expect the price to rise in the future. To get the higher future price, some sellers will increase their inventory of frozen juice, and this action decreases the supply of juice today.

Number of Sellers

The greater the number of sellers in a market, the larger is the supply. For example, many new sellers have developed springs and water-bottling plants in the United States, and the supply of bottled water has increased.

Productivity

Productivity is output per unit of input. An increase in productivity lowers the cost of producing the good and increases its supply. A decrease in productivity has the opposite effect and decreases supply.

Technological change and the increased use of capital increase productivity. For example, advances in electronic technology have lowered the cost of producing a computer and increased the supply of computers. Technological change brings new goods such as the iPod, the supply of which was previously zero.

Natural events such as severe weather and earthquakes decrease productivity and decrease supply. For example, the tsunami of 2004 decreased the supply of agricultural products and seafood in many places surrounding the Indian Ocean.

Change in Quantity Supplied Versus Change in Supply

The influences on sellers' plans you've just considered bring a *change in supply*. These are all the influences on sellers' plans *except the price of the good*. To avoid confusion, when the *price of the good changes* and all other influences on selling plans remain the same, we say there has been a **change in the quantity supplied**.

The distinction between a change in supply and a change in the quantity supplied is crucial for figuring out how a market responds to the forces that hit it. Figure 4.8 illustrates and summarizes the distinction:

- If the price of bottled water *falls* when other things remain the same, the quantity supplied of bottled water *decreases* and there is a *movement down* along the supply curve S_0 . If the price *rises* when other things remain the same, the quantity supplied *increases* and there is a *movement up* along the supply curve S_0 .
- If any influence on water bottlers' plans other than the price of bottled water changes, there is a change in the supply of bottled water. When the supply of bottled water *decreases*, the supply curve *shifts leftward* to S_1 . When the supply of bottled water *increases*, the supply curve *shifts rightward* to S_2 .

When you are thinking about the influences on supply, get into the habit of asking: Does this influence change the quantity supplied or does it change supply? The test is: Did the price change or did some other influence change? If the price of the good changed, then quantity supplied changed. If some other influence changed and the price of the good remained constant, then supply changed.

Change in the quantity supplied

A change in the quantity of a good that suppliers plan to sell that results from a change in the price of the good.

FIGURE 4.8

Change in Quantity Supplied Versus Change in Supply

MyEconLab Animation

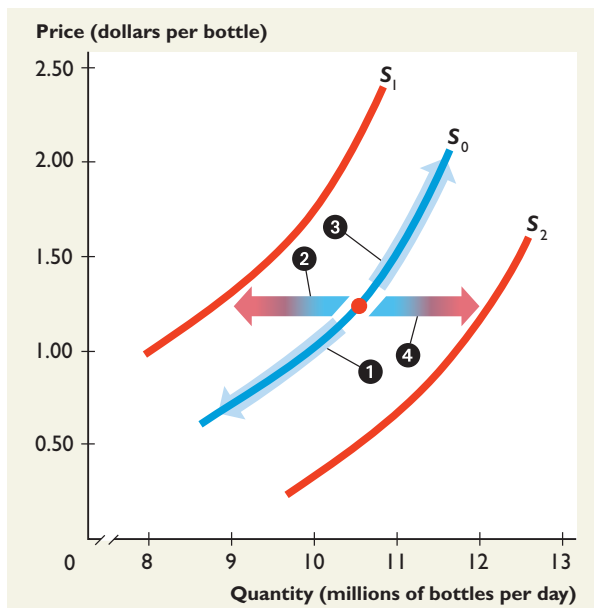
1 A decrease in the quantity supplied

If the price of a good falls, *cet. par.*, the quantity supplied decreases. There is a movement down along the supply curve S_0 .

2 A decrease in supply

Supply decreases and the supply curve shifts leftward (from S_0 to S_1) if

- The price of a substitute in production rises.
- The price of a complement in production falls.
- A resource price or other input price rises.
- The price of the good is expected to rise.
- The number of sellers decreases.
- Productivity decreases.



3 An increase in the quantity supplied

If the price of a good rises, *cet. par.*, the quantity supplied increases. There is a movement up along the supply curve S_0 .

4 An increase in supply

Supply increases and the supply curve shifts rightward (from S_0 to S_2) if

- The price of a substitute in production falls.
- The price of a complement in production rises.
- A resource price or other input price falls.
- The price of the good is expected to fall.
- The number of sellers increases.
- Productivity increases.

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You can work these problems in Study Plan 4.2 and get instant feedback.

CHECKPOINT 4.2

Distinguish between quantity supplied and supply, and explain what determines supply.

Practice Problems

Lumber companies make timber beams from logs. In the process of making beams, the mill produces sawdust, which is made into pressed wood. In the market for timber beams, the following events occur one at a time:

- The wage rate of sawmill workers rises.
 - The price of sawdust rises.
 - The price of a timber beam rises.
 - The price of a timber beam is expected to rise next year.
 - A new law reduces the amount of forest that can be cut for timber.
 - A new technology lowers the cost of producing timber beams.
1. Explain the effect of each event on the supply of timber beams.
 2. Use a graph to illustrate the effect of each event.
 3. Does any event (or events) illustrate the law of supply?

In the News

GM, UAW reach crucial cost-cutting pact

GM and the UAW agree on restructuring workers' jobs. This restructuring, with no change in the wage rate, will save GM billions in labor costs.

Source: *Wall Street Journal*, May 22, 2009

How will this cost-cutting agreement change GM's supply of vehicles? Explain.

FIGURE 1

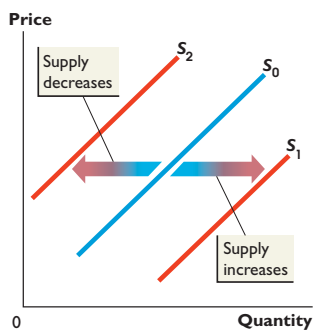


FIGURE 2



Solutions to Practice Problems

1. A rise in workers' wage rates increases the cost of producing a timber beam and decreases the supply of timber beams. A rise in the price of sawdust increases the supply of timber beams because sawdust and timber beams are complements in production. A rise in the price of a timber beam increases the quantity of timber beams supplied but has no effect on the supply of timber beams. An expected rise in the price of a timber beam decreases the supply of timber beams today as producers hold back and wait for the higher price. The new law decreases the supply of timber beams. The new technology increases the supply of timber beams.
2. In Figure 1, an increase in the supply shifts the supply curve from S_0 to S_1 , and a decrease in the supply shifts the supply curve from S_0 to S_2 . In Figure 2, the rise in the price of a beam creates a movement along the supply curve.
3. A rise in the price of a beam, other things remaining the same, is the only event that illustrates the law of supply—see Figure 2.

Solution to In the News

The cut in labor costs with no change in the wage rate is an increase in productivity, which will increase GM's supply of vehicles.

4.3 MARKET EQUILIBRIUM

In everyday language, “equilibrium” means “opposing forces are in balance.” In a market, demand and supply are the opposing forces. **Market equilibrium** occurs when the quantity demanded equals the quantity supplied—when buyers’ and sellers’ plans are in balance. At the **equilibrium price**, the quantity demanded equals the quantity supplied. The **equilibrium quantity** is the quantity bought and sold at the equilibrium price.

In the market for bottled water in Figure 4.9, equilibrium occurs where the demand curve and the supply curve intersect. The equilibrium price is \$1.00 a bottle, and the equilibrium quantity is 10 million bottles a day.

Price: A Market’s Automatic Regulator

When equilibrium is disturbed, market forces restore it. The **law of market forces** states

When there is a surplus, the price falls; and when there is a shortage, the price rises.

A *surplus* is a situation in which the quantity supplied exceeds the quantity demanded. If there is a surplus, suppliers must cut the price to sell more. Buyers are pleased to take the lower price, so the price falls. Because a surplus arises when the price is above the equilibrium price, a falling price is exactly what the market needs to restore equilibrium.

A *shortage* is a situation in which the quantity demanded exceeds the quantity supplied. If there is a shortage, buyers must pay a higher price to get more. Sellers are pleased to take the higher price, so the price rises. Because a shortage arises when the price is below the equilibrium price, a rising price is exactly what is

Market equilibrium

When the quantity demanded equals the quantity supplied—buyers’ and sellers’ plans are in balance.

Equilibrium price

The price at which the quantity demanded equals the quantity supplied.

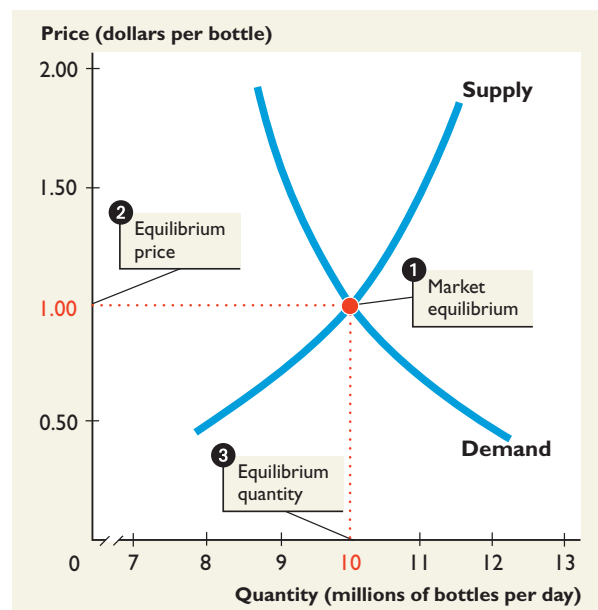
Equilibrium quantity

The quantity bought and sold at the equilibrium price.

FIGURE 4.9

Equilibrium Price and Equilibrium Quantity

MyEconLab Animation

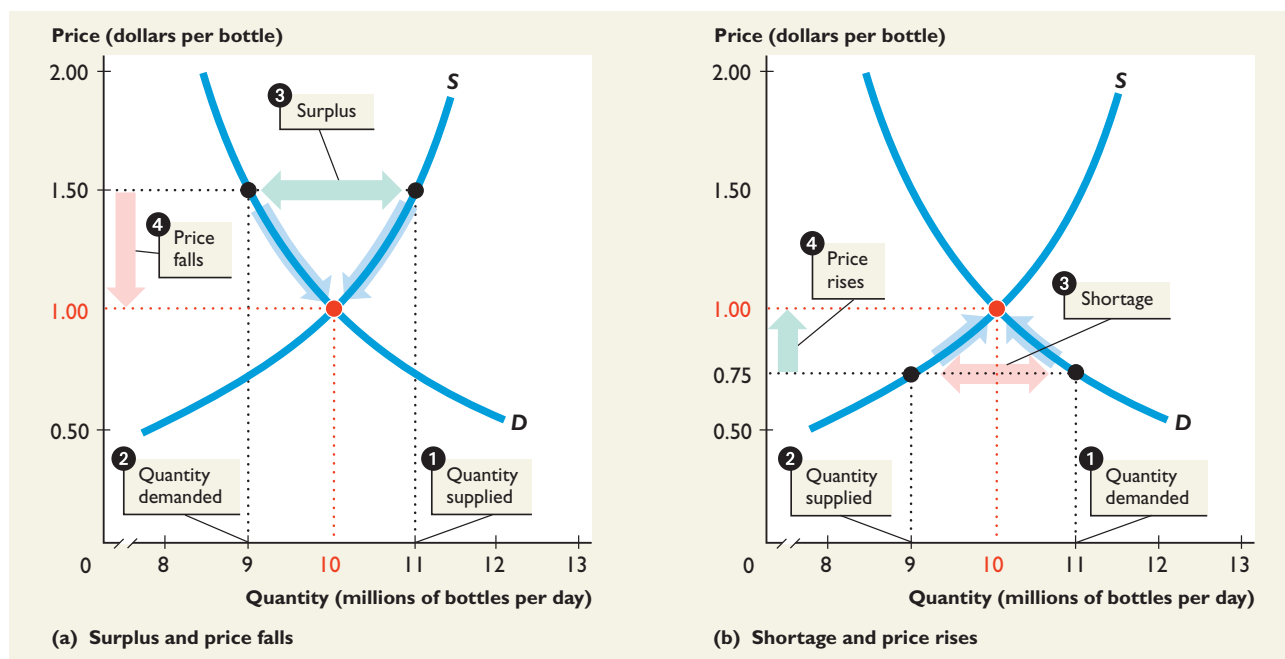


- 1 Market equilibrium occurs at the intersection of the demand curve and the supply curve.
- 2 The equilibrium price is \$1.00 a bottle.
- 3 At the equilibrium price, the quantity demanded and the quantity supplied are 10 million bottles a day, which is the equilibrium quantity.

FIGURE 4.10

The Forces That Achieve Equilibrium

MyEconLab Animation



At \$1.50 a bottle, ① the quantity supplied is 11 million bottles, ② the quantity demanded is 9 million bottles, ③ the surplus is 2 million bottles, and ④ the price falls.

At 75 cents a bottle, ① the quantity demanded is 11 million bottles, ② the quantity supplied is 9 million bottles, ③ the shortage is 2 million bottles, and ④ the price rises.

needed to restore equilibrium.

In Figure 4.10(a), at \$1.50 a bottle, there is a surplus: The price falls, the quantity demanded increases, the quantity supplied decreases, and the surplus is eliminated at \$1.00 a bottle.

In Figure 4.10(b), at 75 cents a bottle, there is a shortage of water: The price rises, the quantity demanded decreases, the quantity supplied increases, and the shortage is eliminated at \$1.00 a bottle.

■ Predicting Price Changes: Three Questions

Because price adjustments eliminate shortages and surpluses, markets are normally in equilibrium. When an event disturbs an equilibrium, a new equilibrium soon emerges. To explain and predict changes in prices and quantities, we need to consider only changes in the *equilibrium* price and the *equilibrium* quantity. We can work out the effects of an event on a market by answering three questions:

1. Does the event influence demand or supply?
2. Does the event *increase* or *decrease* demand or supply—shift the demand curve or the supply curve *rightward* or *leftward*?
3. What are the new *equilibrium* price and *equilibrium* quantity and how have they changed?

Effects of Changes in Demand

Let's practice answering the three questions by working out the effects of an event in the market for bottled water: A new study says that tap water is unsafe.

1. With tap water unsafe, the demand for bottled water changes.
2. The demand for bottled water *increases*, and the demand curve *shifts rightward*. Figure 4.11(a) shows the shift from D_0 to D_1 .
3. There is now a *shortage* at \$1.00 a bottle. The *price rises* to \$1.50 a bottle, and the quantity increases to 11 million bottles.

Note that there is *no change in supply*; the rise in price brings an *increase in the quantity supplied*—a movement along the supply curve.

Let's work out what happens if the price of a zero-calorie sports drink falls.

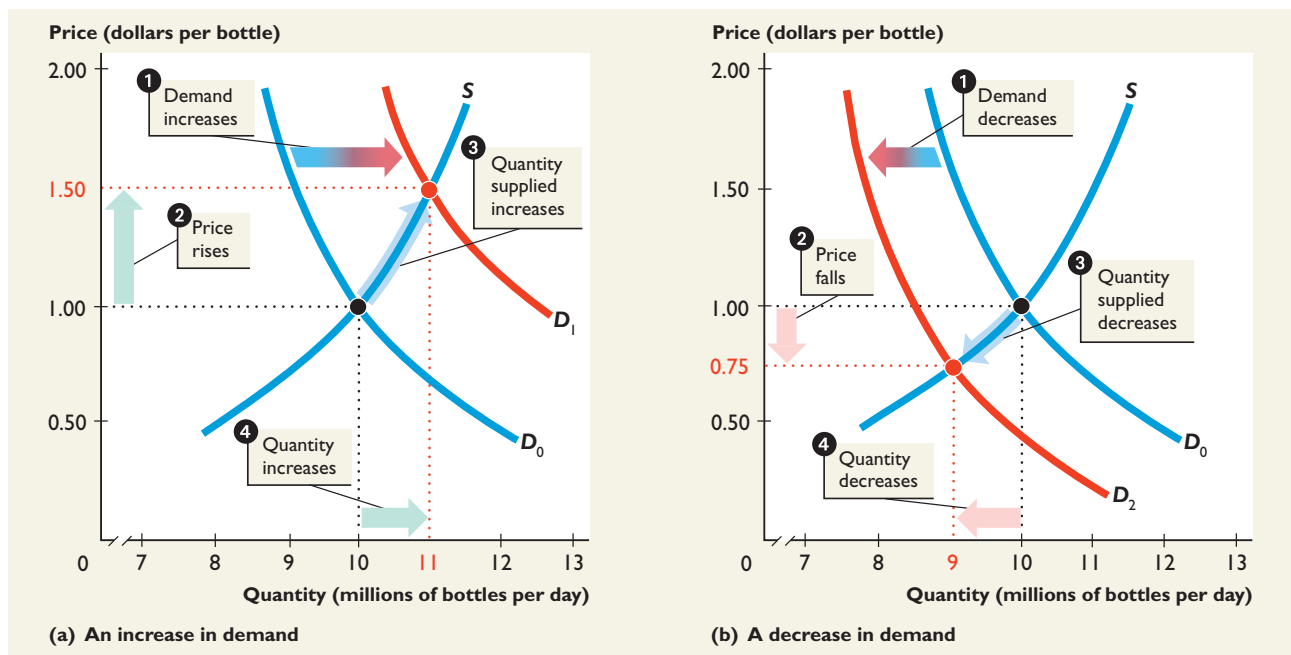
1. The sports drink is a substitute for bottled water, so when its price changes, the demand for bottled water changes.
2. The demand for bottled water *decreases*, and the demand curve *shifts leftward*. Figure 4.11(b) shows the shift from D_0 to D_2 .
3. There is now a *surplus* at \$1.00 a bottle. The price *falls* to 75 cents a bottle, and the quantity decreases to 9 million bottles.

Note again that there is *no change in supply*; the fall in price brings a *decrease in the quantity supplied*—a movement along the supply curve.

FIGURE 4.11

The Effects of a Change in Demand

MyEconLab Animation



1 An increase in demand shifts the demand curve rightward to D_1 and creates a shortage. 2 The price rises, 3 the quantity supplied increases, and 4 the equilibrium quantity increases.

1 A decrease in demand shifts the demand curve leftward to D_2 and creates a surplus. 2 The price falls, 3 the quantity supplied decreases, and 4 the equilibrium quantity decreases.

Effects of Changes in Supply

You can get more practice working out the effects of another event in the market for bottled water: European water bottlers buy springs and open new plants in the United States.

1. With more suppliers of bottled water, the supply changes.
2. The supply of bottled water *increases*, and the supply curve *shifts rightward*. Figure 4.12(a) shows the shift from S_0 to S_1 .
3. There is now a *surplus* at \$1.00 a bottle. The *price falls* to 75 cents a bottle, and the quantity increases to 11 million bottles.

Note that there is *no change in demand*; the fall in price brings an *increase in the quantity demanded*—a movement along the demand curve.

What happens if a drought dries up some springs?

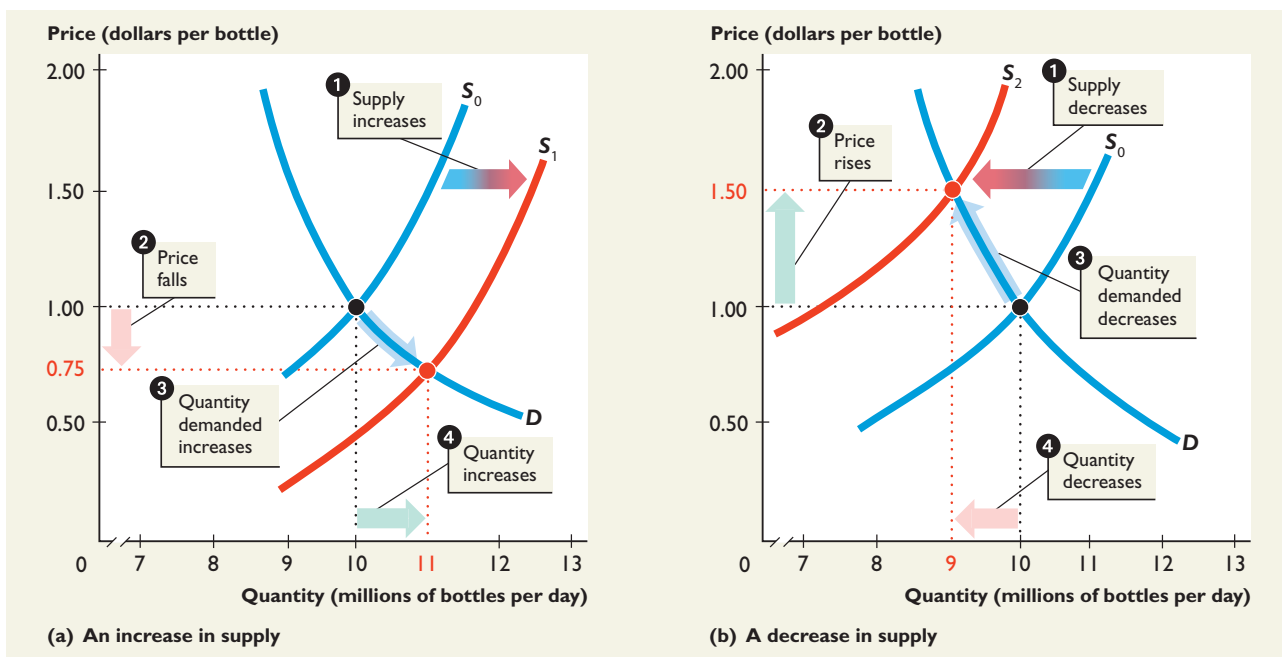
1. The drought is a change in productivity, so the supply of water changes.
2. With fewer springs, the supply of bottled water *decreases*, and the supply curve *shifts leftward*. Figure 4.12(b) shows the shift from S_0 to S_2 .
3. There is now a *shortage* at \$1.00 a bottle. The *price rises* to \$1.50 a bottle, and the quantity decreases to 9 million bottles.

Again, there is *no change in demand*; the rise in price brings a *decrease in the quantity demanded*—a movement along the demand curve.

FIGURE 4.12

The Effects of a Change in Supply

MyEconLab Animation



1 An increase in supply shifts the supply curve rightward to S_1 and creates a surplus. 2 The price falls, 3 the quantity demanded increases, and 4 the equilibrium quantity increases.

1 A decrease in supply shifts the supply curve leftward to S_2 and creates a shortage. 2 The price rises, 3 the quantity demanded decreases, and 4 the equilibrium quantity decreases.



EYE on the PRICE OF COFFEE

Why Did the Price of Coffee Soar in 2010 and 2011?

In January 2009, the price of coffee (the kind that you get at Starbucks and similar coffee shops called Arabica) was \$1.25 a pound (point A in Figure 1) and by May 2011, it had risen to \$3.00 a pound (point B). Why did the price of coffee soar? Figure 2, which shows the

market for coffee, answers this question.

The demand curve D and the supply curve S_{09} determined the equilibrium price and quantity in 2009 at \$1.25 a pound and 950 million pounds.

Heavy rain led to exceptionally low harvests in Colombia, Indonesia, Mexico,

and Vietnam, which decreased the supply of coffee. The supply curve shifted leftward to S_{11} . The price increased to \$3.00 a pound. The quantity demanded and equilibrium quantity decreased to 800 million pounds.

Price of coffee (dollars per pound)

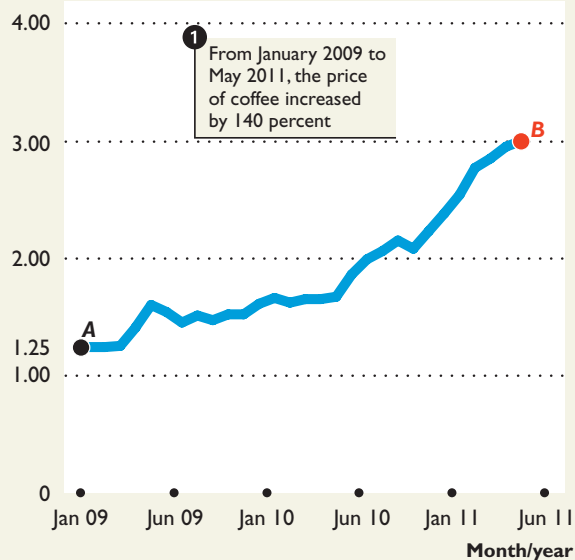


Figure 1 The price of coffee

Price (dollars per pound)

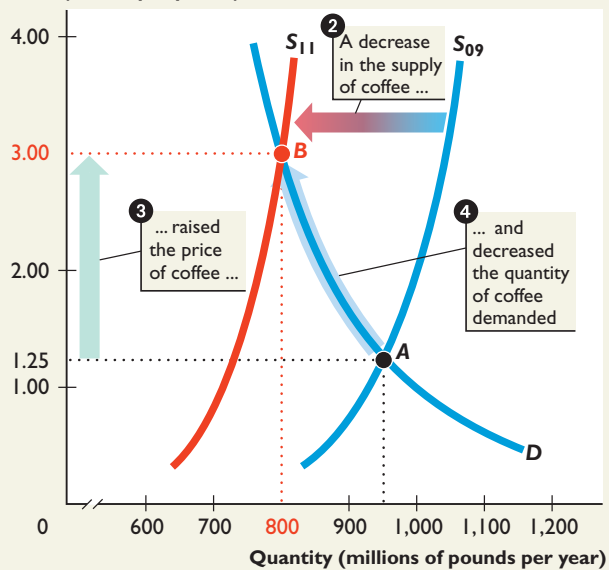


Figure 2 The market for coffee



EYE on YOUR LIFE

Using Demand and Supply

The demand and supply model is going to be a big part of the rest of your life!

First, you will use it again and again during your economics course. The demand and supply model is one of your major tools, so having a firm grasp of it will bring an immediate payoff.

But second, and much more important, by understanding the laws of demand and supply and being aware of how prices adjust to balance these two opposing forces, you will have a much better appreciation of how your economic world works.

Every time you hear someone com-

plaining about a price hike and blaming it on someone's greed, think about the law of market forces and how demand and supply determine that price.

As you shop for your favorite clothing, music, and food items, try to describe how supply and demand influence the prices of these goods.

■ Changes in Both Demand and Supply

When events occur that change *both* demand and supply, you can find the resulting change in the equilibrium price and equilibrium quantity by combining the cases you've just studied. Figure 4.13 summarizes all the possible cases.

Increase in Both Demand and Supply

An increase in demand or an increase in supply increases the equilibrium quantity. So when demand and supply increase together, the *quantity increases*. But the price rises when demand increases and falls when supply increases. So when demand and supply increase together, we can't say what happens to the price unless we know the magnitudes of the changes. If demand increases by more than supply increases, the price rises. But if supply increases by more than demand increases, the price falls. Figure 4.13(e) shows the case when supply increases by the same amount as demand increases, so the price remains unchanged.

Decrease in Both Demand and Supply

A decrease in demand or a decrease in supply decreases the equilibrium quantity. So when demand and supply decrease together, the *quantity decreases*. But the price falls when demand decreases and rises when supply decreases. So when demand and supply decrease together, we can't say what happens to the price unless we know the magnitudes of the changes. If demand decreases by more than supply decreases, the price falls. But if supply decreases by more than demand decreases, the price rises. Figure 4.13(i) shows the case when supply decreases by the same amount as demand decreases, so the price remains unchanged.

Increase in Demand and Decrease in Supply

An increase in demand or a decrease in supply raises the equilibrium price, so combined, these changes *raise the price*. But an increase in demand increases the quantity, and a decrease in supply decreases the quantity. So when these changes occur together, we can't say what happens to the quantity unless we know the magnitudes of the changes. If demand increases by more than supply decreases, the quantity increases. But if supply decreases by more than demand increases, the quantity decreases. Figure 4.13(h) shows the case when demand increases by the same amount as supply decreases, so the quantity remains unchanged.

Decrease in Demand and Increase in Supply

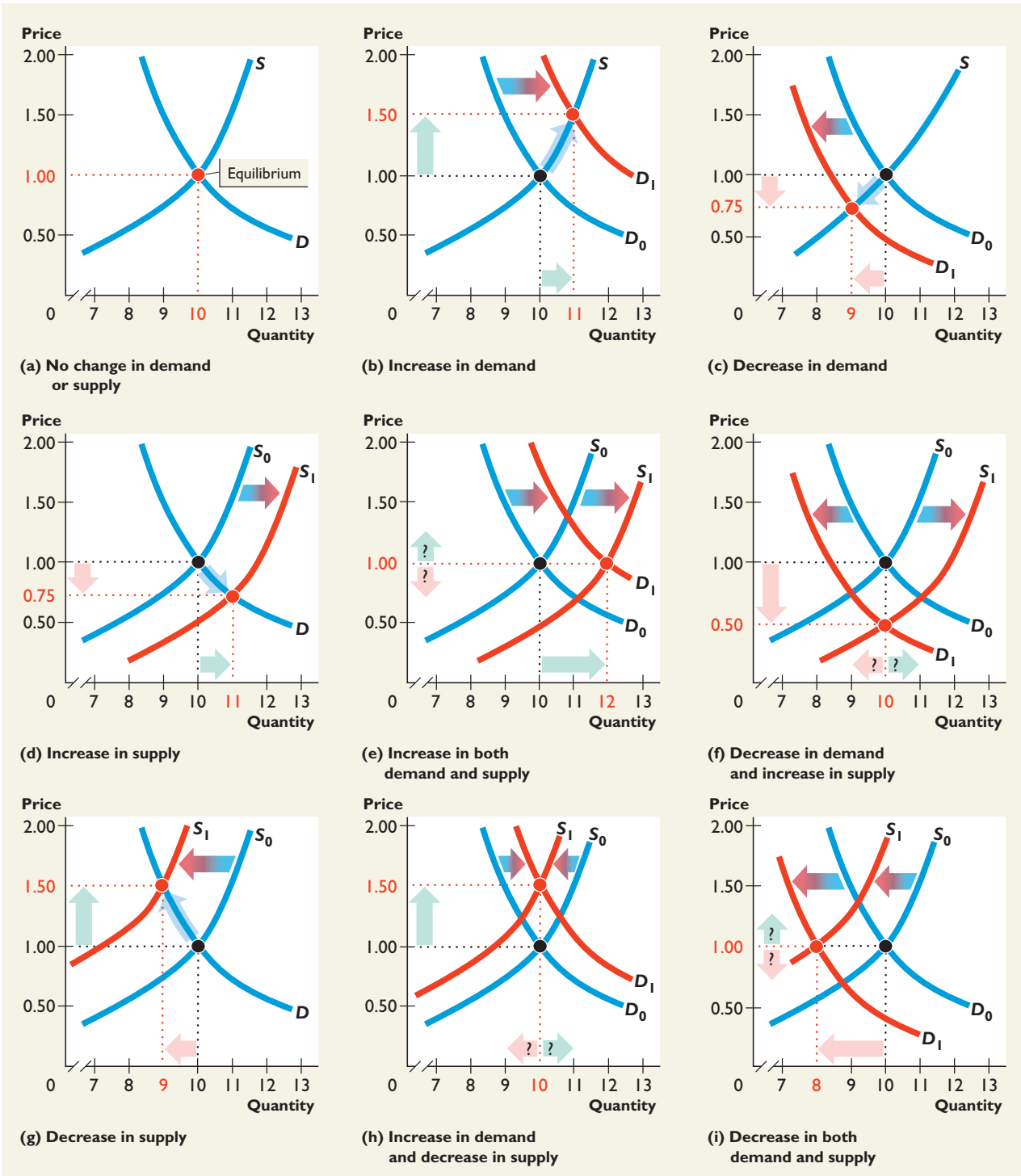
A decrease in demand or an increase in supply lowers the equilibrium price, so combined, these changes *lower the price*. But a decrease in demand decreases the quantity, and an increase in supply increases the quantity. So when these changes occur together, we can't say what happens to the quantity unless we know the magnitudes of the changes. If demand decreases by more than supply increases, the quantity decreases. But if supply increases by more than demand decreases, the quantity increases. Figure 4.13(f) shows the case when demand decreases by the same amount as supply increases, so the quantity remains unchanged.

For the cases in Figure 4.13 where you "can't say" what happens to price or quantity, make some examples that go in each direction.

FIGURE 4.13

The Effects of All the Possible Changes in Demand and Supply

MyEconLab Animation



MyEconLab

You can work these problems in Study Plan 4.3 and get instant feedback.

TABLE 1

| Price (dollars per carton) | Quantity demanded (cartons per day) | Quantity supplied (cartons per day) |
|----------------------------|-------------------------------------|-------------------------------------|
| 1.00 | 200 | 110 |
| 1.25 | 175 | 130 |
| 1.50 | 150 | 150 |
| 1.75 | 125 | 170 |
| 2.00 | 100 | 190 |

FIGURE 1

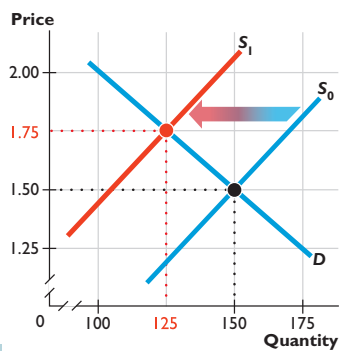
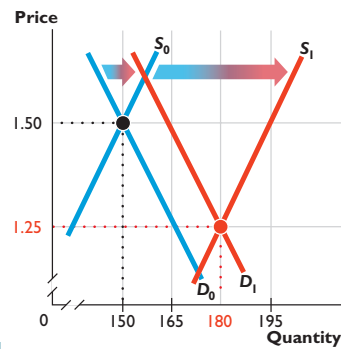


FIGURE 2



CHECKPOINT 4.3

Explain how demand and supply determine price and quantity in a market, and explain the effects of changes in demand and supply.

Practice Problems

Table 1 sets out the demand and supply schedules for milk.

1. What is the equilibrium price and equilibrium quantity of milk?
2. Describe the situation in the milk market if the price were \$1.75 a carton and explain how the market reaches equilibrium.
3. A drought decreases the quantity supplied by 45 cartons a day at each price. What is the new equilibrium and how does the market adjust to it?
4. If milk becomes more popular and better feeds increase milk production, describe how the equilibrium price and quantity of milk will change.

In the News

After wild weather, higher food prices on horizon

After heavy rain this year, the corn harvest will be less than expected while the demand for corn will continue to increase. Food prices will continue to rise.

Source: npr, June 9, 2011

Using the demand and supply model explain why food prices are expected to rise.

Solutions to Practice Problems

1. Equilibrium price is \$1.50 a carton; equilibrium quantity is 150 cartons a day.
2. At \$1.75 a carton, the quantity demanded (125 cartons) is less than the quantity supplied (170 cartons), so there is a surplus of 45 cartons a day. The price begins to fall, and as it does, the quantity demanded increases, the quantity supplied decreases, and the surplus decreases. The price will fall until the surplus is eliminated. The price falls to \$1.50 a carton.
3. The supply decreases by 45 cartons a day so at \$1.50 a carton there is a shortage of milk. The price begins to rise, and as it does, the quantity demanded decreases, the quantity supplied increases, and the shortage decreases. The price will rise until the shortage is eliminated. The new equilibrium occurs at \$1.75 a carton and 125 cartons a day (Figure 1).
4. With milk more popular, demand increases. With better feeds, supply increases. If supply increases by more than demand, a surplus arises. The price falls, and the quantity increases (Figure 2). If demand increases by more than supply, a shortage arises. The price rises, and the quantity increases. If demand and supply increase by the same amount, there is no shortage or surplus, so the price does not change, but the quantity increases.

Solution to In the News

A fall in the corn harvest will decrease the supply of corn and shift the supply curve of corn leftward. The increase in the demand for corn will shift the demand curve rightward. The price of corn will rise. The higher price of corn will decrease the supply of food made from corn and raise the price of this food.

CHAPTER SUMMARY

Key Points

1. Distinguish between quantity demanded and demand, and explain what determines demand.

- Other things remaining the same, the quantity demanded increases as the price falls and decreases as the price rises—the law of demand.
- The demand for a good is influenced by the prices of related goods, expected future prices, income, expected future income and credit, the number of buyers, and preferences. A change in any of these influences changes the demand for the good.

2. Distinguish between quantity supplied and supply, and explain what determines supply.

- Other things remaining the same, the quantity supplied increases as the price rises and decreases as the price falls—the law of supply.
- The supply of a good is influenced by the prices of related goods, prices of resources and other inputs, expected future prices, the number of sellers, and productivity. A change in any of these influences changes the supply of the good.

3. Explain how demand and supply determine price and quantity in a market, and explain the effects of changes in demand and supply.

- The law of market forces brings market equilibrium—the equilibrium price and equilibrium quantity at which buyers and sellers trade.
- The price adjusts to maintain market equilibrium—to keep the quantity demanded equal to the quantity supplied. A surplus brings a fall in the price to restore market equilibrium; a shortage brings a rise in the price to restore market equilibrium.
- Market equilibrium responds to changes in demand and supply. An increase in demand increases both the price and the quantity; a decrease in demand decreases both the price and the quantity. An increase in supply increases the quantity but decreases the price; and a decrease in supply decreases the quantity but increases the price.

Key Terms

Change in demand, 88

Change in the quantity demanded, 90

Change in the quantity supplied, 97

Change in supply, 95

Complement, 88

Complement in production, 95

Demand, 85

Demand curve, 86

Demand schedule, 86

Equilibrium price, 99

Equilibrium quantity, 99

Inferior good, 89

Law of demand, 85

Law of market forces, 99

Law of supply, 92

Market demand, 87

Market equilibrium, 99

Market supply, 94

Normal good, 89

Quantity demanded, 85

Quantity supplied, 92

Substitute, 88

Substitute in production, 95

Supply, 92

Supply curve, 93

Supply schedule, 93

MyEconLab

You can work these problems in Chapter 4 Study Plan and get instant feedback.

CHAPTER CHECKPOINT

Study Plan Problems and Applications

1. Explain how each of the following events changes the demand for or supply of air travel.
 - Airfares tumble, while long-distance bus fares don't change.
 - The price of jet fuel rises.
 - Airlines reduce the number of flights each day.
 - People expect airfares to increase next summer.
 - The price of train travel falls.
 - The price of a pound of air cargo increases.

Use the laws of demand and supply to explain whether the statements in Problems 2 and 3 are true or false. In your explanation, distinguish between a change in demand and a change in the quantity demanded and between a change in supply and a change in the quantity supplied.

2. The United States does not allow oranges from Brazil (the world's largest producer of oranges) to enter the United States. If Brazilian oranges were sold in the United States, oranges and orange juice would be cheaper.
3. If the price of frozen yogurt falls, the quantity of ice cream consumed will decrease and the price of ice cream will rise.
4. Table 1 shows the demand and supply schedules for running shoes. What is the market equilibrium? If the price is \$70 a pair, describe the situation in the market. Explain how market equilibrium is restored. If a rise in income increases the demand for running shoes by 100 pairs a day at each price, explain how the market adjusts to its new equilibrium.
5. "As more people buy fuel-efficient hybrid cars, the demand for gasoline will decrease and the price of gasoline will fall. The fall in the price of gasoline will decrease the supply of gasoline." Is this statement true? Explain.
6. **OPEC deadlocked on oil production hike**
Oil prices breached the \$100-a-barrel mark Wednesday after OPEC said it could not reach an agreement about raising crude production.

Source: CNN Money, June 8, 2011

Draw a graph to show the oil market in equilibrium. Suppose that OPEC members had agreed to increase production. Show on your graph, the effect of this decision on the market equilibrium.

Use the following information to work Problems 7 and 8.

Pricier bread and cereal. Coming soon?

Wheat and corn prices surged about 10 percent last week and could hit the items in your grocery basket by mid-summer. It's a case of two extremes: dry weather conditions in parts of the southern United States and in Europe have sparked fears of a supply crunch of wheat, while supplies of corn are being threatened by flooding and heavy rain in the Midwest.

Source: CNN Money, May 19, 2011

7. Explain why the dry weather will lead to a rise in the price of bread.
8. Use graphs to show why the price of corn has risen and show its effect on the price of cereals.

TABLE 1

| Price (dollars per pair) | Quantity demanded | Quantity supplied |
|--------------------------------|----------------------|----------------------|
| | (pairs per day) | |
| 60 | 1,000 | 400 |
| 70 | 900 | 500 |
| 80 | 800 | 600 |
| 90 | 700 | 700 |
| 100 | 600 | 800 |
| 110 | 500 | 900 |

Instructor Assignable Problems and Applications

1. If after heavy rain and low production, the weather improves and coffee growers enjoy bumper crops, how does
- The demand for coffee change?
 - The supply of coffee change?
 - The price of coffee change?

Illustrate your answer with a graphical analysis.

2. What is the effect on the equilibrium price and equilibrium quantity of orange juice if the price of apple juice decreases and the wage rate paid to orange grove workers increases?
3. What is the effect on the equilibrium in the orange juice market if orange juice becomes more popular and a cheaper robot is used to pick oranges?

Table 1 shows the demand and supply schedules for boxes of chocolates in an average week. Use this information to work Problems 4 and 5.

4. If the price of chocolates is \$17.00 a box, describe the situation in the market. Explain how market equilibrium is restored.
5. During Valentine's week, more people buy chocolates and chocolatiers offer their chocolates in special red boxes, which cost more to produce than the everyday box. Set out the three-step process of analysis and show on a graph the adjustment process to the new equilibrium. Describe the changes in the equilibrium price and the equilibrium quantity.
6. After a severe bout of foreclosures and defaults on home loans, banks made it harder for people to borrow. How does this change influence
- The demand for new homes?
 - The supply of new homes?
 - The price of new homes?

Illustrate your answer with a graphical analysis.

7. Alabama food prices jump in May

Alabama Farmers Federation announced that food prices in May will increase. In previous unprofitable years, farmers reduced their herds with the result that in 2009 meat production will fall. Bacon is expected to rise by 32 cents a pound to \$4.18 and steaks by 57 cents to \$8.41 a pound.

Source: *The Birmingham News*, May 21, 2009

Explain why the reduction of herds will lead to a rise in meat prices today. Draw a graph to illustrate.

8. "As more people buy computers, the demand for Internet service increases and the price of Internet service decreases. The fall in the price of Internet service decreases the supply of Internet service." Is this statement true or false? Explain.
9. **Steel output set for historic drop**
Steel producers expect to cut output by 10 percent in 2009 in response to cancelled orders from construction companies and car and household appliance producers.

Source: *Financial Times*, December 28, 2008

Does the cancellation of orders change the demand for steel, the quantity demanded, the supply of steel, or the quantity supplied? What happens to the equilibrium price of steel?

Your instructor can assign these problems as homework, a quiz, or a test in [MyEconLab](#).

TABLE 1

| Price (dollars per box) | Quantity demanded | Quantity supplied |
|-------------------------------|----------------------|----------------------|
| | (boxes per week) | |
| 13.00 | 1,600 | 1,200 |
| 14.00 | 1,500 | 1,300 |
| 15.00 | 1,400 | 1,400 |
| 16.00 | 1,300 | 1,500 |
| 17.00 | 1,200 | 1,600 |
| 18.00 | 1,100 | 1,700 |

MyEconLab

You can work this quiz in Chapter 4 Study Plan and get instant feedback.

Multiple Choice Quiz

- Which of the following events illustrates the law of demand: Other things remaining the same, a rise in the price of a good will _____.
 - decrease the quantity demanded of that good
 - increase the demand for a substitute of that good
 - decrease the demand for the good
 - increase the demand for a complement of that good
- In the market for jeans, which of the following events increases the demand for a pair of jeans?
 - rise in the wage rate paid to garment workers
 - rise in the price of a denim skirt (a substitute for jeans)
 - fall in the price of denim cloth
 - new technology, which reduces the time it takes to make a pair of jeans
- Other things remaining the same, a fall in the price of peanuts will _____.
 - increase the supply of peanuts
 - decrease the supply of peanut butter
 - decrease the quantity supplied of peanuts
 - decrease the supply of peanuts
- In the market for cell phones, which of the following events increases the supply of cell phones?
 - New technology lowers the cost of making a cell phone
 - Rise in the price of an e-book reader (a substitute in production)
 - An increase in people's incomes
 - A rise in the wage rate paid to electronics workers
- When floods wiped out the banana crop in Central America, the equilibrium price of bananas _____ and the equilibrium quantity of bananas _____.
 - rose; increased
 - rose; decreased
 - fell; increased
 - fell; decreased
- A decrease in the demand for chocolate with no change in the supply of chocolate will create a _____ of chocolate at today's price, but gradually the price will _____.
 - surplus; fall
 - shortage; fall
 - surplus; rise
 - shortage; rise
- Many Americans are selling their used cars and buying new fuel-efficient hybrids. Other things remaining the same, in the market for used cars, _____ and in the market for hybrids _____.
 - supply increases and the price falls; demand increases and the price rises
 - demand decreases and the price rises; supply increases and the price falls
 - both demand and supply decrease and the price might rise, fall, or not change; demand increases and the price rises
 - demand decreases, supply increases, and the price falls; supply increases and the price falls



What do you do when the price of gasoline rises?

Elasticities of Demand and Supply



CHAPTER CHECKLIST

When you have completed your study of this chapter, you will be able to

- 1 Define the price elasticity of demand, and explain the factors that influence it and how to calculate it.
- 2 Define the price elasticity of supply, and explain the factors that influence it and how to calculate it.
- 3 Define the cross elasticity of demand and the income elasticity of demand, and explain the factors that influence them.

5.1 THE PRICE ELASTICITY OF DEMAND

A decrease in supply of gasoline brings a large rise in its price and a small decrease in the quantity that people buy. The reason is that buying plans for gasoline are not very responsive to a change in price. But an increase in the supply of airline services brings a small decrease in its price and a large increase in the quantity of air travel. In the case of air travel, buying plans are highly sensitive to a change in price. By knowing how sensitive or responsive buying plans are to price changes, we can predict how a given change in supply will change price and quantity.

But we often want to go further and predict by how much a price will change when an event occurs. To make more precise predictions about the magnitudes of price and quantity changes, we need to know more about a demand curve than the fact that it slopes downward. We need to know how responsive the quantity demanded is to a price change. Elasticity provides this information.

The **price elasticity of demand** is a measure of the responsiveness of the quantity demanded of a good* to a change in its price when all other influences on buyers' plans remain the same.

To determine the price elasticity of demand, we compare the percentage change in the quantity demanded with the percentage change in price. But we calculate percentage changes in a special way.

Price elasticity of demand

A measure of the responsiveness of the quantity demanded of a good to a change in its price when all other influences on buyers' plans remain the same.

■ Percentage Change in Price

Suppose that Starbucks raises the price of a latte from \$3 to \$5 a cup. What is the percentage change in price? The change in price is the new price minus the initial price. The percentage change is calculated as the change in price divided by the initial price, all multiplied by 100. The formula for the percentage change is

$$\text{Percentage change in price} = \left(\frac{\text{New price} - \text{Initial price}}{\text{Initial price}} \right) \times 100.$$

In this example, the initial price is \$3 and the new price is \$5, so

$$\text{Percentage change in price} = \left(\frac{\$5 - \$3}{\$3} \right) \times 100 = \left(\frac{\$2}{\$3} \right) \times 100 = 66.67 \text{ percent.}$$

Now suppose that Starbucks cuts the price of a latte from \$5 to \$3 a cup. Now what is the percentage change in price? The initial price is now \$5 and the new price is \$3, so the percentage change in price is calculated as

$$\text{Percentage change in price} = \left(\frac{\$3 - \$5}{\$5} \right) \times 100 = \left(\frac{-\$2}{\$5} \right) \times 100 = -40 \text{ percent.}$$

The same price change, \$2, over the same interval, \$3 to \$5, is a different percentage change (different absolute value or magnitude) depending on whether the price rises or falls.

Because elasticity compares the percentage change in the quantity demanded with the percentage change in price, we need a measure of percentage change that does not depend on the direction of the price change. The measure that economists use is called the *midpoint method*.

*What you learn in this chapter also applies to services and factors of production.

The Midpoint Method

To calculate the percentage change in price using the midpoint method, we divide the change in the price by the *average price*—the *average* of the new price and the initial price—and then multiply by 100. The average price is at the midpoint between the initial and the new price, hence the name *midpoint method*.

The formula for the percentage change using the midpoint method is

$$\text{Percentage change in price} = \left(\frac{\text{New price} - \text{Initial price}}{(\text{New price} + \text{Initial price}) \div 2} \right) \times 100.$$

In this formula, the numerator, (New price – Initial price), is the same as before. The denominator, (New price + Initial price) ÷ 2, is the average of the new price and the initial price.

To calculate the percentage change in the price of a Starbucks latte using the midpoint method, put \$5 for new price and \$3 for initial price in the formula:

$$\begin{aligned} \text{Percentage change in price} &= \left(\frac{\$5 - \$3}{(\$5 + \$3) \div 2} \right) \times 100 = \left(\frac{\$2}{\$8 \div 2} \right) \times 100 \\ &= \left(\frac{\$2}{\$4} \right) \times 100 = 50 \text{ percent.} \end{aligned}$$

Because the average price is the same regardless of whether the price rises or falls, the percentage change in price calculated by the midpoint method is the same (absolute value or magnitude) for a price rise and a price fall. In this example, it is 50 percent.

■ Percentage Change in Quantity Demanded

Suppose that when the price of a latte rises from \$3 to \$5 a cup, the quantity demanded decreases from 15 cups to 5 cups an hour. The percentage change in the quantity demanded using the midpoint method is

$$\begin{aligned} \text{Percentage change in quantity} &= \left(\frac{\text{New quantity} - \text{Initial quantity}}{(\text{New quantity} + \text{Initial quantity}) \div 2} \right) \times 100 \\ &= \left(\frac{5 - 15}{(5 + 15) \div 2} \right) \times 100 = \left(\frac{-10}{20 \div 2} \right) \times 100 \\ &= \left(\frac{-10}{10} \right) \times 100 = -100 \text{ percent.} \end{aligned}$$

When the price of a good *rises*, the quantity demanded of it *decreases*—a *positive* change in price brings a *negative* change in the quantity demanded. Similarly, when the price of a good *falls*, the quantity demanded of it *increases*—this time a *negative* change in price brings a *positive* change in the quantity demanded.

To compare the percentage change in the price and the percentage change in the quantity demanded, we use the absolute values or magnitudes of the percentage changes and we ignore the minus sign.

■ Elastic and Inelastic Demand

To determine the responsiveness of the quantity of Starbucks latte demanded to its price, we need to compare the two percentage changes we've just calculated. The percentage change in quantity is 100 and the percentage change in price is 50, so the percentage change in quantity demanded is twice the percentage change in price. If we collected data on the prices and quantities of a number of goods and services (and we were careful to check that other things had remained the same), we could calculate lots of percentage changes. Our calculations would fall into three groups: The percentage change in the quantity demanded might exceed the percentage change in price, equal the percentage change in price, or be less than the percentage change in price. Which of these three possibilities arises depends on the elasticity of demand:

Elastic demand

When the percentage change in the quantity demanded exceeds the percentage change in price.

Unit elastic demand

When the percentage change in the quantity demanded equals the percentage change in price.

Inelastic demand

When the percentage change in the quantity demanded is less than the percentage change in price.

Perfectly elastic demand

When the quantity demanded changes by a very large percentage in response to an almost zero percentage change in price.

Perfectly inelastic demand

When the percentage change in the quantity demanded is zero for any percentage change in the price.

- When the percentage change in the quantity demanded exceeds the percentage change in price, demand is **elastic**.
- When the percentage change in the quantity demanded equals the percentage change in price, demand is **unit elastic**.
- When the percentage change in the quantity demanded is less than the percentage change in price, demand is **inelastic**.

Figure 5.1 shows the different types of demand curves that illustrate the range of possible price elasticities of demand. Part (a) shows an extreme case of an elastic demand called a **perfectly elastic demand**—an almost zero percentage change in the price brings a very large percentage change in the quantity demanded. Consumers are willing to buy any quantity of the good at a given price but none at a higher price. Part (b) shows an elastic demand—the percentage change in the quantity demanded exceeds the percentage change in price. Part (c) shows a unit elastic demand—the percentage change in the quantity demanded equals the percentage change in price. Part (d) shows an inelastic demand—the percentage change in the quantity demanded is less than the percentage change in price. Finally, part (e) shows an extreme case of an inelastic demand called a **perfectly inelastic demand**—the percentage change in the quantity demanded is zero for any percentage change in price.

■ Influences on the Price Elasticity of Demand

What makes the demand for some things elastic and the demand for others inelastic? The influences on the price elasticity of demand fall into two groups:

- Availability of substitutes
- Proportion of income spent

Availability of Substitutes

The demand for a good is elastic if a substitute for it is easy to find. Soft drink containers can be made of either aluminum or plastic and it doesn't matter which, so the demand for aluminum is elastic.

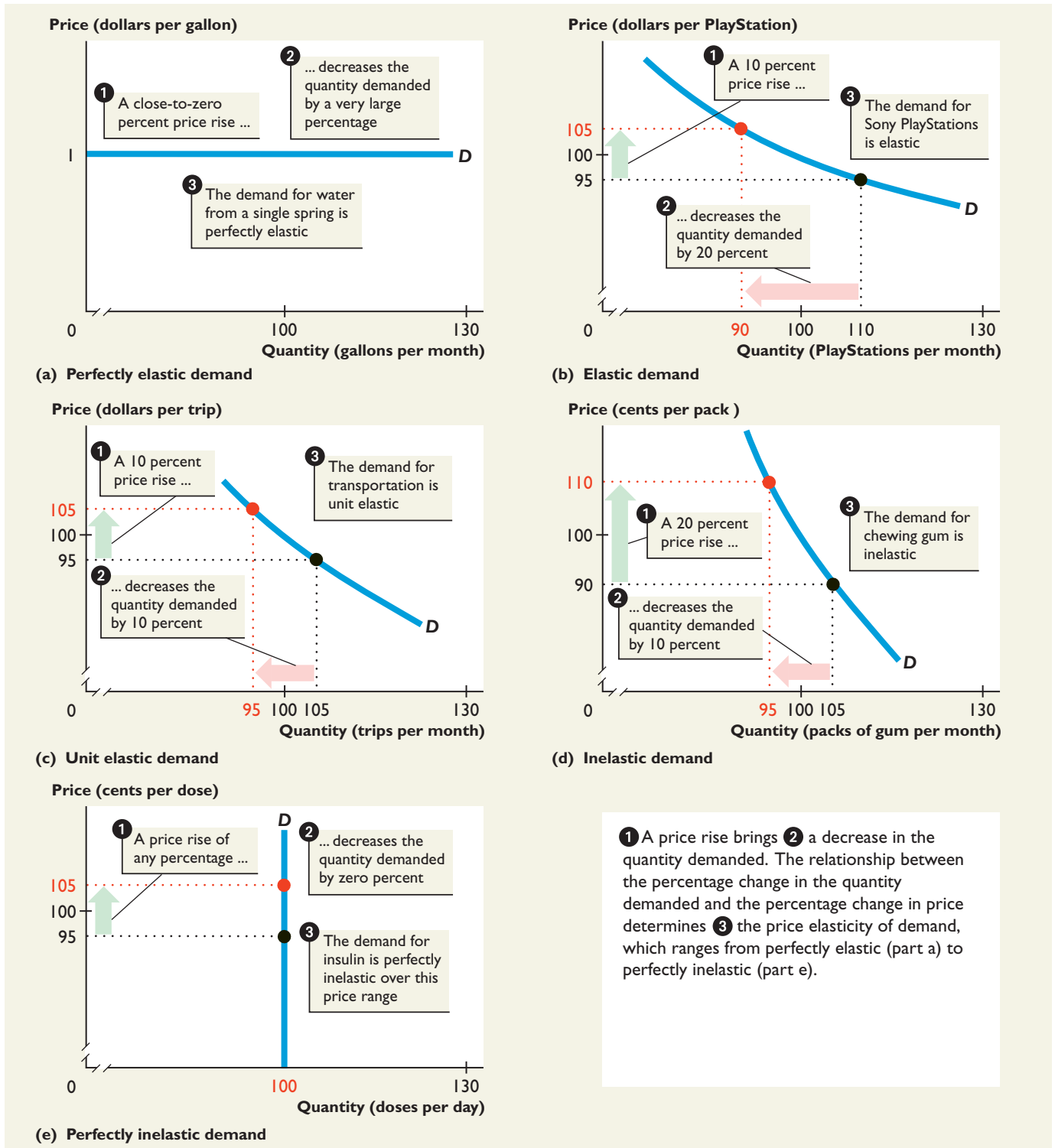
The demand for a good is inelastic if a substitute for it is hard to find. Oil has poor substitutes (imagine a coal-fueled car), so the demand for oil is inelastic.

Three main factors influence the ability to find a substitute for a good: whether the good is a luxury or a necessity, how narrowly it is defined, and the amount of time available to find a substitute for it.

FIGURE 5.1

The Range of Price Elasticities of Demand

MyEconLab Animation



Luxury Versus Necessity We call goods such as food and housing *necessities* and goods such as exotic vacations *luxuries*. A necessity has poor substitutes—you must eat—so the demand for a necessity is inelastic. A luxury has many substitutes—you don’t absolutely have to go to the Galapagos Islands this summer—so the demand for a luxury is elastic.

Narrowness of Definition The demand for a narrowly defined good is elastic. For example, the demand for a Starbucks latte is elastic because a New World latte is a good substitute for it. The demand for a broadly defined good is inelastic. For example, the demand for coffee is inelastic because tea is a poor substitute for it.

Time Elapsed Since Price Change The longer the time that has elapsed since the price of a good changed, the more elastic is the demand for the good. For example, when the price of gasoline increased steeply during the 1970s and 1980s, the quantity of gasoline demanded didn’t change much because many people owned gas-guzzling automobiles—the demand for gasoline was inelastic. But eventually, fuel-efficient cars replaced gas guzzlers and the quantity of gasoline demanded decreased—the demand for gasoline became more elastic.

Proportion of Income Spent

A price rise, like a decrease in income, means that people cannot afford to buy the same quantities of goods and services as before. The greater the proportion of income spent on a good, the greater is the impact of a rise in its price on the quantity of that good that people can afford to buy and the more elastic is the demand for the good. For example, toothpaste takes a tiny proportion of your budget and housing takes a large proportion. If the price of toothpaste doubles, you buy almost as much toothpaste as before. Your demand for toothpaste is inelastic. If your apartment rent doubles, you shriek and look for more roommates. Your demand for housing is more elastic than is your demand for toothpaste.

■ Computing the Price Elasticity of Demand

To determine whether the demand for a good is elastic, unit elastic, or inelastic, we compute a numerical value for the price elasticity of demand by using the following formula:

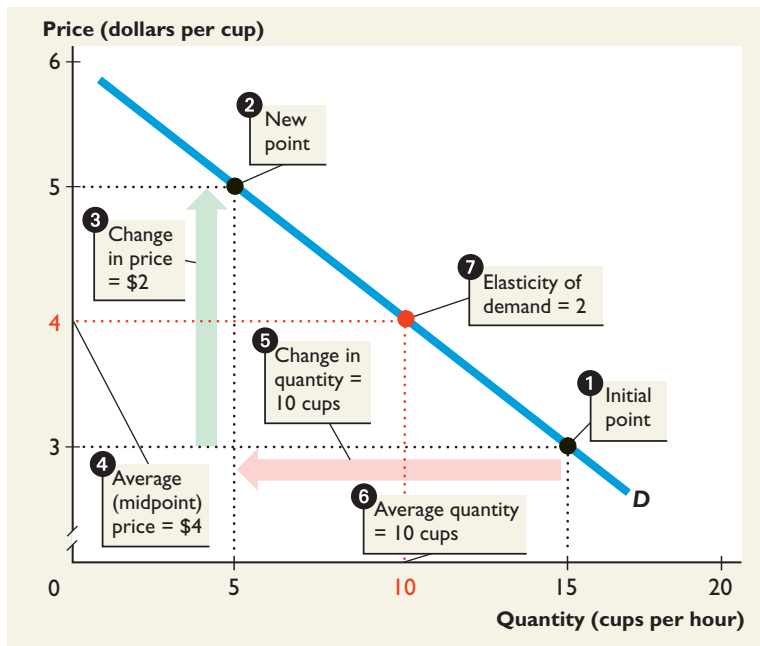
$$\text{Price elasticity of demand} = \frac{\text{Percentage change in quantity demanded}}{\text{Percentage change in price}}$$

- If the price elasticity of demand is greater than 1, demand is elastic.
- If the price elasticity of demand equals 1, demand is unit elastic.
- If the price elasticity of demand is less than 1, demand is inelastic.

Figure 5.2 illustrates and summarizes the calculation for the Starbucks latte example. Initially, the price is \$3 a cup and 15 cups an hour are demanded—the initial point in the figure. Then the price rises to \$5 a cup and the quantity demanded decreases to 5 cups an hour—the new point in the figure. The price rises by \$2 a cup and the average (midpoint) price is \$4 a cup, so the percentage change in price is 50. The quantity demanded decreases by 10 cups an hour and the average (midpoint) quantity is 10 cups an hour, so the percentage change in quantity demanded is 100.

FIGURE 5.2
Price Elasticity of Demand Calculation

MyEconLab Animation



- 1 At the initial point, the price is \$3 a cup and the quantity demanded is 15 cups an hour.
- 2 At the new point, the price is \$5 a cup and the quantity demanded is 5 cups an hour.
- 3 The change in price is \$2 and
- 4 the average price is \$4, so the percentage change in price equals $(\$2 \div \$4) \times 100$, which is 50 percent.
- 5 The change in the quantity demanded is 10 cups and
- 6 the average quantity demanded is 10 cups, so the percentage change in quantity demanded equals $(10 \text{ cups} \div 10 \text{ cups}) \times 100$, which is 100 percent.
- 7 The price elasticity of demand equals $100 \text{ percent} \div 50 \text{ percent}$, which is 2.

Using the above formula, you can see that the price elasticity of demand for a Starbucks latte is

$$\text{Price elasticity of demand} = \frac{100 \text{ percent}}{50 \text{ percent}} = 2.$$

The price elasticity of demand is 2 at the midpoint between the initial price and the new price on the demand curve. Over this price range, the demand for a Starbucks latte is elastic.

■ Interpreting the Price Elasticity of Demand Number

The number we've just calculated for a Starbucks latte is only an example. We don't have real data on the price and quantity. But suppose we did have real data and we discovered that the price elasticity of demand for a Starbucks latte is 2. What does this number tell us?

It tells us three main things:

1. The demand for Starbucks latte is elastic. Being elastic, the good has plenty of convenient substitutes (such as other brands of latte) and takes only a small proportion of buyers' incomes.
2. Starbucks must be careful not to charge too high a price for its latte. Pushing the price up brings in more revenue per cup but wipes out a lot of potential business.
3. The flip side of the second point: Even a slightly lower price could create a lot of potential business and end up bringing in more revenue.

■ Elasticity Along a Linear Demand Curve

Slope measures responsiveness. But elasticity is *not* the same as *slope*. You can see the distinction most clearly by looking at the price elasticity of demand along a linear (straight-line) demand curve. The slope is constant, but the elasticity varies. Figure 5.3 shows the same demand curve for a Starbucks latte as that in Figure 5.2 but with the axes extended to show lower prices and larger quantities demanded.

Let's calculate the elasticity of demand at point A. If the price rises from \$3 to \$5 a cup, the quantity demanded decreases from 15 to 5 cups an hour. The average price is \$4 a cup, and the average quantity is 10 cups—point A. The elasticity of demand at point A is 2, and demand is elastic.

Let's calculate the elasticity of demand at point C. If the price falls from \$3 to \$1 a cup, the quantity demanded increases from 15 to 25 cups an hour. The average price is \$2 a cup, and the average quantity is 20 cups—point C. The elasticity of demand at point C is 0.5, and demand is inelastic.

Finally, let's calculate the elasticity of demand at point B, which is the midpoint of the demand curve. If the price rises from \$2 to \$4 a cup, the quantity demanded decreases from 20 to 10 cups an hour. The average price is \$3 a cup, and the average quantity is 15 cups—point B. The elasticity of demand at point B is 1, and demand is unit elastic.

Along a linear demand curve,

- Demand is unit elastic at the midpoint of the curve.
- Demand is elastic at all points above the midpoint of the curve.
- Demand is inelastic at all points below the midpoint of the curve.

FIGURE 5.3

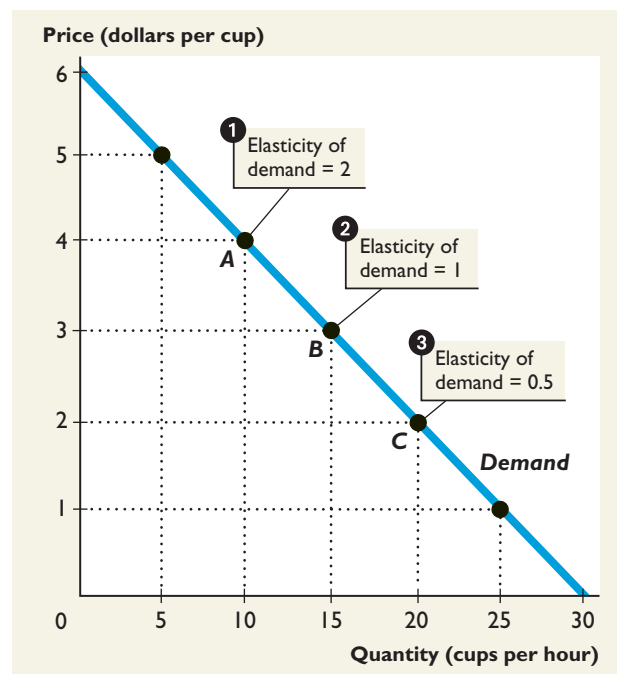
Elasticity Along a Linear Demand Curve

MyEconLab Animation

On a linear demand curve, the slope is constant but the elasticity decreases as the price falls and the quantity demanded increases.

- 1 At point A, demand is elastic.
- 2 At point B, which is the midpoint of the demand curve, demand is unit elastic.
- 3 At point C, demand is inelastic.

Demand is elastic at all points above the midpoint of the demand curve and inelastic at all points below the midpoint of the demand curve.





EYE on the GLOBAL ECONOMY

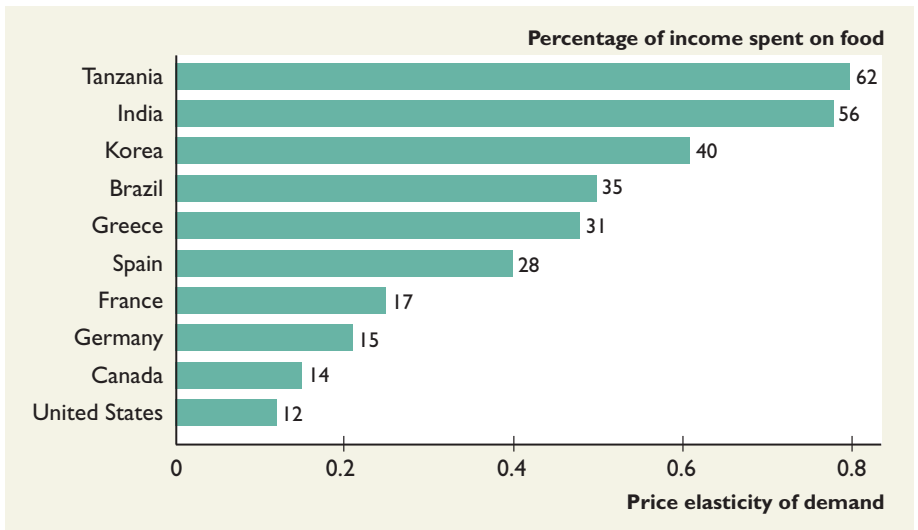
Price Elasticities of Demand

A rich American student is casual about her food. It costs only a few dollars a day, and she's going to have her burger, even at double the price. But a poor Tanzanian boy takes his food with deadly seriousness. He has a tough time getting, preparing, and even defending his food. A rise in the price of food means that he must cut back and eat even less.

The figure shows the percentage of income spent on food and the price elasticity of demand for food in ten countries. The larger the proportion of income spent on food, the larger is the price elasticity of demand for food.

As the low-income countries become richer, the proportion of income they spend on food will decrease and their demand for food will become more inelastic. Consequently, the world's demand for food will become more inelastic.

Harvests fluctuate and bring fluctuations in the price of food. And as the world demand for food becomes



more and more inelastic, the fluctuations in the prices of food items will become larger.

The table shows a few real-world price elasticities of demand. The numbers in the table range from 1.52 for metals to 0.12 for food. Metals have good substitutes, such as plastics, while food has virtually no substitutes. As we move down the list of items, they have

fewer good substitutes and are more likely to be regarded as necessities.

Some Price Elasticities of Demand

| Good or Service | Elasticity |
|----------------------------------|------------|
| Elastic Demand | |
| Metals | 1.52 |
| Electrical engineering products | 1.39 |
| Mechanical engineering products | 1.30 |
| Furniture | 1.26 |
| Motor vehicles | 1.14 |
| Instrument engineering products | 1.10 |
| Professional services | 1.09 |
| Transportation services | 1.03 |
| Inelastic Demand | |
| Gas, electricity, and water | 0.92 |
| Oil | 0.91 |
| Chemicals | 0.89 |
| Beverages (all types) | 0.78 |
| Clothing | 0.64 |
| Tobacco | 0.61 |
| Banking and insurance services | 0.56 |
| Housing services | 0.55 |
| Agricultural and fish products | 0.42 |
| Books, magazines, and newspapers | 0.34 |
| Food | 0.12 |

SOURCES OF DATA: See page C1.



Total revenue

The amount spent on a good and received by its seller and equals the price of the good multiplied by the quantity sold.

■ Total Revenue and the Price Elasticity of Demand

Total revenue is the amount spent on a good and received by its sellers and equals the price of the good multiplied by the quantity of the good sold. For example, suppose that the price of a Starbucks latte is \$3 and that 15 cups an hour are sold. Then total revenue is \$3 a cup multiplied by 15 cups an hour, which equals \$45 an hour.

We can use the demand curve for Starbucks latte to illustrate total revenue. Figure 5.4(a) shows the total revenue from the sale of latte when the price is \$3 a cup and the quantity of latte demanded is 15 cups an hour. Total revenue is shown by the blue rectangle, the area of which equals \$3, its height, multiplied by 15, its length, which equals \$45.

When the price changes, total revenue can change in the same direction, the opposite direction, or remain constant. Which of these outcomes occurs depends on the price elasticity of demand. By observing the change in total revenue that results from a price change (with all other influences on the quantity remaining

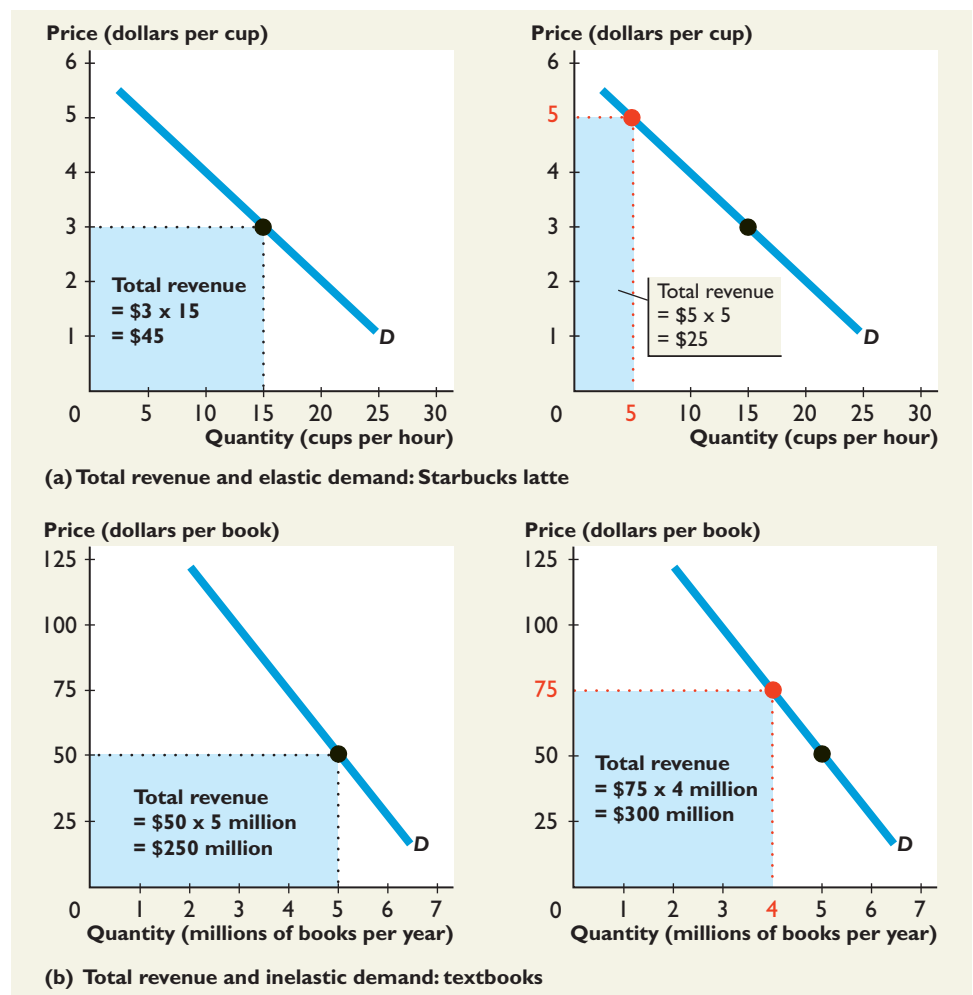
■ **FIGURE 5.4**

Total Revenue and the Price Elasticity of Demand

MyEconLab Animation

Total revenue equals price multiplied by quantity. In part (a), when the price is \$3 a cup, the quantity demanded is 15 cups an hour and total revenue equals \$45 an hour. When the price rises to \$5 a cup, the quantity demanded decreases to 5 cups an hour and total revenue decreases to \$25 an hour. Demand is elastic.

In part (b), when the price is \$50 a book, the quantity demanded is 5 million books a year and total revenue equals \$250 million a year. When the price rises to \$75 a book, the quantity demanded decreases to 4 million books a year and total revenue increases to \$300 million a year. Demand is inelastic.



unchanged), we can estimate the price elasticity of demand. This method of estimating the price elasticity of demand is called the **total revenue test**.

If demand is elastic, a given percentage rise in price brings a larger percentage decrease in the quantity demanded, so total revenue—price multiplied by quantity—decreases. Figure 5.4(a) shows this outcome. When the price of a latte is \$3, the quantity demanded is 15 cups an hour and total revenue is \$45 ($\3×15). If the price of a latte rises to \$5, the quantity demanded decreases to 5 cups an hour and total revenue *decreases* to \$25 ($\5×5).

If demand is inelastic, a given percentage rise in price brings a smaller percentage decrease in the quantity demanded, so total revenue increases. Figure 5.4(b) shows this outcome. When the price of a textbook is \$50, the quantity demanded is 5 million textbooks a year and total revenue is \$250 million ($\50×5 million). If the price of a textbook rises to \$75, the quantity demanded decreases to 4 million textbooks a year and total revenue *increases* to \$300 million ($\75×4 million).

The relationship between the price elasticity of demand and total revenue is

- If price and total revenue change in opposite directions, demand is elastic.
- If a price change leaves total revenue unchanged, demand is unit elastic.
- If price and total revenue change in the same direction, demand is inelastic.

Total revenue test

A method of estimating the price elasticity of demand by observing the change in total revenue that results from a price change (with all other influences on the quantity sold remaining unchanged).



EYE on the PRICE OF GAS

What Do You Do When the Price of Gasoline Rises?

If you are like most people, you complain when the price of gasoline rises, but you don't cut back very much on your gas purchases.

University of London economists Phil Goodwin, Joyce Dargay, and Mark Hanly studied the effects of a hike in the price of gasoline on the quantity of gasoline demanded and on the volume of road traffic.

By using data for the United States and a large number of other countries, they estimated that a 10 percent rise in the price of gasoline decreases the quantity of gasoline used by 2.5 percent within one year and by 6 percent after five years.

Price Elasticity of Demand

We can translate these numbers into price elasticities of demand for gasoline.

The short-run (up to one year) price elasticity of demand is 2.5 percent divided by 10 percent, which equals 0.25. The long-run (after five years) price elasticity of demand is 6 percent divided by 10 percent, which equals 0.6. Because these price elasticities are less than one, the demand for gasoline is inelastic.

When the price of gasoline rises, the quantity of gasoline demanded decreases but the amount spent on gasoline increases.

The effect of a rise in the price of gasoline on the volume of traffic is smaller than on the quantity of gasoline used.

A 10-percent rise in the price of gasoline decreases the volume of traffic by only 1 percent within one year and by 3 percent after five years.

How can the volume of traffic fall by less than the quantity of gasoline used? The answer is by switching to smaller, more fuel-efficient vehicles.

The price elasticity of demand for gasoline is low—the demand for gasoline is inelastic—because gasoline has poor substitutes, but it does have a substitute—a smaller vehicle.

■ Applications of the Price Elasticity of Demand

Does a frost in Florida bring a massive or a modest rise in the price of oranges? And does a smaller orange crop mean bad news or good news for orange growers? Knowledge of the price elasticity of demand for oranges enables us to answer these questions.

Orange Prices and Total Revenue

Economists have estimated the price elasticity of demand for agricultural products to be about 0.4—an inelastic demand. If this number applies to the demand for oranges, then

$$\text{Price elasticity of demand} = 0.4 = \frac{\text{Percentage change in quantity demanded}}{\text{Percentage change in price}}$$

If supply changes and demand doesn't, the percentage change in the quantity demanded equals the percentage change in the equilibrium quantity. So if a frost in Florida decreases the orange harvest and decreases the equilibrium quantity of oranges by 1 percent, the price of oranges will rise by 2.5 percent. The percentage change in the quantity demanded (1 percent) divided by the percentage change in price (2.5 percent) equals the price elasticity of demand (0.4).

So the answer to the first question is that when the frost strikes, the price of oranges will rise by a larger percentage than the percentage decrease in the quantity of oranges. But what happens to the total revenue of the orange growers?

The answer is again provided by knowledge of the price elasticity of demand. Because the price rises by a larger percentage than the percentage decrease in quantity, total revenue increases. A frost is bad news for consumers and those growers who lose their crops, but good news for growers who escape the frost.



A Florida frost is bad news for buyers of orange juice and for growers who lose their crops, but good news for growers who escape the frost.



Cracking down on imports of illegal drugs limits supply, which leads to a large price increase. But it also increases the expenditure on drugs by addicts and increases the amount of crime that finances addiction.

Addiction and Elasticity

We can gain important insights that might help to design potentially effective policies for dealing with addiction to drugs, whether legal (such as tobacco and alcohol) or illegal (such as crack cocaine or heroin). Nonusers' demand for addictive substances is elastic. A moderately higher price leads to a substantially smaller number of people trying a drug and so exposing themselves to the possibility of becoming addicted to it. But the existing users' demand for addictive substances is inelastic. Even a substantial price rise brings only a modest decrease in the quantity demanded.

These facts about the price elasticity of demand mean that high taxes on cigarettes and alcohol limit the number of young people who become habitual users of these products, but high taxes have only a modest effect on the quantities consumed by established users.

Similarly, effective policing of imports of an illegal drug that limits its supply leads to a large price rise and a substantial decrease in the number of new users but only a small decrease in the quantity consumed by addicts. Expenditure on the drug by addicts increases. Further, because many drug addicts finance their purchases with crime, the amount of theft and burglary increases.

Because the price elasticity of demand for drugs is low for addicts, any successful policy to decrease drug use will be one that focuses on the demand for drugs and attempts to change preferences through rehabilitation programs.

CHECKPOINT 5.1

Define the price elasticity of demand, and explain the factors that influence it and how to calculate it.

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You can work these problems in Study Plan 5.1 and get instant feedback.

Practice Problems

When the price of a good increased by 10 percent, the quantity demanded of it decreased by 2 percent.

1. Is the demand for this good elastic, unit elastic, or inelastic?
2. Does this good have close substitutes or poor substitutes? Is this good more likely to be a necessity or a luxury and to be narrowly or broadly defined? Why?
3. Calculate the price elasticity of demand for this good; explain how the total revenue from the sale of the good has changed; and explain which of the following goods this good is most likely to be: orange juice, bread, toothpaste, theater tickets, clothing, blue jeans, or Super Bowl tickets.

In the News

Music giant chops price to combat downloads

In 2003, when music downloading first took off, Universal Music slashed the price of a CD from \$21 to \$15. The company said that it expected the price cut to boost the quantity of CDs sold by 30 percent, other things remaining the same.

Source: *Globe and Mail*, September 4, 2003

What was Universal Music's estimate of the price elasticity of demand for CDs? Was the demand estimated to be elastic or inelastic?

Solutions to Practice Problems

1. The demand for a good is *inelastic* if the percentage decrease in the quantity demanded is less than the percentage increase in its price. In this example, a 10 percent price rise brings a 2 percent decrease in the quantity demanded, so demand is inelastic.
2. Because the good has an inelastic demand, it most likely has poor substitutes, is a necessity rather than a luxury, and is broadly defined.
3. Price elasticity of demand = Percentage change in the quantity demanded ÷ Percentage change in price. In this example, the price elasticity of demand is 2 percent divided by 10 percent, or 0.2. An elasticity less than 1 means that demand is inelastic. When demand is inelastic, a price rise increases total revenue. This good is most likely a necessity (bread), or has poor substitutes (toothpaste), or is broadly defined (clothing).

Solution to In the News

Price elasticity of demand = Percentage change in the quantity demanded ÷ Percentage change in price. The percentage change in the price equals $[(\$21 - \$15)/(\$21)] \times 100$, which is 28.6 percent. The percentage change in the quantity is 30 percent. So Universal Music's estimate of the price elasticity of demand for CDs was 30 percent ÷ 28.6 percent, or 1.05. Because the percentage change in the quantity is greater than the percentage change in the price, demand is estimated to be elastic, which is what an elasticity of 1.05 means.

5.2 THE PRICE ELASTICITY OF SUPPLY

You know that when demand increases, the equilibrium price rises and the equilibrium quantity increases. But does the price rise by a large amount and the quantity increase by a little? Or does the price barely rise and the quantity increase by a large amount? To answer this question, we need to know the price elasticity of supply.

Price elasticity of supply

A measure of the responsiveness of the quantity supplied of a good to a change in its price when all other influences on sellers' plans remain the same.

The **price elasticity of supply** is a measure of the responsiveness of the quantity supplied of a good to a change in its price when all other influences on sellers' plans remain the same. We determine the price elasticity of supply by comparing the percentage change in the quantity supplied with the percentage change in price.

■ Elastic and Inelastic Supply

The supply of a good might be

- Elastic
- Unit elastic
- Inelastic

Perfectly elastic supply

When the quantity supplied changes by a very large percentage in response to an almost zero percentage change in price.

Figure 5.5 illustrates the range of supply elasticities. Figure 5.5(a) shows the extreme case of a **perfectly elastic supply**—an almost zero percentage change in price brings a very large percentage change in the quantity supplied. Figure 5.5 (b) shows an **elastic supply**—the percentage change in the quantity supplied exceeds the percentage change in price. Figure 5.5(c) shows a **unit elastic supply**—the percentage change in the quantity supplied equals the percentage change in price. Figure 5.5(d) shows an **inelastic supply**—the percentage change in the quantity supplied is less than the percentage change in price. And Figure 5.5(e) shows the extreme case of a **perfectly inelastic supply**—the percentage change in the quantity supplied is zero when the price changes.

Elastic supply

When the percentage change in the quantity supplied exceeds the percentage change in price.

Unit elastic supply

When the percentage change in the quantity supplied equals the percentage change in price.

Inelastic supply

When the percentage change in the quantity supplied is less than the percentage change in price.

Perfectly inelastic supply

When the percentage change in the quantity supplied is zero for any percentage change in the price.

■ Influences on the Price Elasticity of Supply

What makes the supply of some things elastic and the supply of others inelastic? The two main influences on the price elasticity of supply are

- Production possibilities
- Storage possibilities

Production Possibilities

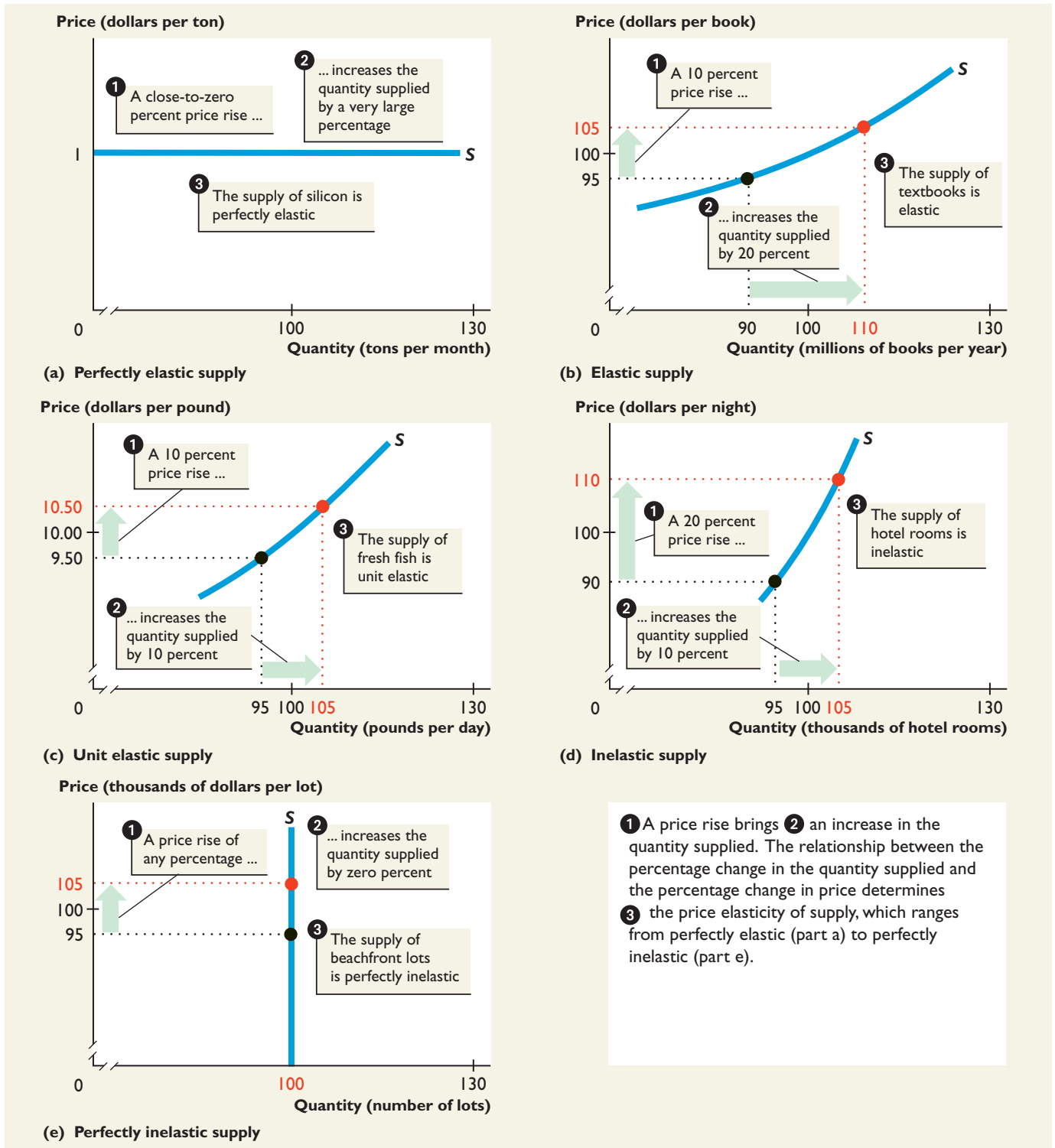
Some goods can be produced at a constant (or very gently rising) opportunity cost. These goods have an elastic supply. The silicon in your computer chips is an example of such a good. Silicon is extracted from sand at a tiny and almost constant opportunity cost, so the supply of silicon is perfectly elastic.

Some goods can be produced in only a fixed quantity. These goods have a perfectly inelastic supply. A beachfront home in Malibu can be built only on a unique beachfront lot, so the supply of these homes is perfectly inelastic.

Hotel rooms in New York City can't easily be used as office accommodation and office space cannot easily be converted into hotel rooms, so the supply of hotel rooms in New York City is inelastic. Paper and printing presses can be used to produce textbooks or magazines, and the supplies of these goods are elastic.

FIGURE 5.5
The Range of Price Elasticities of Supply

MyEconLab Animation



Time Elapsed Since Price Change As time passes after a price change, it becomes easier to change production plans and supply becomes more elastic. For some items—fruits and vegetables are examples—it is difficult or perhaps impossible to change the quantity supplied immediately after a price change. These goods have a perfectly inelastic supply on the day of a price change. The quantities supplied depend on crop-planting decisions that were made earlier. In the case of oranges, for example, planting decisions have to be made many years in advance of the crop being available.

Many manufactured goods also have an inelastic supply if production plans have had only a short period in which to change. For example, before it launched the Wii in November 2006, Nintendo made a forecast of demand, set a price, and drew up a production plan to supply the United States with the quantity that it believed people would be willing to buy. It turned out that demand outstripped Nintendo's earlier forecast. The price of the Wii increased on eBay, an Internet auction market, to bring market equilibrium. At the high price that emerged, Nintendo would have liked to ship more units of Wii, but it could do nothing to increase the quantity supplied in the near term. The supply of the Wii was inelastic.

As time passes, the elasticity of supply increases. After all the technologically possible ways of adjusting production have been exploited, supply is extremely elastic—perhaps perfectly elastic—for most manufactured items. In 2007, Nintendo was able to step up the production rate of the Wii and the price on eBay began to fall. The supply of Wii had become more elastic as production continued to expand.

Storage Possibilities



Fresh strawberries must be sold before they deteriorate, so their supply is inelastic.

The elasticity of supply of a good that cannot be stored (for example, a perishable item such as fresh strawberries) depends only on production possibilities. But the elasticity of supply of a good that can be stored depends on the decision to keep the good in storage or offer it for sale. A small price change can make a big difference to this decision, so the supply of a storable good is highly elastic. The cost of storage is the main influence on the elasticity of supply of a storable good. For example, rose growers in Colombia, anticipating a surge in demand on Valentine's Day in February, hold back supplies in late January and early February and increase their inventories of roses. They then release roses from inventory for Valentine's Day.

■ Computing the Price Elasticity of Supply

To determine whether the supply of a good is elastic, unit elastic, or inelastic, we compute a numerical value for the price elasticity of supply in a way similar to that used to calculate the price elasticity of demand. We use the formula:

$$\text{Price elasticity of supply} = \frac{\text{Percentage change in quantity supplied}}{\text{Percentage change in price}}.$$

- If the price elasticity of supply is greater than 1, supply is elastic.
- If the price elasticity of supply equals 1, supply is unit elastic.
- If the price elasticity of supply is less than 1, supply is inelastic.

Let's calculate the price elasticity of supply of roses. Suppose that in a normal month, the price of roses is \$40 a bouquet and 6 million bouquets are supplied. And suppose that in February, the price rises to \$80 a bouquet and the quantity supplied increases to 24 million bouquets. Figure 5.6 illustrates the supply of roses and summarizes the calculation. The figure shows the initial point at \$40 a bouquet and the new point at \$80 a bouquet. The price increases by \$40 a bouquet and the average, or midpoint, price is \$60 a bouquet, so the percentage change in the price is 66.67 percent. The quantity supplied increases by 18 million bouquets and the average, or midpoint, quantity is 15 million bouquets, so the percentage change in the quantity supplied is 120 percent.

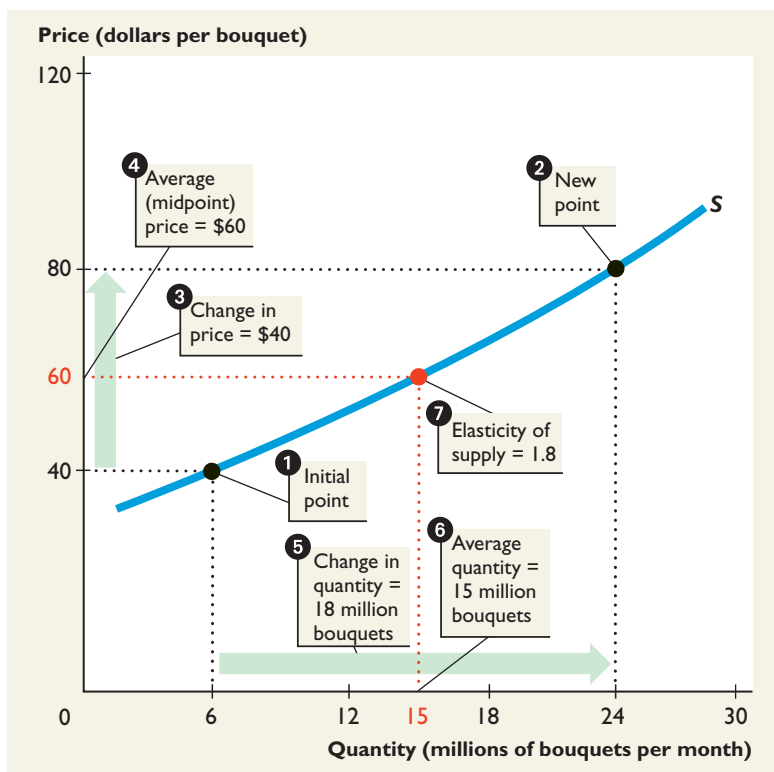
Using the above formula, you can see that the price elasticity of supply of roses is

$$\text{Price elasticity of supply} = \frac{120 \text{ percent}}{66.67 \text{ percent}} = 1.8.$$

The price elasticity of supply is 1.8 at the midpoint between the initial point and the new point on the supply curve. In this example, over this price range, the supply of roses is elastic.

FIGURE 5.6
Price Elasticity of Supply Calculation

MyEconLab Animation



- 1 At the initial point, the price is \$40 a bouquet and the quantity supplied is 6 million bouquets a month.
- 2 At the new point, the price is \$80 a bouquet and the quantity supplied is 24 million bouquets a month.
- 3 The change in price is \$40, and 4 the average price is \$60, so the percentage change in price equals $(\$40 \div \$60) \times 100$, which is 66.67 percent.
- 5 The change in the quantity supplied is 18 million bouquets and 6 the average quantity supplied is 15 million bouquets, so the percentage change in quantity supplied is $(18 \text{ million} \div 15 \text{ million}) \times 100$, which is 120 percent.
- 7 The price elasticity of supply equals $120 \text{ percent} \div 66.6 \text{ percent}$, which is 1.8.

MyEconLab

You can work these problems in Study Plan 5.2 and get instant feedback.

CHECKPOINT 5.2

Define the price elasticity of supply, and explain the factors that influence it and how to calculate it.

Practice Problems

A 10 percent increase in the price of a good increased the quantity supplied of the good by 1 percent after one month and by 25 percent after one year.

1. Is the supply of this good elastic, unit elastic, or inelastic? Is this good likely to be produced using factors of production that are easily obtained? What is the price elasticity of supply of this good?
2. What is the price elasticity of supply after one year? Has the supply of this good become more elastic or less elastic? Why?

In the News

Weak coal prices hit China's third-largest coal miner

The chairman of Yanzhou Coal Mining, Wang Xin, reported that the demand for coal has fallen by 11.9 percent to 7.92 million tons from 8.99 million tons a year earlier, despite the price falling by 10.6 percent.

Source: Dow Jones, April 27, 2009

Calculate the price elasticity of supply of coal. Is the supply of coal elastic or inelastic?

Solutions to Practice Problems

1. The supply of a good is *inelastic* if the percentage increase in the quantity supplied is less than the percentage increase in price. In this example, a 10 percent price rise brings a 1 percent increase in the quantity supplied, so supply is inelastic. Because the quantity supplied increases by such a small percentage after one month, the factors of production that are used to produce this good are more likely to be difficult to obtain.
The price elasticity of supply = Percentage change in the quantity supplied ÷ Percentage change in the price. In this example, the price elasticity of supply equals 1 percent divided by 10 percent, or 0.1.
2. The price elasticity of supply = Percentage change in the quantity supplied ÷ Percentage change in the price. After one year, the price elasticity of supply is 25 percent divided by 10 percent, or 2.5. The supply of the good has become more elastic over the year since the price rise. Possibly other producers have gradually started producing the good and with the passage of time more factors of production can be reallocated.

Solution to In the News

The demand for coal decreased, so we can use these data to calculate the price elasticity of supply. The price elasticity of supply equals the percentage change in the quantity supplied divided by the percentage change in the price. The price elasticity of supply equals 11.9 percent divided by 10.6 percent, or 1.12. The quantity supplied fell by a larger percentage than the price, so the supply of coal is elastic, which is what a price elasticity of supply of 1.12 means.

5.3 CROSS ELASTICITY AND INCOME ELASTICITY

Domino's Pizza in Chula Vista has a problem. Burger King has just cut its prices. Domino's manager, Pat, knows that pizzas and burgers are substitutes. He also knows that when the price of a substitute for pizza falls, the demand for pizza decreases. But by how much will the quantity of pizza bought decrease if Pat maintains his current price?

Pat also knows that pizza and soda are complements. He knows that if the price of a complement of pizza falls, the demand for pizza increases. So he wonders whether he might keep his customers by cutting the price he charges for soda. But he wants to know by how much he must cut the price of soda to keep selling the same quantity of pizza with cheaper burgers all around him.

To answer these questions, Pat needs to calculate the cross elasticity of demand. Let's examine this elasticity measure.

■ Cross Elasticity of Demand

The **cross elasticity of demand** is a measure of the responsiveness of the demand for a good to a change in the price of a substitute or complement when other things remain the same. It is calculated by using the formula:

$$\text{Cross elasticity of demand} = \frac{\text{Percentage change in quantity demanded of a good}}{\text{Percentage change in price of one of its substitutes or complements}}$$

Suppose that when the price of a burger falls by 10 percent, the quantity of pizza demanded decreases by 5 percent.* The cross elasticity of demand for pizza with respect to the price of a burger is

$$\text{Cross elasticity of demand} = \frac{-5 \text{ percent}}{-10 \text{ percent}} = 0.5.$$

The cross elasticity of demand for a substitute is positive. A *fall* in the price of a substitute brings a *decrease* in the quantity demanded of the good. The quantity demanded of a good and the price of one of its substitutes change in the *same* direction.

Suppose that when the price of soda falls by 10 percent, the quantity of pizza demanded increases by 2 percent. The cross elasticity of demand for pizza with respect to the price of soda is

$$\text{Cross elasticity of demand} = \frac{+2 \text{ percent}}{-10 \text{ percent}} = -0.2.$$

The cross elasticity of demand for a complement is negative. A *fall* in the price of a complement brings an *increase* in the quantity demanded of the good. The quantity demanded of a good and the price of one of its complements change in *opposite* directions.

Cross elasticity of demand

A measure of the responsiveness of the demand for a good to a change in the price of a substitute or complement when other things remain the same.

*As before, these percentage changes are calculated by using the midpoint method.

FIGURE 5.7

Cross Elasticity of Demand

MyEconLab Animation

- 1 A burger is a *substitute* for pizza. When the price of a burger falls, the demand curve for pizza shifts leftward from D_0 to D_1 . At the price of \$10 a pizza, people plan to buy fewer pizzas. The cross elasticity of the demand for pizza with respect to the price of a burger is *positive*.
- 2 Soda is a *complement* of pizza. When the price of soda falls, the demand for pizza increases and the demand curve for pizza shifts rightward from D_0 to D_2 . At the price of \$10 a pizza, people plan to buy more pizzas. The cross elasticity of the demand for pizza with respect to the price of soda is *negative*.

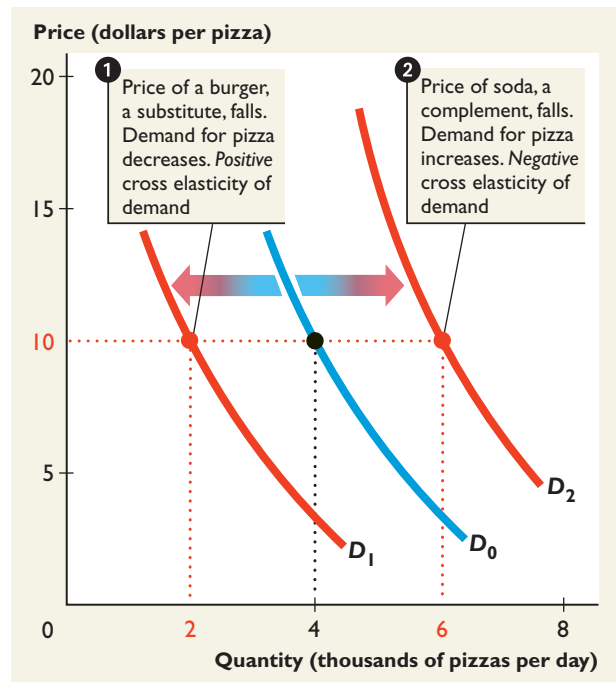


Figure 5.7 illustrates these two cross elasticities of demand for pizza. With the price of a pizza constant at \$10, when the price of a burger falls, the demand for pizza decreases and the demand curve for pizza shifts leftward from D_0 to D_1 . When the price of soda falls, the demand for pizza increases and the demand curve for pizza shifts rightward from D_0 to D_2 . The magnitude of the cross elasticity determines how far the demand curve shifts.

Income Elasticity of Demand

The U.S. and global economies are expanding, and people are enjoying rising incomes. This increasing prosperity brings an increasing demand for most types of goods. But by how much will the demand for different items increase? Will the demand for some items increase so rapidly that we spend an increasing percentage of our incomes on them? And will the demand for some items decrease?

The answer depends on the income elasticity of demand. The **income elasticity of demand** is a measure of the responsiveness of the demand for a good to a change in income when other things remain the same. It is calculated by using the following formula:

$$\text{Income elasticity of demand} = \frac{\text{Percentage change in quantity demanded}}{\text{Percentage change in income}}$$

The income elasticity of demand falls into three ranges:

- Greater than 1 (normal good, income elastic)
- Between zero and 1 (normal good, income inelastic)
- Less than zero (inferior good)

Income elasticity of demand

A measure of the responsiveness of the demand for a good to a change in income when other things remain the same.

As our incomes increase: items that have

- An income elastic demand take an increasing share of income
- An income inelastic demand take a decreasing share of income
- A negative income elasticity of demand take an absolutely smaller amount of income.

You can make some strong predictions about how the world will change over the coming years by knowing the income elasticities of demand of different goods and services. The table provides a sampling of numbers.

These estimated income elasticities of demand tell us that we can expect air travel—both domestic and international—to become hugely more important; increasing share of our incomes will be spent on watching movies, eating out in restaurants, using public transportation and getting haircuts. Two other prominent items not shown in the table, items for which demand is income elastic, are health care and education. As our incomes grow, we can expect education and health care to take increasing shares of our incomes.

As our incomes grow, we'll spend a decreasing percentage on clothing, phone calls, and food. The income elasticity of demand for food is less than one, even for the poorest people. So we can predict a continuation of the trends of the past—shrinking agriculture and manufacturing, and expanding services.

Table 5.1

Some Income Elasticities of Demand

| Good or Service | Elasticity |
|-------------------------|------------|
| Income Elastic | |
| Airline travel | 5.82 |
| Movies | 3.41 |
| Foreign travel | 3.08 |
| Electricity | 1.94 |
| Restaurant meals | 1.61 |
| Local buses and trains | 1.38 |
| Haircuts | 1.36 |
| Income Inelastic | |
| Tobacco | 0.86 |
| Alcoholic beverages | 0.62 |
| Clothing | 0.51 |
| Newspapers | 0.38 |
| Telephone | 0.32 |
| Food | 0.14 |

SOURCES OF DATA: See page C1.



EYE on YOUR LIFE

Your Price Elasticities of Demand

Pay close attention the next time the price of something that you buy rises. Did you spend more, the same, or less on this item?

Your expenditure on a good is equal to the price of the good multiplied by the quantity that you buy.

But recall that a seller's total revenue is equal to the price of the good multiplied by the quantity sold.

Because the buyer's expenditure on a good is equal to the seller's total revenue, the total revenue test that the seller uses to estimate the price elasticity of demand for the good sold can also be used by a buyer.

You can determine whether your demand for a good is elastic, unit elas-

tic, or inelastic by noting what happens to your total expenditure on the good when its price changes.

When the price of a good rises, your demand for that good is

- *Elastic* if your expenditure on it decreases.
- *Unit elastic* if your expenditure on it remains constant.
- *Inelastic* if your expenditure on it increases.

Think about why your demand for a good might be elastic, unit elastic, or inelastic by checking back to the list of influences on the price elasticity of demand on page 116.

Most likely, as we noted in the chapter opener, when the price of

gasoline rises, you use almost as much as you did at the lower price. Gasoline has poor substitutes and your demand for gasoline is inelastic.

What do you do if the price of using your cell phone falls? Do you spend less on your cell phone, as you would if your demand for cell phone service is inelastic? Or do you spend more on your cell phone, which would indicate an elastic demand for cell phone service?

What about your iPod and iTunes? Is your demand for these items elastic or inelastic? And is your demand for textbooks elastic or inelastic? You can estimate all these elasticities.

MyEconLab

You can work these problems in Study Plan 5.3 and get instant feedback.

CHECKPOINT 5.3

Define the cross elasticity of demand and the income elasticity of demand, and explain the factors that influence them.

Practice Problems

1. The quantity demanded of good *A* increases by 5 percent when the price of good *B* rises by 10 percent and other things remain the same. Are goods *A* and *B* complements or substitutes? Describe how the demand for good *A* changes and calculate the cross elasticity of demand.
2. When income rises by 5 percent and other things remain the same, the quantity demanded of good *C* increases by 1 percent. Is good *C* a normal good or an inferior good? Describe how the demand for good *C* changes and calculate the income elasticity of demand for good *C*.

In the News

Rising incomes make China the world's largest luxury goods market

China is estimated to become the world's largest luxury goods market over the next decade, boosted by rising incomes and a transition from saving to spending culture.

Source: ibtimes.com, February 2, 2011

Are luxury goods normal goods or just not necessities? Explain your answer.

FIGURE 1



FIGURE 2



Solutions to Practice Problems

1. Goods *A* and *B* are substitutes because when the price of good *B* rises, the quantity demanded of good *A* increases. People switch from good *B* to good *A*. The demand for good *A* increases (Figure 1).
 Cross elasticity of demand = Percentage change in the quantity demanded of good *A* ÷ Percentage increase in the price of good *B*.
 Cross elasticity of demand = $5 \div 10$, or 0.5.
2. Good *C* is a normal good; as income rises, the quantity demanded increases. The demand for good *C* increases (Figure 2).
 Income elasticity of demand = Percentage change in the quantity demanded of good *C* ÷ Percentage increase in income.
 Income elasticity of demand = $1 \div 5$, or 0.2.

Solution to In the News

To know whether a good is a normal good, we need to calculate the income elasticity of demand. A normal good is a good that has a positive income elasticity of demand. The source of the increase in the sales of luxury goods is rising incomes and people spending their past savings. As people spend more, the quantity of luxury goods bought increases, so the income elasticity of demand for luxury goods is positive. Luxury goods are normal goods.

CHAPTER SUMMARY

Key Points

1 Define the price elasticity of demand, and explain the factors that influence it and how to calculate it.

- The demand for a good is elastic if, when its price changes, the percentage change in the quantity demanded exceeds the percentage change in price.
- The demand for a good is inelastic if, when its price changes, the percentage change in the quantity demanded is less than the percentage change in price.
- The price elasticity of demand for a good depends on how easy it is to find substitutes for the good and on the proportion of income spent on it.
- Price elasticity of demand equals the percentage change in the quantity demanded divided by the percentage change in price.
- If demand is elastic, a rise in price leads to a decrease in total revenue. If demand is unit elastic, a rise in price leaves total revenue unchanged. And if demand is inelastic, a rise in price leads to an increase in total revenue.

2 Define the price elasticity of supply, and explain the factors that influence it and how to calculate it.

- The supply of a good is elastic if, when its price changes, the percentage change in the quantity supplied exceeds the percentage change in price.
- The supply of a good is inelastic if, when its price changes, the percentage change in the quantity supplied is less than the percentage change in price.
- The main influences on the price elasticity of supply are the flexibility of production possibilities and storage possibilities.

3 Define the cross elasticity of demand and the income elasticity of demand, and explain the factors that influence them.

- Cross elasticity of demand shows how the demand for a good changes when the price of one of its substitutes or complements changes.
- Cross elasticity is positive for substitutes and negative for complements.
- Income elasticity of demand shows how the demand for a good changes when income changes. For a normal good, the income elasticity of demand is positive. For an inferior good, the income elasticity of demand is negative.

Key Terms

Cross elasticity of demand, 129
 Elastic demand, 114
 Elastic supply, 124
 Income elasticity of demand, 130
 Inelastic demand, 114
 Inelastic supply, 124

Perfectly elastic demand, 114
 Perfectly elastic supply, 124
 Perfectly inelastic demand, 114
 Perfectly inelastic supply, 124
 Price elasticity of demand, 112
 Price elasticity of supply, 124

Total revenue, 120
 Total revenue test, 121
 Unit elastic demand, 114
 Unit elastic supply, 124

MyEconLab

You can work these problems in Chapter 5 Study Plan and get instant feedback.

CHAPTER CHECKPOINT

Study Plan Problems and Applications

When the price of home heating oil increased by 20 percent, the quantity demanded decreased by 2 percent and the quantity of wool sweaters demanded increased by 10 percent. Use this information to work Problems 1 and 2.

1. Use the total revenue test to determine whether the demand for home heating oil is elastic or inelastic.
2. If the price of a wool sweater did not change, calculate the cross elasticity of demand for wool sweaters with respect to the price of home heating oil. Are home heating oil and wool sweaters substitutes or complements? Why?
3. Figure 1 shows the demand for movie tickets. Is the demand for movie tickets elastic or inelastic over the price range \$7 to \$9 a ticket? If the price falls from \$9 to \$7 a ticket, explain how the total revenue from the sale of movie tickets will change. Calculate the price elasticity of demand for movie tickets when the price is \$8 a ticket.
4. The price elasticity of demand for Pete's chocolate chip cookies is 1.5. Pete wants to increase his total revenue. Would you recommend that Pete raise or lower his price of cookies? Explain your answer.

Use the following information to work Problems 5 and 6.

The price of a plane ride rises by 10 percent. The price elasticity of demand for plane rides is 0.5 and the price elasticity of demand for train rides is 0.2. The cross elasticity of demand for train rides with respect to the price of a plane ride is 0.4.

5. Calculate the percentage changes in the quantity demanded of plane rides and train rides.
6. Given the rise in the price of a plane ride, what percentage change in the price of a train ride will leave the quantity demanded of train rides unchanged?
7. A survey found that when incomes increased by 10 percent, the following changes in quantities demanded occurred: spring water up by 5 percent; sports drinks down by 2 percent; cruises up by 15 percent. Which demand is income elastic? Which is income inelastic? Which are normal goods?

Use the following information to work Problems 8 and 9.

Record U.S. corn crop, up 24%, is forecast

The USDA reported that world corn production will be 9.9 percent greater than last year's, while U.S. corn production will be 24 percent larger. The price of corn is expected to be 46 percent higher than last year's price.

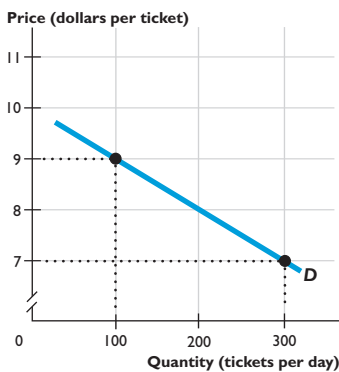
Source: *Bloomberg News*, August 11, 2007

8. Calculate the U.S. price elasticity of supply of corn. Is this supply elastic?
9. Calculate the world price elasticity of supply of corn.
10. In May 2011, higher food prices forced consumers to cut spending.

Source: *CNN Money*, June 4, 2011

Is the demand for food elastic or inelastic? Explain your answer.

FIGURE 1



Instructor Assignable Problems and Applications

Use the following information to work Problems 1 and 2.

Why the tepid response to higher gasoline prices?

Most studies report that when U.S. gas prices rise by 10 percent, the quantity purchased falls by 1 to 2 percent. In September 2005, the retail gasoline price was \$2.90 a gallon, about \$1.00 higher than in September 2004, but purchases of gasoline fell by only 3.5 percent.

Source: *The New York Times*, October 13, 2005

1. Calculate the price elasticity of demand for gasoline implied by what most studies have found.
2. Compare the elasticity implied by the data for the period from September 2004 to September 2005 with that implied by most studies. What might explain the difference?
3. When heavy rain ruined the banana crop in Central America, the price of bananas rose from \$1 a pound to \$2 a pound. Banana growers sold fewer bananas, but their total revenue remained unchanged. By how much did the quantity of bananas demanded change? Is the demand for bananas from Central America elastic, unit elastic, or inelastic?
4. The income elasticity of demand for haircuts is 1.5, and the income elasticity of demand for food is 0.14. You take a weekend job, and the income you have to spend on food and haircuts doubles. If the prices of food and haircuts remain the same, will you double your expenditure on haircuts and double your expenditure on food? Explain why or why not.
5. Drought cuts the quantity of wheat grown by 2 percent. If the price elasticity of demand for wheat is 0.5, by how much will the price of wheat rise? If pasta makers estimate that this change in the price of wheat will increase the price of pasta by 25 percent and decrease the quantity demanded of pasta by 8 percent, what is the pasta makers' estimate of the price elasticity of demand for pasta? If pasta sauce makers estimate that, with the change in the price of pasta, the quantity of pasta sauce demanded will decrease by 5 percent, what is the pasta sauce makers' estimate of the cross elasticity of demand for pasta sauce with respect to the price of pasta?
6. "In a market in which demand is price inelastic, producers can gouge consumers and the government must set high standards of conduct for producers to ensure that consumers gets a fair deal." Do you agree or disagree with each part of this statement? Explain how you might go about testing the parts of the statement that are positive and lay bare the normative parts.

Use the following information to work Problems 7 and 8.

Almonds galore!

The quantity of almonds harvested in 2008–2009 was expected to increase by 22 percent, while total receipts of growers was expected to increase by 17 percent.

Source: Almond Board of California

7. Was the price of almonds expected to rise or fall? Did a change in the supply of or demand for almonds bring about this expected change in the price?
8. If the price of almonds changed as a result of a change in the supply of almonds, is the demand for almonds elastic or inelastic? Explain your answer.

Your instructor can assign these problems as homework, a quiz, or a test in [MyEconLab](#).

MyEconLab

You can work this quiz in Chapter 5 Study Plan and get instant feedback.

Multiple Choice Quiz

- When the price of ice cream rises from \$3 to \$5 a scoop, the quantity of ice cream bought decreases by 10 percent. The price elasticity of demand for ice cream is _____.
 - 5
 - 0.2
 - 50
 - 2.5
- In Pioneer Ville, the price elasticity of demand for bus rides is 0.5. When the price of a bus ticket rises by 5 percent, _____.
 - the demand for bus rides increases by 10 percent
 - the quantity of bus rides demanded increases by 2.5 percent
 - the demand for bus rides decreases by 2.5 percent
 - the quantity of bus rides demanded decreases by 2.5 percent
- The price elasticity of demand for a good is 0.2. A 10 percent rise in the price will _____ the total revenue from sales of the good.
 - decrease
 - increase
 - decrease the quantity sold with no change in
 - not change
- If the price of a good falls and expenditure on the good rises, the demand for the good is _____.
 - elastic
 - perfectly elastic
 - inelastic
 - unit elastic
- When the price of a good rises from \$5 to \$7 a unit, the quantity supplied increases from 110 to 130 units a day. The price elasticity of supply is _____. The supply of the good is _____.
 - 60; elastic
 - 10; elastic
 - 0.5; inelastic
 - 2; inelastic
- The cross elasticity of demand for good *A* with respect to good *B* is 0.2. A 10 percent change in the price of good *B* will lead to a ____ percent change in the quantity of good *A* demanded. Goods *A* and *B* are _____.
 - 2; substitutes
 - 0.5; complements
 - 2; complements
 - 0.5; substitutes
- A 2 percent increase in income increases the quantity demanded of a good by 1 percent. The income elasticity of demand for this good is _____. The good is a _____ good.
 - 2; normal
 - 2; inferior
 - 1/2; normal
 - 2; inferior



Should price gouging be illegal?

Efficiency and Fairness of Markets

When you have completed your study of this chapter, you will be able to

- 1 Describe the alternative methods of allocating scarce resources and define and explain the features of an efficient allocation.
- 2 Distinguish between value and price and define consumer surplus.
- 3 Distinguish between cost and price and define producer surplus.
- 4 Evaluate the efficiency of the alternative methods of allocating resources.
- 5 Explain the main ideas about fairness and evaluate the fairness of the alternative methods of allocating scarce resources.



CHAPTER CHECKLIST

6.1 ALLOCATION METHODS AND EFFICIENCY

Because resources are scarce, they must be allocated somehow among their competing uses. Doing nothing and leaving the allocation to chance is one method of allocation. The goal of this chapter is to evaluate the ability of markets to allocate resources efficiently and fairly—to allocate them in the social interest.

But trading in markets is only one of several methods of allocating resources. To know whether the market does a good job, we need to compare it with its alternatives. We also need to know what is meant by an efficient and fair allocation.

Economists have much more to say about efficiency than about fairness, so efficiency is the main focus of this chapter. We leave the difficult issue of fairness until the final section. We begin by describing the alternative ways in which resources might be allocated. Then we explain the characteristics of an efficient allocation.

■ Resource Allocation Methods

Resources might be allocated by using any one or some combination of the following methods:

- Market price
- Command
- Majority rule
- Contest
- First-come, first-served
- Sharing equally
- Lottery
- Personal characteristics
- Force

Let's see how each method works and look at an example of each.

Market Price

When a market price allocates a scarce resource, the people who get the resource are those who are willing and able to pay the market price. People who don't value the resource as highly as the market price leave it for others to buy and use.

Most of the scarce resources that you supply get allocated by market price. For example, you sell your labor services in a market, and you buy most of what you consume in markets.

Two kinds of people decide not to pay the market price: those who can afford to pay but choose not to buy and those who are too poor and simply can't afford to pay.

For many goods and services, distinguishing between those who choose not to buy and those who can't afford to pay doesn't matter. For a few items, that distinction does matter. For example, some poor people can't afford to pay school fees and doctor's fees. The inability of poor people to buy items that most people consider to be essential is not handled well by the market price method and is usually dealt with by one of the other allocation methods.

But for most goods and services, the market turns out to do a good job. We'll examine just how good a job it does later in this chapter.



Market price allocates resources to those who are willing and able to pay.

Command

A **command system** allocates resources by the order (command) of someone in authority. Many resources get allocated by command. In the U.S. economy, the command system is used extensively inside firms and government bureaus. For example, if you have a job, it is most likely that someone tells you what to do. Your labor time is allocated to specific tasks by a command.

Sometimes, a command system allocates the resources of an entire economy. The former Soviet Union is an example. North Korea and Cuba are the only remaining command economies.

A command system works well in organizations in which the lines of authority and responsibility are clear and it is easy to monitor the activities being performed. But a command system works badly when applied to an entire economy. The range of activities to be monitored is just too large, and it is easy for people to fool those in authority. The system works so badly in North Korea that it fails even to deliver an adequate supply of food.

Majority Rule

Majority rule allocates resources in the way that a majority of voters choose. Societies use majority rule for some of their biggest decisions. For example, majority rule decides the tax rates that end up allocating scarce resources between private use and public use. And majority rule decides how tax dollars are allocated among competing uses such as national defense and health care for the aged.

Having 200 million people vote on every line in a nation's budget would be extremely costly, so instead of direct majority rule, the United States (and most other countries) use the system of representative government. Majority rule determines who will represent the people, and majority rule among the representatives decides the detailed allocation of scarce resources.

Majority rule works well when the decisions being made affect large numbers of people and self-interest must be suppressed to use resources most effectively.

Contest

A contest allocates resources to a winner (or a group of winners). The most obvious contests are sporting events. Maria Sharapova and Serena Williams do battle on a tennis court, and the winner gets twice as much in prize money as the loser.

But contests are much more general than those in a sports arena, though we don't call them contests in ordinary speech. For example, Bill Gates won a big contest to provide the world's personal computer operating system, and Natalie Portman won a type of contest to rise to the top of the movie-acting business.

Contests do a good job when the efforts of the "players" are hard to monitor and reward directly. By dangling the opportunity to win a big prize, people are motivated to work hard and try to be the "winner." Even though only a few people end up with a big prize, many people work harder in the process of trying to win and so total production is much greater than it would be without the contest.

First-Come, First-Served

A first-come, first-served method allocates resources to those who are first in line. Most national parks allocate campsites in this way. Airlines use first-come, first-served to allocate standby seats at the departure gate. A freeway is an everyday example of first-come, first-served. This scarce transportation resource gets allo-

Command system

A system that allocates resources by the order of someone in authority.



A command allocates resources by the order of someone in authority.



Voting allocates resources in the way that the majority wants.



A contest allocates resources to the winner, in sport and business.



First-come, first-served allocates resources to the first in line.

cated to the first to arrive at the on-ramp. If too many vehicles enter the freeway, the speed slows and people, in effect, wait in line for a bit of the “freeway” to become free!

First-come, first-served works best when, as in the above examples, a scarce resource can serve just one user at a time in a sequence. By serving the user who arrives first, this method minimizes the time spent waiting in line for the resource to become free.



Sharing allocates resources by mutual agreement.

Sharing Equally

When a resource is shared equally, everyone gets the same amount of it. You perhaps use this method to share dessert at a restaurant. People sometimes jointly own a vacation apartment and share its use equally.

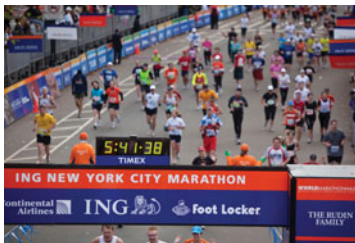
To make equal shares work, people must agree on how to use the resource and must make an arrangement to implement the agreement. Sharing equally can work for small groups who share a set of common goals and ideals.

Lottery

Lotteries allocate resources to those who pick the winning number, draw the lucky cards, or come up lucky on some other gaming system. State lotteries and casinos reallocate millions of dollars worth of goods and services every year.

But lotteries are far more widespread than state jackpots and roulette wheels in casinos. They are used in a variety of situations to allocate scarce resources. For example, some marathon organizers use lotteries to determine who gets to participate and some airports use them to allocate landing slots to airlines.

Lotteries work well when there is no effective way to distinguish among potential users of a scarce resource.



A lottery allocates resources to the one who draws the winning number.

Personal Characteristics

When resources are allocated on the basis of personal characteristics, people with the “right” characteristics get the resources. Some of the resources that matter most to you are allocated in this way. The people you like are the ones you spend the most time with. You try to avoid having to spend time with people you don’t like. People choose marriage partners on the basis of personal characteristics. The use of personal characteristics to allocate resources is regarded as completely natural and acceptable.

But this method also gets used in unacceptable ways. Allocating the best jobs to white, Anglo-Saxon males and discriminating against minorities and women is an example.



Personal characteristics allocate resources based on whom we like.

Force

Force plays a crucial role, for both good and ill, in allocating scarce resources. Let’s start with the ill.

War, the use of military force by one nation against another, has played an enormous role historically in allocating resources. The economic supremacy of European settlers in the Americas and Australia owes much to the use of this method.

Theft, the taking of the property of others without their consent, also plays a large role. Both large-scale organized crime and small-scale petty crime collectively allocate billions of dollars worth of resources annually. A large amount of



Force protects the rule of law and facilitates economic activity.

theft today is conducted by using sophisticated electronic methods that move resources from banks and thousands of innocent people.

But force plays a crucial positive role in allocating resources. It provides an effective method for the state to transfer wealth from the rich to the poor and the legal framework in which voluntary exchange in markets takes place.

Most income and wealth redistribution in modern societies occurs through a taxation and benefits system that is enforced by the power of the state. We vote for taxes and benefits—a majority vote allocation—but we use the power of the state to ensure that everyone complies with the rules and pays their allotted share.

A legal system is the foundation on which our market economy functions. Without courts to enforce contracts, it would be difficult to do business. But the courts could not enforce contracts without the ability to apply force if necessary. The state provides the ultimate force that enables the courts to do their work.

More broadly, the force of the state is essential to uphold the principle of the *rule of law*. This principle is the bedrock of civilized economic (and social and political) life. With the rule of law upheld, people can go about their daily economic lives with the assurance that their property will be protected—that they can sue for violations of their property (and be sued if they violate the property of others).

Free from the burden of protecting their property and confident in the knowledge that those with whom they trade will honor their agreements, people can get on with focusing on the activity at which they have a comparative advantage and trading for mutual gain.

In the next sections of this chapter, we're going to see how a market achieves an efficient use of resources, examine obstacles to efficiency, and see how sometimes, an alternative method might improve on the market. But first we need to be clear about the meaning of efficiency. What are the characteristics of an efficient allocation of resources?

■ Using Resources Efficiently

In everyday language, *efficiency* means getting the most out of something. An efficient automobile is one that gets the best possible gas mileage; an efficient furnace is one that uses as little fuel as possible to deliver its heat. In economics, efficiency means getting the most out of the entire economy.

Efficiency and the PPF

The **production possibilities frontier** (PPF) is the boundary between the combinations of goods and services that can be produced and those that cannot be produced given the available factors of production and state of technology (p. 60). Production is efficient when the economy is *on* its PPF (Chapter 3, pp. 62–63). Production at a point *inside* the PPF is *inefficient*.

Allocative efficiency is achieved when the quantities of goods and services produced are those that people *value most highly*. To put it another way, resources are allocated efficiently when we cannot produce more of one thing without giving up something else *that people value more highly*. If we can give up some units of one good to get more of something that is *valued more highly*, we haven't achieved the most valued point on the PPF.

The PPF tells us what it is *possible* to produce but it doesn't tell us about the *value* of what we produce. To find the *highest-valued* point on the PPF, we need some information about value. *Marginal benefit* provides that information.

Production possibilities frontier

The boundary between the combinations of goods and services that can be produced and the combinations that cannot be produced, given the available factors of production and the state of technology.

Allocative efficiency

A situation in which the quantities of goods and services produced are those that people *value most highly*—it is not possible to produce more of a good or service without giving up some of another good that people *value more highly*.

Marginal Benefit

Marginal benefit is the benefit that people receive from consuming *one more unit* of a good or service. People's *preferences* determine marginal benefit and we can measure the marginal benefit from a good or service by what people *are willing to give up* to get *one more unit* of it.

The more we have of any good or service, the smaller is our marginal benefit from it—the *principle of decreasing marginal benefit*. Think about your own marginal benefit from pizza. You really enjoy the first slice. A second slice is fine, too, but not quite as satisfying as the first one. But eat three, four, five, six, and more slices, and each additional slice is less enjoyable than the previous one. You get diminishing marginal benefit from pizza. The more pizza you have, the less of some other good or service you are willing to give up to get one more slice.

Figure 6.1 illustrates the economy's marginal benefit schedule and marginal benefit curve for pizza. The schedule and curve show the same information. In the schedule and on the curve, the quantity of other goods that people *are willing to give up* to get one more pizza *decreases* as the quantity of pizza available *increases*.

Marginal Cost

To achieve allocative efficiency, we must compare the marginal benefit from pizza with its marginal cost. *Marginal cost* is the opportunity cost of producing one more unit of a good or service (see p. 10) and is measured by the slope of the production possibilities frontier (see pp. 66–67). The marginal cost of a good increases as the quantity produced of that good increases.

FIGURE 6.1
Marginal Benefit from Pizza

MyEconLab Animation

The table and the graph show the marginal benefit from pizza.

Possibility A and point A tell us that if 2,000 pizzas a day are produced, people are willing to give up 15 units of other goods for a pizza. Each point A, B, and C in the graph represents the possibility in the table identified by the same letter.

The line passing through these points is the marginal benefit curve. The marginal benefit from pizza decreases as the quantity of pizza available increases.

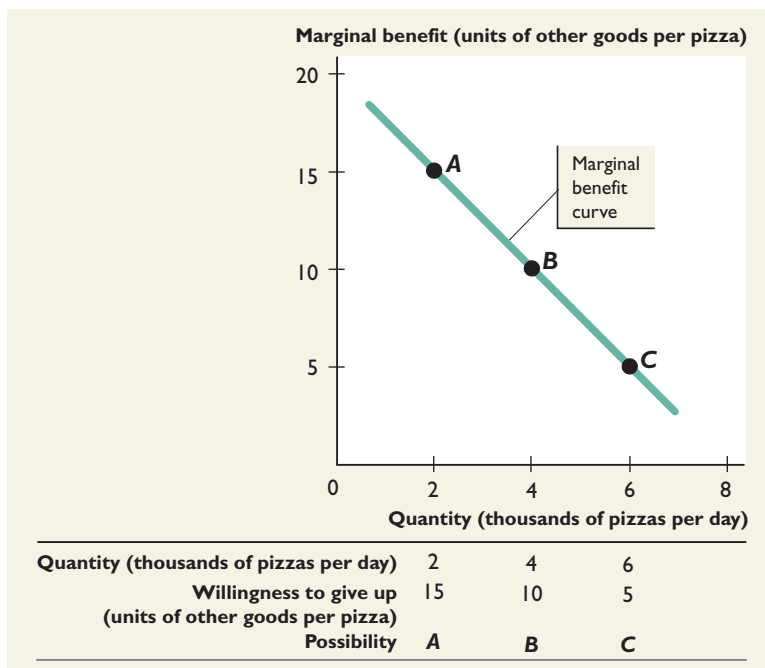


Figure 6.2 illustrates the economy's marginal cost schedule and marginal cost curve. In the schedule and along the curve, which show the same information, the quantity of other goods that people *must give up* to get one more pizza *increases* as the quantity of pizza produced *increases*.

We can now use the concepts of marginal benefit and marginal cost to discover the efficient quantity of pizza to produce.

Efficient Allocation

The efficient allocation is the highest-valued allocation. To find this allocation, we compare marginal benefit and marginal cost.

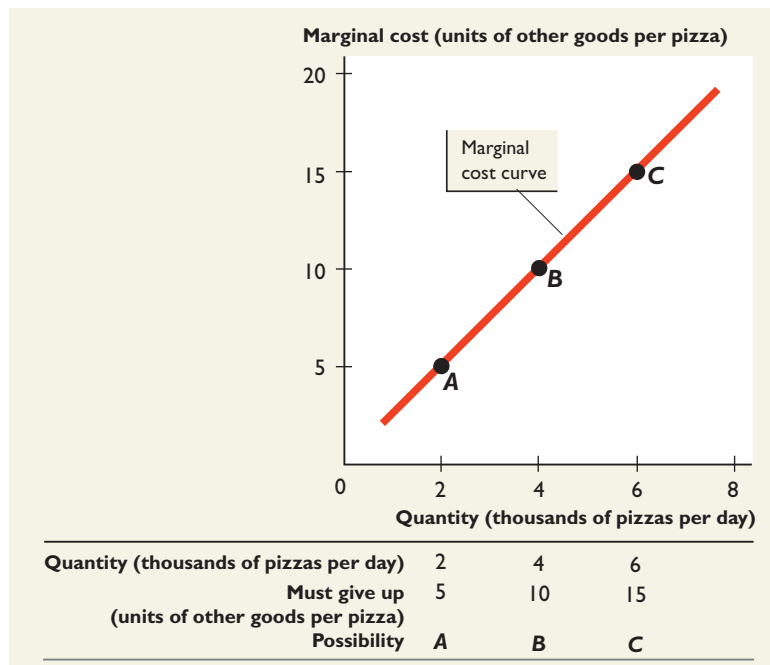
If the marginal benefit from pizza exceeds its marginal cost, we're producing too little pizza (and too many units of other goods). If we increase the quantity of pizza produced, we incur a cost but receive a larger benefit from the additional pizza. Our allocation of resources becomes more efficient.

If the marginal cost of pizza exceeds its marginal benefit, we're producing too much pizza (and too little of other goods). Now if we decrease the quantity of pizza produced, we receive a smaller benefit from pizza but save an even greater cost of pizza. Again, our allocation of resources becomes more efficient.

Only when the marginal benefit and marginal cost of pizza are equal are we allocating resources efficiently. Figure 6.3 on the next page illustrates this efficient allocation and provides a graphical summary of the above description of allocative efficiency.

FIGURE 6.2
Marginal Cost of Pizza

MyEconLab Animation



The table and the graph show the marginal cost of a pizza. Marginal cost is the opportunity cost of producing one more unit. It is derived from the PPF and is measured by the slope of the PPF.

Points A, B, and C in the graph represent the possibilities in the table. The marginal cost curve shows that the marginal cost of a pizza increases as the quantity of pizza produced increases.

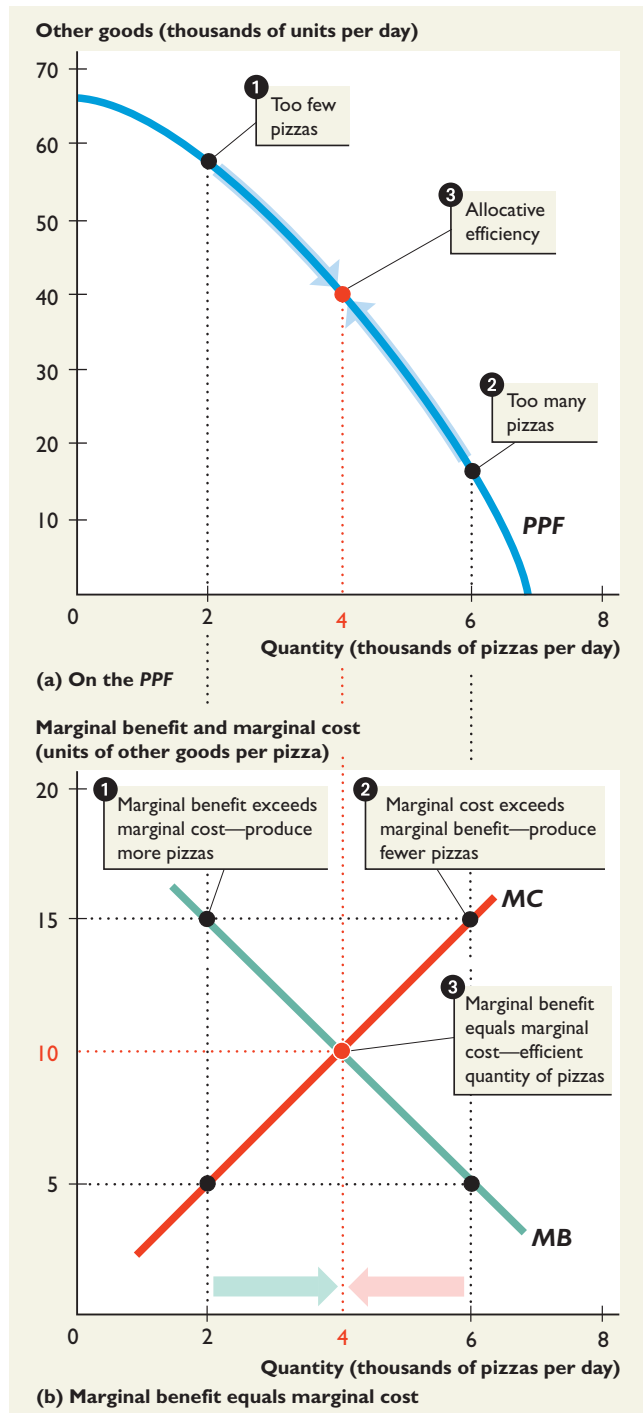
FIGURE 6.3

The Efficient Quantity of Pizza

MyEconLab Animation

Production efficiency occurs at all points on the PPF, but allocative efficiency occurs at only one point on the PPF.

- 1 When 2,000 pizzas are produced in part (a), the marginal benefit from pizza exceeds its marginal cost in part (b). Too few pizzas are being produced. If more pizzas and less of other goods are produced, the value of production increases and resources are used more efficiently.
- 2 When 6,000 pizzas are produced in part (a), the marginal cost of a pizza exceeds its marginal benefit in part (b). Too many pizzas are being produced. If fewer pizzas and more of other goods are produced, the value of production increases and resources are used more efficiently.
- 3 When 4,000 pizzas a day are produced in part (a), the marginal cost of a pizza equals its marginal benefit in part (b). The efficient quantity of pizzas is being produced. It is not possible to get greater value from the economy's scarce resources. If one less pizza and more other goods are produced, the value of the lost pizza exceeds the value of the additional other goods, so total value falls. And if one more pizza and less other goods are produced, the value of the gained pizza is less than the value of the lost other goods, so again total value falls.



CHECKPOINT 6.1

Describe the alternative methods of allocating scarce resources and define and explain the features of an efficient allocation.

MyEconLab

You can work these problems in Study Plan 6.1 and get instant feedback.

Practice Problems

- Which method is used to allocate the following scarce resources?
 - Campus parking space between student areas and faculty areas
 - A spot in a restricted student parking area
 - Textbooks
 - Host city for the Olympic Games

Use Figure 1, which shows a nation's *PPF*, and Table 1, which shows its marginal benefit and marginal cost schedules, to work Problems 2 and 3.

- What is the marginal benefit from bananas when 1 pound of bananas is grown? What is the marginal cost of growing 1 pound of bananas?
- On Figure 1, mark two points: Point *A* at which production is efficient but too much coffee is produced for allocative efficiency; and point *B*, the point of allocative efficiency.

FIGURE 1

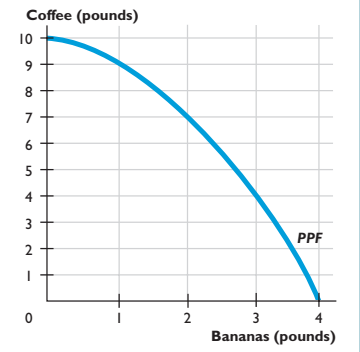


TABLE 1 MARGINAL BENEFIT AND MARGINAL COST

| Bananas (pounds) | Willing to give up | Must give up |
|------------------|---|--------------|
| | (pounds of coffee per pound of bananas) | |
| 1 | 3 | 1 |
| 2 | 2 | 2 |
| 3 | 1 | 3 |

In the News

AC/DC's "Black Ice" tour breaks records down under

The 40,000 tickets for the March 6 gig sold out in seven minutes—a record. Many people who camped out overnight missed getting a ticket.

Source: *WAToday*, May 25, 2009

What method was used to allocate AC/DC concert tickets? Was it efficient?

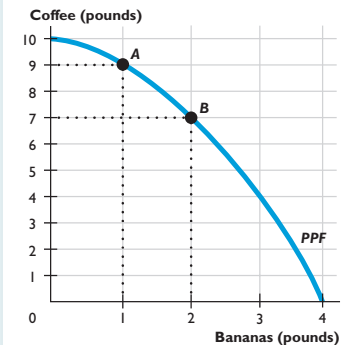
Solutions to Practice Problems

- Campus parking is allocated by command. The spot in a restricted student parking area is allocated by first-come, first-served. Textbooks are allocated by market price. The Olympic Games' host city is allocated by contest.
- The marginal benefit from 1 pound of bananas is 3 pounds of coffee. Marginal benefit is the amount of coffee that the nation is *willing to give up* to get *one additional* pound of bananas. The marginal cost of growing 1 pound of bananas is 1 pound of coffee. Marginal cost is the amount of coffee that the nation *must give up* to get *one additional* pound of bananas.
- Point *A* on Figure 2 shows production efficiency (on the *PPF*) but not allocative efficiency because from Table 1 marginal benefit from bananas exceeds the marginal cost—too few bananas are produced. Point *B* is the point of allocative efficiency: It is on the *PPF* and marginal benefit equals marginal cost.

Solution to In the News

The concert organizer used first-come, first-served to allocate tickets. The allocation was efficient if the concert-goer's willingness to pay (the ticket price plus the opportunity cost of time spent in the line), which is also the marginal benefit, equaled the organizer's marginal cost of providing one more seat.

FIGURE 2



6.2 VALUE, PRICE, AND CONSUMER SURPLUS

To investigate whether a market is efficient, we need to understand the connection between demand and marginal benefit and between supply and marginal cost.

■ Demand and Marginal Benefit

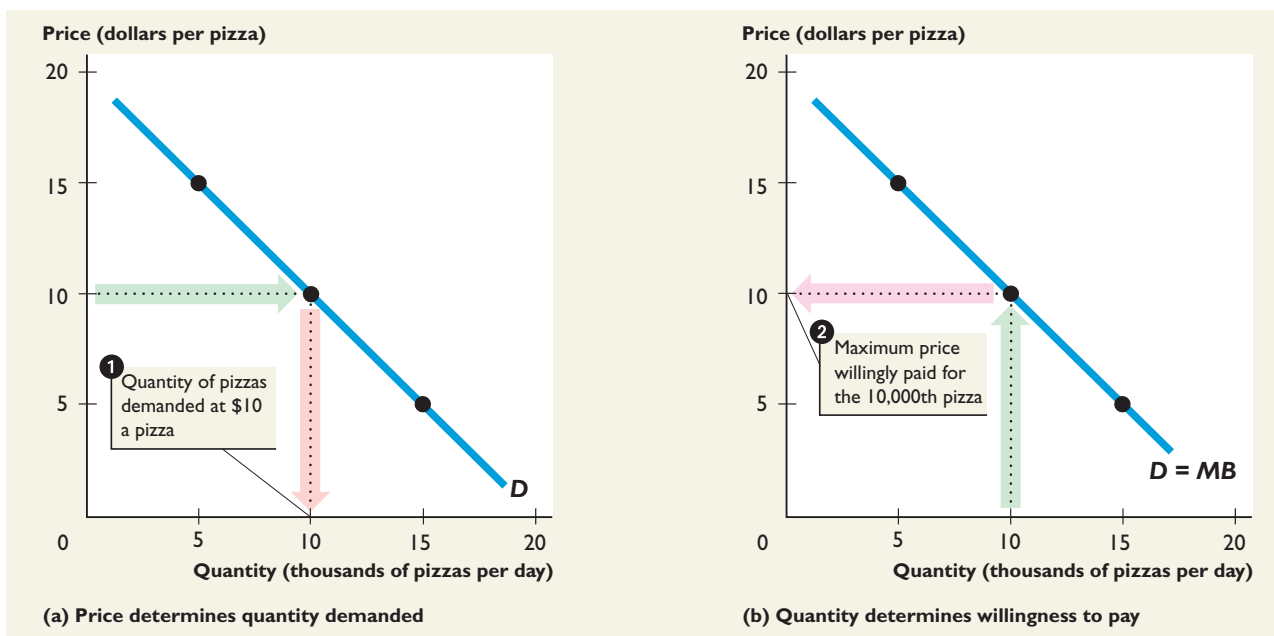
In everyday life, when we talk about “getting value for money,” we’re distinguishing between *value* and *price*. Value is what we get, and price is what we pay. In economics, the everyday idea of value is *marginal benefit*, which we measure as the maximum price that people are willing to pay for another unit of the good or service. The demand curve tells us this price. In Figure 6.4(a), the demand curve shows the quantity demanded at a given price—when the price is \$10 a pizza, the quantity demanded is 10,000 pizzas a day. In Figure 6.4(b), the demand curve shows the maximum price that people are willing to pay when there is a given quantity—when 10,000 pizzas a day are available, the most that people are willing to pay for the 10,000th pizza is \$10. The marginal benefit from the 10,000th pizza is \$10.

A demand curve is a marginal benefit curve. The demand curve for pizza tells us the dollars’ worth of other goods and services that people are willing to forgo to consume one more pizza.

FIGURE 6.4

Demand, Willingness to Pay, and Marginal Benefit

MyEconLab Animation



1 The demand curve for pizza, D , shows the quantity of pizza demanded at each price, other things remaining the same. At \$10 a pizza, the quantity demanded is 10,000 pizzas a day.

2 The demand curve shows the maximum price willingly paid (marginal benefit) for a given quantity. If 10,000 pizzas are available, the maximum price willingly paid for the 10,000th pizza is \$10. The demand curve is also the marginal benefit curve MB .

Consumer Surplus

We don't always have to pay as much as we're willing to pay. When people buy something for less than it is worth to them, they receive a consumer surplus.

Consumer surplus is the excess of marginal benefit from a good over the price paid for it, summed over the quantity consumed.

Figure 6.5 illustrates consumer surplus. The demand curve for pizza tells us the quantity of pizza that people plan to buy at each price and the marginal benefit from pizza at each quantity. If the price of a pizza is \$10, people buy 10,000 pizzas a day. Expenditure on pizza is \$100,000, which is shown by the area of the blue rectangle.

To calculate consumer surplus, we must find the consumer surplus on each pizza and add these consumer surpluses together. For the 10,000th pizza, marginal benefit equals \$10 and people pay \$10, so the consumer surplus on this pizza is zero. For the 5,000th pizza (highlighted in the figure), marginal benefit is \$15. So on this pizza, consumer surplus is \$15 minus \$10, which is \$5. For the first pizza, marginal benefit is almost \$20, so on this pizza, consumer surplus is almost \$10.

Consumer surplus—the sum of the consumer surpluses on the 10,000 pizzas that people buy—is \$50,000 a day, which is shown by the area of the green triangle. (The base of the triangle is 10,000 pizzas a day and its height is \$10, so its area is $(10,000 \times \$10) \div 2 = \$50,000$.)

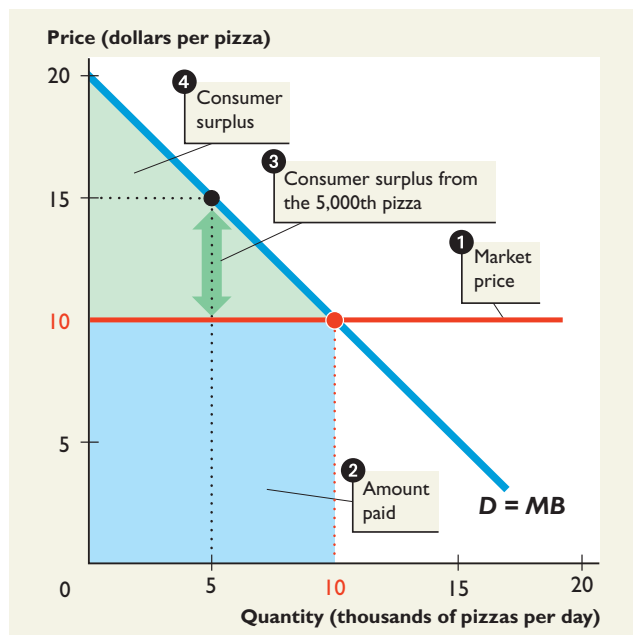
The total benefit is the amount paid, \$100,000 (blue rectangle), plus consumer surplus, \$50,000 (green triangle), and is \$150,000. Consumer surplus is the total benefit minus the amount paid, or net benefit to consumers.

Consumer surplus

The marginal benefit from a good or service in excess of the price paid for it, summed over the quantity consumed.

FIGURE 6.5
Demand and Consumer Surplus

MyEconLab Animation

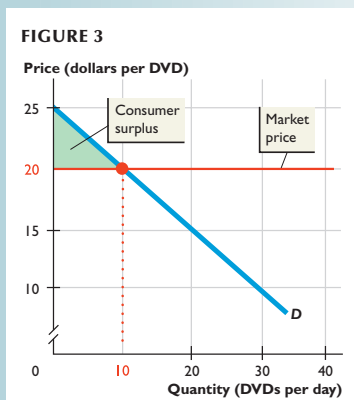
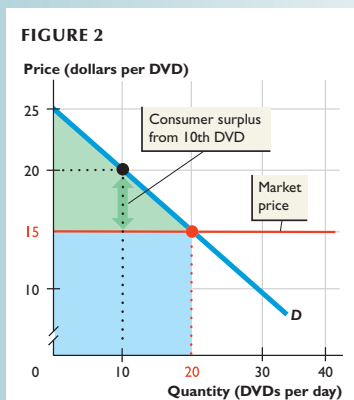
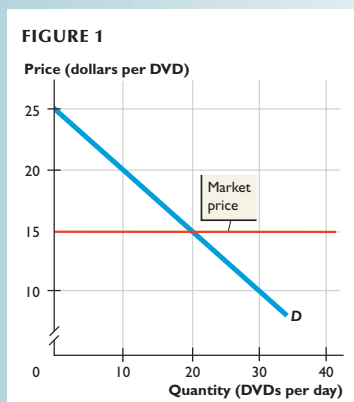


- 1 The market price of a pizza is \$10.
- 2 At the market price, people buy 10,000 pizzas a day and spend \$100,000 on pizza—the blue rectangle.
- 3 The demand curve tells us that people are willing to pay \$15 for the 5,000th pizza, so consumer surplus on the 5,000th pizza is \$5.
- 4 Consumer surplus from the 10,000 pizzas that people buy is \$50,000—the area of the green triangle.

The total benefit from pizza is the \$100,000 that people pay plus the \$50,000 consumer surplus they receive, or \$150,000.

MyEconLab

You can work these problems in Study Plan 6.2 and get instant feedback.



CHECKPOINT 6.2

Distinguish between value and price and define consumer surplus.

Practice Problems

Figure 1 shows the demand curve for DVDs and the market price of a DVD.

1. What is the willingness to pay for the 20th DVD? Calculate the value of the 10th DVD and the consumer surplus on the 10th DVD.
2. What is the quantity of DVDs bought? Calculate the consumer surplus, the amount spent on DVDs, and the total benefit from the DVDs bought.
3. If the price of a DVD rises to \$20, what is the change in consumer surplus?

In the News

Airlines stacked against consumers

The airlines change prices from day to day. For example, the fare on one Delta flight from New York to Los Angeles jumped from \$755 to \$1,143 from a Friday to Saturday in April, then fell to \$718 on Sunday.

Source: boston.com, June 22, 2011

Jodi planned a trip from New York to Los Angeles and was equally happy to travel on Friday, Saturday, or Sunday. The Saturday price was the most she was willing to pay. On which day do you predict she travelled and how much consumer surplus did she receive?

Solutions to Practice Problems

1. The willingness to pay for the 20th DVD is the price on the demand curve at 20 DVDs, which is \$15 (Figure 2). The value of the 10th DVD is its marginal benefit which is also the maximum price that someone is willing to pay for it. In Figure 2, the value of the 10th DVD is \$20. The consumer surplus on the 10th DVD is its marginal benefit minus the price paid for the DVD, which is $\$20 - \$15 = \$5$ (the length of the green arrow in Figure 2).
2. The quantity of DVDs bought is 20 a day, and the consumer surplus is $(\$25 - \$15) \times 20 \div 2 = \$100$ (the green triangle in Figure 2). The amount spent on DVDs is the price multiplied by the quantity bought, which is $\$15 \times 20 = \300 (the area of the blue rectangle in Figure 2). The total benefit from DVDs is the amount spent on DVDs plus the consumer surplus from DVDs, which is $\$300 + \$100 = \$400$.
3. If the price rises to \$20, the quantity bought decreases to 10 a day. Consumer surplus decreases to $(\$25 - \$20) \times 10 \div 2 = \$25$ (the area of the green triangle in Figure 3). Consumer surplus decreases by \$75 (from \$100 to \$25).

Solution to In the News

Being equally happy to travel on any of the three days means that Jodi's marginal benefit from the trip was the same on each day. Because Saturday's price of \$1,143 was the most she was willing to pay, that is her marginal benefit. Being rational, Jodi would travel on the day with the lowest price, Sunday, and pay a fare of \$718. Her consumer surplus would be her marginal benefit of \$1,143 minus the price she paid, \$718, which equals \$425.

6.3 COST, PRICE, AND PRODUCER SURPLUS

You are now going to learn about cost, price, and producer surplus, which parallels what you've learned about value, price, and consumer surplus.

Supply and Marginal Cost

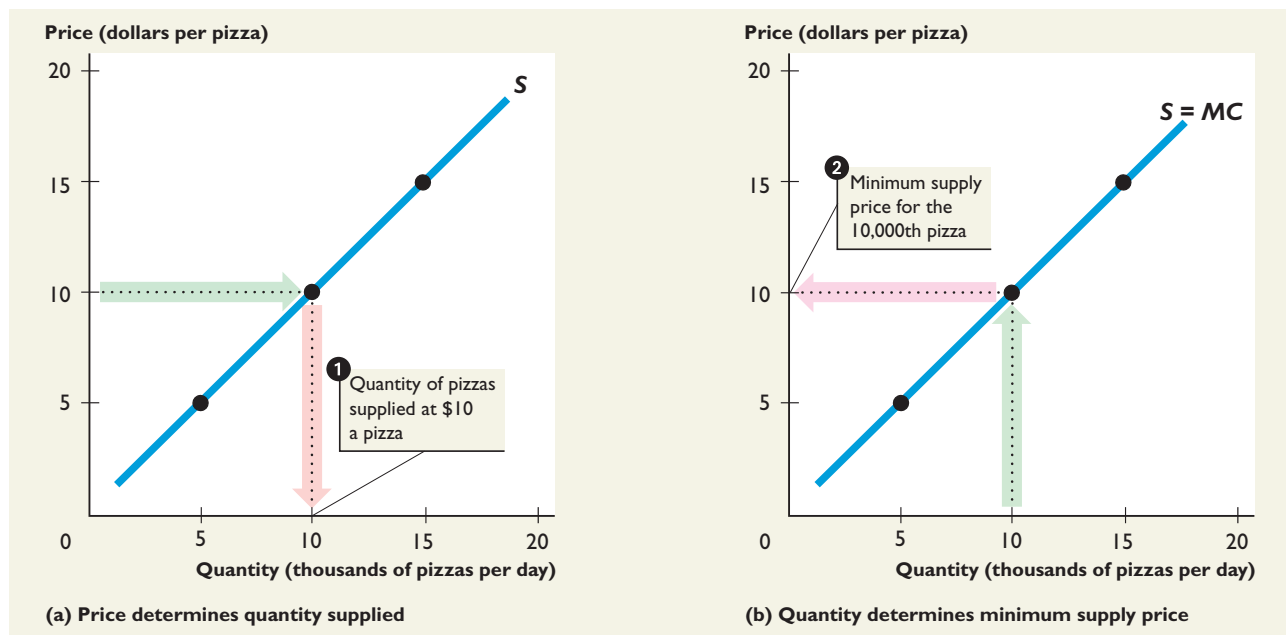
Just as buyers distinguish between *value* and *price*, so sellers distinguish between *cost* and *price*. Cost is what a seller must give up to produce the good, and price is what a seller receives when the good is sold. The cost of producing one more unit of a good or service is its *marginal cost*. It is just worth producing one more unit of a good or service if the price for which it can be sold equals marginal cost. The supply curve tells us this price. In Figure 6.6(a), the supply curve shows the quantity supplied at a given price—when the price of a pizza is \$10, the quantity supplied is 10,000 pizzas a day. In Figure 6.6(b), the supply curve shows the minimum price that producers must receive to supply a given quantity—to supply 10,000 pizzas a day, producers must be able to get at least \$10 for the 10,000th pizza. The marginal cost of the 10,000th pizza is \$10. So:

A supply curve is a marginal cost curve. The supply curve of pizza tells us the dollars' worth of other goods and services that people must forgo if firms produce one more pizza.

FIGURE 6.6

Supply, Minimum Supply Price, and Marginal Cost

MyEconLab Animation



1 The supply curve of pizza, S , shows the quantity of pizza supplied at each price, other things remaining the same. At \$10 a pizza, the quantity supplied is 10,000 pizzas a day.

2 The supply curve shows the minimum price that firms must be offered to supply a given quantity. The minimum supply price equals marginal cost, which for the 10,000th pizza is \$10. The supply curve is also the marginal cost curve MC .

Producer surplus

The price of a good in excess of the marginal cost of producing it, summed over the quantity produced.

Producer Surplus

When the price exceeds marginal cost, the firm obtains a producer surplus. **Producer surplus** is the excess of the price of a good over the marginal cost of producing it, summed over the quantity produced.

Figure 6.7 illustrates the producer surplus for pizza producers. The supply curve of pizza tells us the quantity of pizza that producers plan to sell at each price. The supply curve also tells us the marginal cost of pizza at each quantity produced. If the price of a pizza is \$10, producers plan to sell 10,000 pizzas a day. The total revenue from pizza is \$100,000 per day.

To calculate producer surplus, we must find the producer surplus on each pizza and add these surpluses together. For the 10,000th pizza, marginal cost equals \$10 and producers receive \$10, so the producer surplus on this pizza is zero. For the 5,000th pizza (highlighted in the figure), marginal cost is \$6. So on this pizza, producer surplus is \$10 minus \$6, which is \$4. For the first pizza, marginal cost is \$2, so on this pizza, producer surplus is \$10 minus \$2, which is \$8.

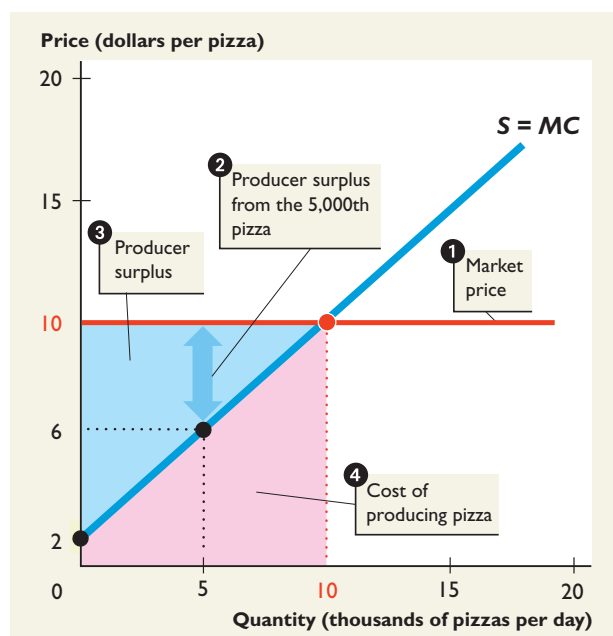
Producer surplus—the sum of the producer surpluses on the 10,000 pizzas that firms produce—is \$40,000 a day, which is shown by the area of the blue triangle. The base of the triangle is 10,000 pizzas a day and its height is \$8, so its area is $(10,000 \times \$8) \div 2 = \$40,000$.

The total cost of producing pizza is the amount received from selling it, \$100,000, minus the producer surplus, \$40,000 (blue triangle), and is \$60,000 (the red area). Producer surplus is the total amount received minus the total cost, or net benefit to producers.

FIGURE 6.7**Supply and Producer Surplus**

MyEconLab Animation

- 1 The market price of a pizza is \$10. At this price, producers plan to sell 10,000 pizzas a day and receive a total revenue of \$100,000 a day.
- 2 The supply curve shows that the marginal cost of the 5,000th pizza a day is \$6, so producers receive a producer surplus of \$4 on the 5,000th pizza.
- 3 Producer surplus from the 10,000 pizzas sold is \$40,000 a day—the area of the blue triangle.
- 4 The cost of producing 10,000 pizzas a day is the red area beneath the marginal cost curve. It equals total revenue of \$100,000 minus producer surplus of \$40,000 and is \$60,000 a day.



CHECKPOINT 6.3

Distinguish between cost and price and define producer surplus.

Practice Problems

Figure 1 shows the supply curve of DVDs and the market price of a DVD.

1. What is the minimum supply price of the 20th DVD? Calculate the marginal cost of the 10th DVD and the producer surplus on the 10th DVD.
2. What is the quantity of DVDs sold? Calculate the producer surplus, the total revenue from the DVDs sold, and the cost of producing the DVDs sold.
3. If the price of a DVD falls to \$10, what is the change in producer surplus?

In the News

Is Australia's ski season headed for a wipeout?

The Australian dollar has soared 26% against the U.S. dollar since last June, making those foreign lift tickets cheaper than those in Australia, and travel agents report a jump in interest in travel to North American ski destinations like Vail and Aspen.

Source: *The Wall Street Journal*, June 6, 2011

As Australians switch from skiing in Australia and flock to Vail and Aspen, how will the Australian ski operators' producer surplus change? How will the Vail and Aspen ski operators' producer surplus change?

Solutions to Practice Problems

1. The minimum supply price of the 20th DVD is the marginal cost of the 20th DVD, which is \$15 (Figure 2). The marginal cost of the 10th DVD is equal to the minimum supply price for the 10th DVD, which is \$10. The producer surplus on the 10th DVD is its market price minus the marginal cost of producing it, which is $\$15 - \$10 = \$5$ (the blue arrow in Figure 2).
2. The quantity sold is 20 a day. Producer surplus equals $(\$15 - \$5) \times 20 \div 2$, which is \$100 (the area of the blue triangle in Figure 2). The total revenue is price multiplied by quantity sold. Total revenue is $\$15 \times 20 = \300 . The cost of producing DVDs equals total revenue minus producer surplus, which is $\$300 - \$100 = \$200$ (the red area in Figure 2).
3. The quantity sold decreases to 10 a day. The producer surplus decreases to $(\$10 - \$5) \times 10 \div 2 = \$25$ (the area of the blue triangle in Figure 3). The change in producer surplus is a decrease of \$75 (from \$100 down to \$25).

Solution to In the News

Producer surplus is the excess of the price of a good over the marginal cost of producing it, summed over the quantity produced.

In Australia, the demand for ski tickets decreases, the price and quantity of tickets sold decreases, and Australian ski operators' producer surplus decreases.

In Vail and Aspen, the demand for ski tickets increases, the price and quantity of tickets sold increases, and ski operators' producer surplus increases.

MyEconLab

You can work these problems in Study Plan 6.3 and get instant feedback.

FIGURE 1



FIGURE 2

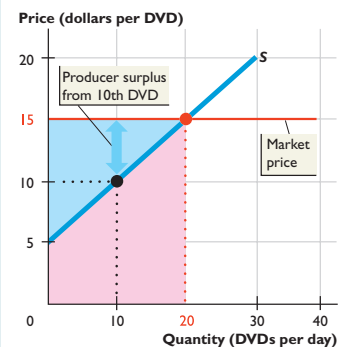
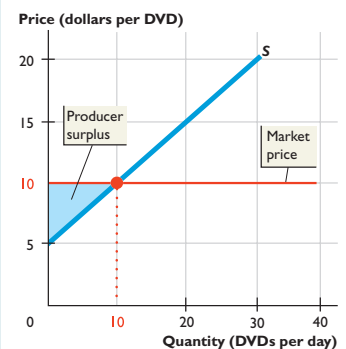


FIGURE 3



6.4 ARE MARKETS EFFICIENT?

Figure 6.8 shows the market for pizza. The demand curve is D , the supply curve is S , the equilibrium price is \$10 a pizza, and the equilibrium quantity is 10,000 pizzas a day. The market forces that you studied in Chapter 4 (pp. 99–100) pull the pizza market to its equilibrium and coordinate the plans of buyers and sellers. But does this competitive equilibrium deliver the efficient quantity of pizza?

If the equilibrium is efficient, it does more than coordinate plans. It coordinates them in the best possible way. Resources are used to produce the quantity of pizza that people value most highly. It is not possible to produce more pizza without giving up some of another good or service that is valued more highly. And if a smaller quantity of pizza is produced, resources are used to produce some other good that is not valued as highly as the pizza that is forgone.

■ Marginal Benefit Equals Marginal Cost

To check whether the equilibrium in Figure 6.8 is efficient, recall the interpretation of the demand curve as a marginal benefit curve and the supply curve as a marginal cost curve. The demand curve tells us the marginal benefit from pizza. The supply curve tells us the marginal cost of pizza. Where the demand curve and the supply curve intersect, marginal benefit equals marginal cost.

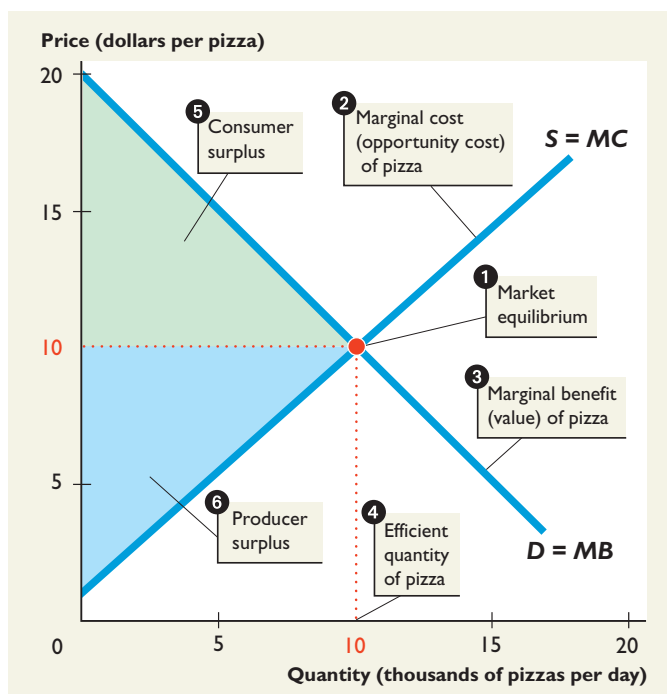
FIGURE 6.8

An Efficient Market for Pizza

MyEconLab Animation

- 1 Market equilibrium occurs at a price of \$10 a pizza and a quantity of 10,000 pizzas a day.
- 2 The supply curve is also the marginal cost curve.
- 3 The demand curve is also the marginal benefit curve.

Because at the market equilibrium, marginal benefit equals marginal cost, the 4 efficient quantity of pizza is produced. The sum of the 5 consumer surplus and 6 producer surplus is maximized.



This condition—marginal benefit equals marginal cost—is the condition that delivers an efficient use of resources. Because a competitive equilibrium allocates resources to the activities that create the greatest possible value, it is efficient.

■ Total Surplus Is Maximized

Another way of checking that the equilibrium is efficient is to look at the total surplus that it generates. **Total surplus** is the sum of producer surplus and consumer surplus. A price above the equilibrium might increase producer surplus, but it would decrease consumer surplus by more. And a price below the equilibrium price might increase consumer surplus, but it would decrease producer surplus by more. The competitive equilibrium price maximizes total surplus.

Total surplus
The sum of producer surplus and consumer surplus.

In Figure 6.8, if production is less than 10,000 pizzas a day, someone is willing to buy a pizza for more than it costs to produce. Buyers and sellers will gain if production increases. If production exceeds 10,000 pizzas a day, it costs more to produce a pizza than anyone is willing to pay for it. Buyers and sellers will gain if production decreases. Only when 10,000 pizzas a day are produced is there no unexploited gain from changing the quantity of pizza produced, and total surplus is maximized.

Buyers and sellers each attempt to do the best they can for themselves—they pursue their self-interest. No one plans for an efficient outcome for society as a whole. No one worries about the social interest. Buyers seek the lowest possible price, and sellers seek the highest possible price. But as buyers and sellers pursue their self-interest, this astonishing outcome occurs: The social interest is served.

■ The Invisible Hand

Writing in his *Wealth of Nations* in 1776, Adam Smith was the first to suggest that competitive markets send resources to the uses in which they have the highest value. Smith believed that each participant in a competitive market is “led by an invisible hand to promote an end [the efficient use of resources] which was no part of his intention.”

You can see the effects of the invisible hand at work every day. Your campus bookstore is stuffed with texts at the start of each term. It has the quantities that it predicts students will buy. The coffee shop has the variety and quantities of drinks and snacks that people plan to buy. Your local clothing store has the sweatpants and socks and other items that you plan to buy. Truckloads of textbooks, coffee and cookies, and sweatpants and socks roll along our highways and bring these items to where you and your friends want to buy them. Firms that don’t know you anticipate your wants and work hard to help you satisfy them.

No government organizes all this production, and no government auditor monitors producers to ensure that they serve the social interest. The allocation of scarce resources is not planned. It happens because prices adjust to make buying plans and selling plans compatible, and it happens in a way that sends resources to the uses in which they have the highest value.

Adam Smith explained why all this amazing activity occurs. “It is not from the benevolence of the butcher, the brewer, or the baker that we expect our dinner,” he wrote, “but from their regard to their own interest.”

Publishing companies, coffee growers, garment manufacturers, and a host of other producers are led by their regard for *their* own interest to serve *your* interest.



EYE on the U.S. ECONOMY

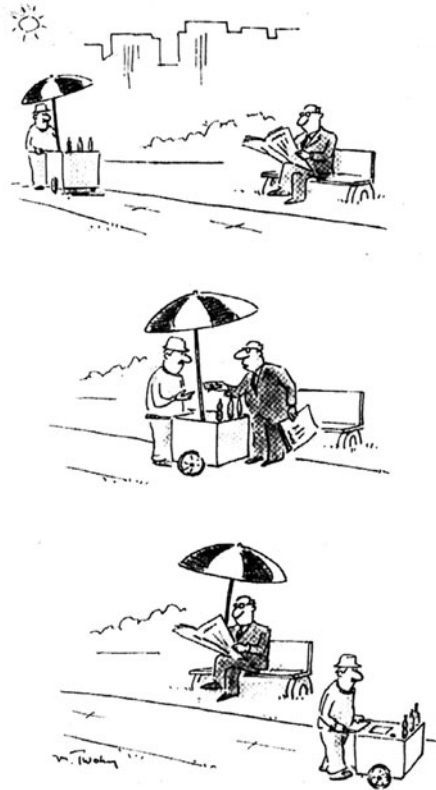
The Invisible Hand and e-Commerce

You can see the influence of the invisible hand at work in the cartoon and in today's information economy.

The cold drinks vendor has both cold drinks and shade. He has an opportunity cost and a minimum supply price of each item. The park bench reader has a marginal benefit from a cold drink and from shade. The transaction that occurs tells us that for shade, the reader's marginal benefit exceeds the vendor's marginal cost but for a cold drink, the vendor's marginal cost exceeds the reader's marginal benefit. The transaction creates consumer surplus and producer surplus. The vendor obtains a producer surplus from selling the shade for more than its opportunity cost, and the reader obtains a consumer surplus from buying the shade for less than its marginal benefit. In the third frame of the cartoon, both the consumer and the producer are better off than they were in the first frame. The umbrella has moved to its highest-valued use.

The market economy relentlessly performs the activity illustrated in the cartoon to achieve an efficient allocation of resources. New technologies have cut the cost of using the Internet and during the past few years, hundreds of Web sites have been established that are dedicated to facilitating trade in all types of goods, services, and factors of production.

The electronic auction site eBay (<http://www.ebay.com/>), has brought a huge increase in consumer surplus and producer surplus, and helps to achieve ever greater allocative efficiency.



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Market Failure

Markets do not always achieve an efficient outcome. We call a situation in which a market delivers an inefficient outcome one of **market failure**. Market failure can occur because either too little of an item is produced—underproduction—or too much is produced—overproduction.

Market failure

A situation in which the market delivers an inefficient outcome.

Underproduction

In Figure 6.9(a), the quantity of pizza produced is 5,000 a day. At this quantity, consumers are willing to pay \$15 for a pizza that costs only \$6 to produce. The quantity produced is inefficient—there is underproduction.

A **deadweight loss**, which is the decrease in total surplus that results from an inefficient underproduction or overproduction, measures the scale of the inefficiency. The area of the gray triangle in Figure 6.9(a) measures the deadweight loss.

Deadweight loss

The decrease in total surplus that results from an inefficient underproduction or overproduction.

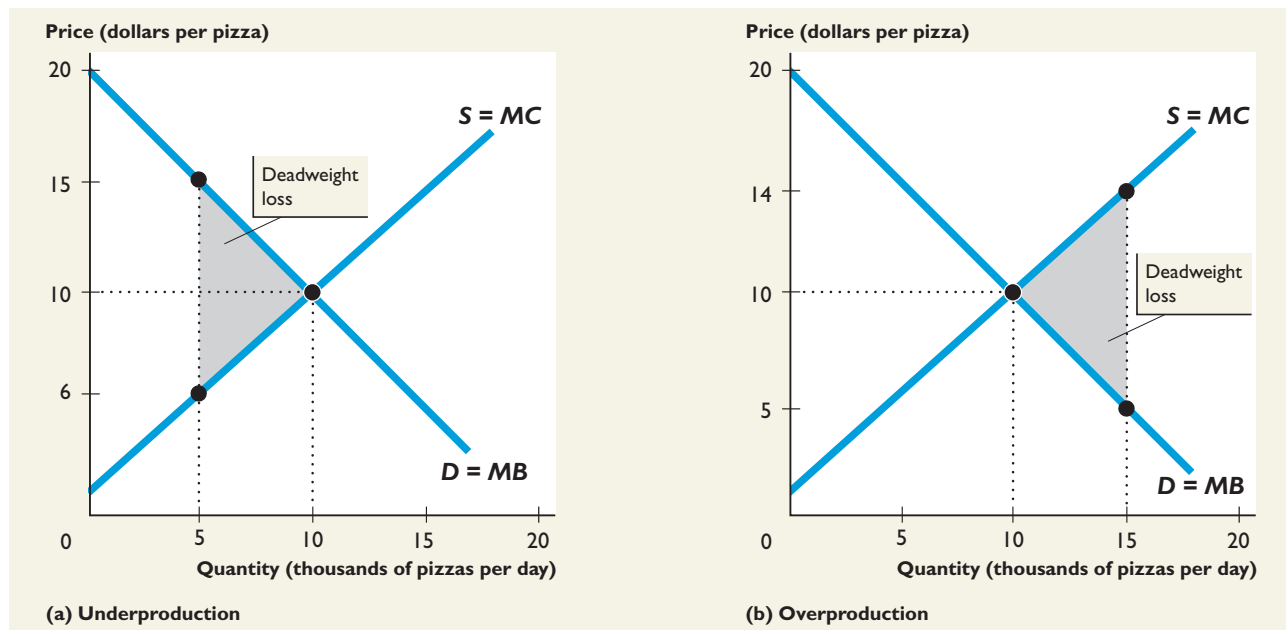
Overproduction

In Figure 6.9(b), the quantity of pizza produced is 15,000 a day. At this quantity, consumers are willing to pay only \$5 for a pizza that costs \$14 to produce. By producing the 15,000th pizza, \$9 is lost. Again, the gray triangle shows the deadweight loss. The total surplus is smaller than its maximum by the amount of the deadweight loss. The deadweight loss is borne by the entire society. It is not a loss for the producer and a gain for the consumers. It is a *social loss*.

FIGURE 6.9

Inefficient Outcomes

MyEconLab Animation



If production is restricted to 5,000 pizzas a day, a deadweight loss (the gray triangle) arises. Total surplus is reduced by the area of the deadweight loss triangle. Underproduction is inefficient.

If production increases to 15,000 pizzas, a deadweight loss arises. Total surplus is reduced by the area of the deadweight loss triangle. Overproduction is inefficient.

■ Sources of Market Failure

Obstacles to efficiency that bring market failure and create deadweight losses are

- Price and quantity regulations
- Taxes and subsidies
- Externalities
- Public goods and common resources
- Monopoly
- High transactions costs

Price and Quantity Regulations

Price regulations that put a cap on the rent a landlord is permitted to charge and laws that require employers to pay a minimum wage sometimes block the price adjustments that balance the quantity demanded and the quantity supplied and lead to underproduction. *Quantity regulations* that limit the amount that a farm is permitted to produce also lead to underproduction.

Taxes and Subsidies

Taxes increase the prices paid by buyers and lower the prices received by sellers. So taxes decrease the quantity produced and lead to underproduction. *Subsidies*, which are payments by the government to producers, decrease the prices paid by buyers and increase the prices received by sellers. So subsidies increase the quantity produced and lead to overproduction.

Externalities

An *externality* is a cost or a benefit that affects someone other than the seller and the buyer of a good. An electric utility creates an *external cost* by burning coal that brings acid rain and crop damage. The utility doesn't consider the cost of pollution when it decides how much power to produce. The result is overproduction.

A condominium owner would provide an *external benefit* if she installed a smoke detector. But she doesn't consider her neighbor's marginal benefit and decides not to install a smoke detector. The result is underproduction.

Public Goods and Common Resources

A *public good* benefits everyone and no one can be excluded from its benefits. National defense is an example. It is in everyone's self-interest to avoid paying for a public good (called the *free-rider problem*), which leads to its underproduction.

A *common resource* is owned by no one but used by everyone. Atlantic salmon is an example. It is in everyone's self-interest to ignore the costs of their own use of a common resource that fall on others (called the *tragedy of the commons*), which leads to overproduction.

Monopoly

A *monopoly* is a firm that is the sole provider of a good or service. Local water supply and cable television are supplied by firms that are monopolies.

The self-interest of a monopoly is to maximize its profit. Because the monopoly has no competitors, it can set the price to achieve its self-interested goal. To achieve its goal, a monopoly produces too little and charges too high a price, which leads to underproduction.

High Transactions Costs

Stroll around a shopping mall and observe the retail markets in which you participate. You'll see that these markets employ enormous quantities of scarce labor and capital resources. It is costly to operate any market. Economists call the opportunity costs of making trades in a market **transactions costs**.

To use market prices as the allocators of scarce resources, it must be worth bearing the opportunity cost of establishing a market. Some markets are just too costly to operate. For example, when you want to play tennis on your local "free" court, you don't pay a market price for your slot on the court. You hang around until the court becomes vacant, and you "pay" with your waiting time.

When transactions costs are high, the market might underproduce.

Transactions costs

The opportunity costs of making trades in a market.

■ Alternatives to the Market

When a market is inefficient, can one of the alternative non-market methods that we described at the beginning of this chapter do a better job? Sometimes it can.

Table 6.1 summarizes the sources of market failure and the possible remedies. Often, majority rule might be used, but majority rule has its own shortcomings. A group that pursues the self-interest of its members can become the majority. For example, price and quantity regulations that create deadweight loss are almost always the result of a self-interested group becoming the majority and imposing costs on the minority. Also, with majority rule, votes must be translated into actions by bureaucrats who have their own agendas.

Managers in firms issue commands and avoid the transactions costs that they would incur if they went to a market every time they needed a job done. First-come, first-served saves a lot of hassle in waiting lines. These lines could have markets in which people trade their place in the line—but someone would have to enforce the agreements. Can you imagine the hassle at a busy Starbucks if you had to buy your spot at the head of the line?

There is no one mechanism for allocating resources efficiently. But markets bypassed by command systems inside firms and supplemented by majority rule and first-come, first-served do an amazingly good job.

■ **Table 6.1**

Market Failure and Some Possible Remedies

| Reason for market failure | Possible remedy |
|-----------------------------------|---|
| 1. Price and quantity regulations | Remove regulation by majority rule |
| 2. Taxes and subsidies | Minimize deadweight loss by majority rule |
| 3. Externalities | Minimize deadweight loss by majority rule |
| 4. Public goods | Allocate by majority rule |
| 5. Common resources | Allocate by majority rule |
| 6. Monopoly | Regulate by majority rule |
| 7. High transactions costs | Command or first-come, first-served |

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You can work these problems in Study Plan 6.4 and get instant feedback.



CHECKPOINT 6.4

Evaluate the efficiency of the alternative methods of allocating resources.

Practice Problems

Figure 1 shows the market for paper.

1. At the market equilibrium, what are consumer surplus, producer surplus, and total surplus? Is the market for paper efficient? Why or why not?
2. Lobbyists for a group of news magazines persuade the government to pass a law that requires producers to sell 50 tons of paper a day. Is the market for paper efficient? Why or why not? Shade the deadweight loss on the figure.
3. An environmental lobbying group persuades the government to pass a law that limits the quantity of paper that producers sell to 20 tons a day. Is the market for paper efficient? If not, what is the deadweight loss?

In the News

Senate votes to end ethanol subsidies

The Senate has voted to end the \$6 billion a year in subsidies paid to the ethanol industry for the past three decades. Refiners would lose the 45-cent-a-gallon subsidy, and the tax on imported ethanol would be eliminated.

Source: *USA Today*, June 16, 2011

Describe the efficiency of the market for ethanol with the \$6 billion subsidies in place. If the subsidies and taxes are eliminated, explain how the efficiency of the market for ethanol would change.

Solutions to Practice Problems

1. Market equilibrium is 40 tons a day at a price of \$3 a ton (Figure 2).
 Consumer surplus = $(\$9 - \$3) \times 40 \div 2 = \$120$ (the area of the green triangle in Figure 2).
 Producer surplus is $(\$3 - \$1) \times 40 \div 2$, which equals \$40 (the area of the blue triangle in Figure 2).
 Total surplus is the sum of consumer surplus and producer surplus, which is \$160.
 The market is efficient because marginal benefit (on the demand curve) equals marginal cost (on the supply curve) and total surplus (consumer surplus plus producer surplus) is maximized.
2. The market is inefficient because marginal cost exceeds marginal benefit. Deadweight loss is the area of the gray triangle 1 in Figure 3.
3. This market is now inefficient because marginal benefit exceeds marginal cost. The deadweight loss is the area of the gray triangle 2 in Figure 3.

Solution to In the News

Subsidies to producers increase the supply of the good, which decreases the market price. The price received by producers equals the market price plus the subsidy per gallon, which results in overproduction and inefficiency. A deadweight loss arises. By eliminating the subsidies and taxes, overproduction will decrease. The market for ethanol will be more efficient, and the deadweight loss will decrease.

FIGURE 1

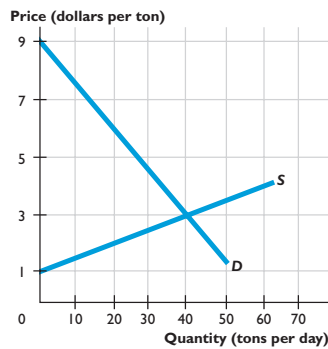


FIGURE 2

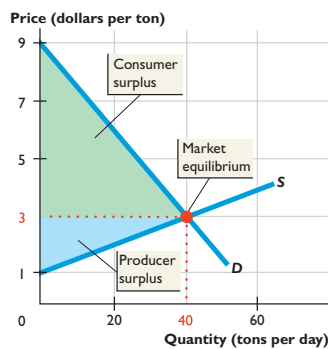
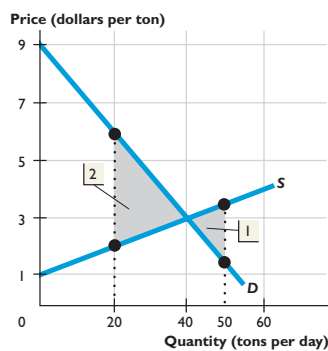


FIGURE 3



6.5 ARE MARKETS FAIR?

Following a severe winter storm or hurricane, the prices of many essential items jump. Is it fair that disaster victims should be hit with higher prices? Many low-skilled people work for a wage that is below what most would regard as a living wage. Is that fair? How do we decide whether something is fair or unfair?

Economists have a clear definition of efficiency but they do not have a similarly clear definition of fairness. Also, ideas about fairness are not exclusively economic ideas. They involve the study of ethics.

To study ideas about fairness, think of economic life as a game—a serious game—that has *rules* and a *result*. Two broad and generally conflicting approaches to fairness are

- It's not fair if the *rules* aren't fair.
- It's not fair if the *result* isn't fair.

■ It's Not Fair If the *Rules* Aren't Fair

Harvard philosopher Robert Nozick argued for the fair rules view in a book entitled *Anarchy, State, and Utopia*, published in 1974. Nozick argued that fairness requires two rules:

- The state must establish and protect private property rights.
- Goods and services and the services of factors of production may be transferred from one person to another only by voluntary exchange with everyone free to engage in such exchange.

The first rule says that everything that is valuable—all scarce resources and goods—must be owned by individuals and that the state must protect private property rights. The second rule says that the only way a person can acquire something is to buy it in voluntary trade.

If these rules are followed, says Nozick, the outcome is fair. It doesn't matter how unequally the economic pie is shared provided that the people who bake it supply their services voluntarily in exchange for the share of the pie offered in compensation. Opportunity is equal but the result might be unequal. This fair rules approach is consistent with allocative efficiency.

■ It's Not Fair If the *Result* Isn't Fair

Most people think that the fair rules approach leads to too much inequality—to an unfair result: For example, that it is unfair for a bank president to earn millions of dollars a year while a bank teller earns only thousands of dollars a year.

But what is “too unequal”? Is it fair for some people to receive twice as much as others but not ten times as much or a hundred times as much? Or is all that matters that the poorest people shouldn't be “too poor”?

There is no easy answer to these questions. Generally, greater equality is regarded as good but there is no measure of the most desirable shares.

The fair result approach conflicts with allocative efficiency and leads to what is called the **big tradeoff**—a tradeoff between efficiency and fairness that recognizes the cost of making income transfers.

The big tradeoff is based on the fact that income can be transferred to people with low incomes only by taxing people with high incomes. But taxing people's

Big tradeoff

A tradeoff between efficiency and fairness that recognizes the cost of making income transfers.



EYE on PRICE GOUGING

Should Price Gouging Be Illegal?

Price gouging is the practice of selling an essential item for a much higher price than normal, and usually occurs following a natural disaster. In Florida and Texas, where hurricanes happen all too often, price gouging is illegal.

Whether price gouging *should* be illegal depends on the view of fairness employed and on the facts about whether the buyers or the sellers are the poorer group.

The standard view of economists is that price gouging should *not* be illegal and that it is the expected and *efficient* response to a change in demand.

After a hurricane, the demand for items such as generators, pumps, lamps, gasoline, and camp stoves increases and the prices of these items rise in a natural response to the change in demand.

The figure illustrates the market for camp stoves. The supply of stoves is the curve S , and in normal times, the demand for stoves is D_0 . The price is \$20 per stove and the equilibrium quantity is 5 stoves per day.

Following a hurricane that results in a lengthy power failure, the demand for camp stoves increases to D_1 . Provided there is no price gouging law, the equilibrium price of a stove jumps to \$40 and the equilibrium quantity increases to 7 stoves per day.

This outcome is efficient because the marginal cost of a stove (on the supply curve) equals the marginal benefit from a stove (on the demand curve).

If a strict price gouging law requires the price after the hurricane to be the same as the price before the hurricane,

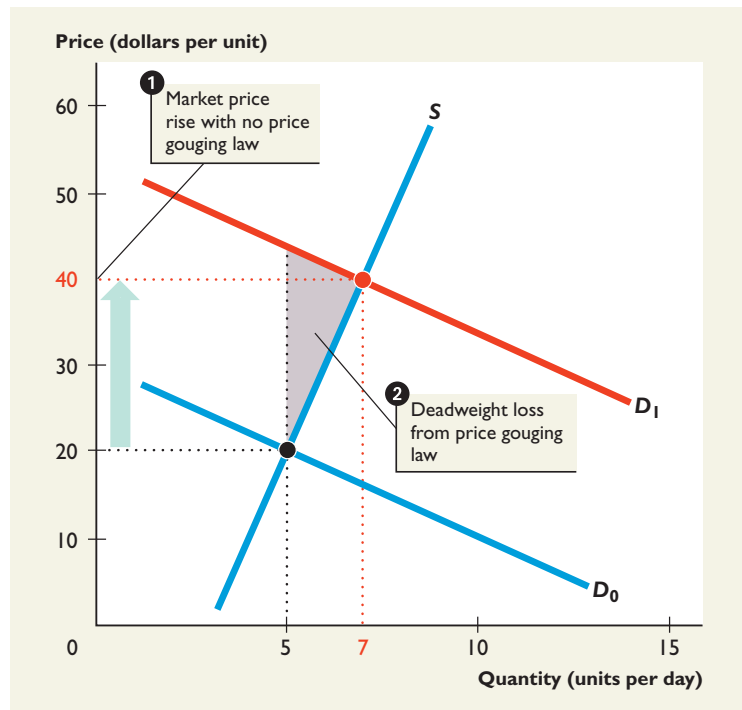
the price of a stove is stuck at \$20.

At this price, the quantity of stoves supplied remains at 5 per day and a deadweight loss shown by the gray triangle arises. The price gouging law is inefficient, and the price rise is efficient.

Whether a doubling of the price is *fair* depends on the idea of fairness used. On the *fair rules* view, the price rise is fair. Trade is voluntary and both the buyer and the seller are better off. On the *fair outcome* view, the price rise might be considered unfair if the buyers are poor and the sellers are rich. But if the buyers are rich and the sellers are poor, the price rise would be considered fair even on the fair result view.

After Hurricane Katrina, John Shepperson bought 19 generators, loaded them into a rented U-Haul vehicle, and drove the 600 miles from his home in Kentucky to a place in Mississippi that had no power. He offered his generators to eager buyers for twice the price he had paid for them. But before he could complete a sale, the Mississippi police swooped in on him. They confiscated his generators and put him in jail for four days. His crime: price gouging.

Was it efficient to stop Mr. Shepperson from selling his generators? Was it fair either to him or his deprived customers?





EYE on YOUR LIFE

Allocation Methods, Efficiency, and Fairness

You live in the national economy, your state economy, your regional economy, and your own household economy. The many decisions you must make affect efficiency and fairness at all these levels. Think about your household economy.

Make a spreadsheet and on it identify all the factors of production that your household owns. Count all the person-hours available and any capi-

tal. Show how these resources are allocated.

By what methods are your household's scarce resources allocated? Identify those allocated by market price; by command; by first-come, first-served; and by equal shares. Are any resources allocated by majority vote?

Now the tough part: Are these resources allocated efficiently—is the

value of your household's resources maximized? Think about how you can check whether marginal benefit equals marginal cost for each of your household's activities.

And now an even tougher question: Are your household's resources allocated fairly? Think about the two ideas of fairness and how they apply in your household.

income from employment discourages work. It results in the quantity of labor being less than the efficient quantity. Taxing people's income from capital discourages saving. It results in the quantity of capital being less than the efficient quantity. With smaller quantities of both labor and capital, the quantity of goods and services produced is less than the efficient quantity. The economic pie shrinks.

Income redistribution creates a tradeoff between the size of the economic pie and the equality with which it is shared. The greater the scale of income redistribution through income taxes, the greater is the inefficiency—the smaller is the pie.

There is a second source of inefficiency: A dollar taken from a rich person does not end up as a dollar in the hands of a poorer person. Some of the dollar is spent on administration of the tax and transfer system, which includes the cost of accountants, auditors, and lawyers. These activities use skilled labor and capital resources that could otherwise be used to produce other goods and services that people value.

You can see that when all these costs are taken into account, transferring a dollar from a rich person does not give a dollar to a poor person. It is even possible that those with low incomes end up being worse off. For example, if a highly taxed entrepreneur decides to work less hard and shut down a business, low-income workers get fired and must seek other, perhaps even lower-paid, work.

■ Compromise

Most people, and probably most economists, have sympathy with the Nozick view but think it too extreme. They see a role for taxes and government income support schemes to transfer some income from the rich to the poor. Such transfers could be considered voluntary in the sense that they are decided by majority voting, and even those who vote against such transfers voluntarily participate in the political process. Once we agree that using the tax system to make transfers from the rich to the poor is fair, we need to determine just what we mean by a fair tax.

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You can work these problems in Study Plan 6.5 and get instant feedback.

CHECKPOINT 6.5

Explain the main ideas about fairness and evaluate the fairness of the alternative methods of allocating scarce resources.

Practice Problems

A winter storm cuts the power supply and isolates a small town in the mountains. The people rush to buy candles from the town store, which is the only source of candles. The store owner decides to ration the candles to one per family but to keep the price of a candle unchanged.

1. Who gets to use the candles? Who receives the consumer surplus and who receives the producer surplus on candles?
2. Is the allocation efficient? Is the allocation fair?

In the News**National parks to offer free-entry weekends**

Interior Secretary Ken Salazar said he hoped American families would take the opportunity during these hard times to enjoy an affordable weekend vacation in our national parks. Most Americans live within an hour's drive of a national park.

Source: *Los Angeles Times*, June 3, 2009

Which families will be most likely to visit the national parks on the free weekends? Is the policy to waive the admission fair?

Solutions to Practice Problems

1. The people who buy candles from the town store are not necessarily the people who use the candles. A buyer from the town store can sell a candle and will do so if he or she can get a price that exceeds his or her marginal benefit. The people who value the candles most—who are willing to pay the most—will use the candles.
Only the people who are willing to pay the most for candles receive the consumer surplus on candles, and the store owner receives the same producer surplus as normal. People who sell the candles they buy from the store receive additional producer surplus.
2. The allocation is efficient because the people who value the candles most use them. Two views of fairness: The rules view is that if the rule of one candle per family is followed and exchange is voluntary, then the outcome is fair. But the results view is that if the candles are allocated unequally, then the allocation is unfair.

Solution to In the News

Most of the families will be those who own a car and do not work on weekends. The idea of waiving the admission is to allow families to enjoy an affordable vacation in these hard times. If the families hit by the hard times are the ones that visit the national parks, then, in the fair result view, the policy is fair. But if families hit by the hard times are the ones who do not visit, then, in the fair result view, the policy is unfair. If the families who visit the national parks do so voluntarily, then, no matter which families visit, in the fair rules view, the policy is fair.

CHAPTER SUMMARY

Key Points

- 1 Describe the alternative methods of allocating scarce resources and define and explain the features of an efficient allocation.**
 - The methods of allocating scarce resources are market price; command; majority rule; contest; first-come, first-served; sharing equally; lottery; personal characteristics; and force.
 - Allocative efficiency occurs when resources are used to create the greatest value, which means that marginal benefit equals marginal cost.
- 2 Distinguish between value and price and define consumer surplus.**
 - Marginal benefit is measured by the maximum price that consumers are willing to pay for another unit of a good or service.
 - A demand curve is a marginal benefit curve.
 - Value is what people are *willing to pay*; price is what they *must* pay.
 - Consumer surplus equals the excess of marginal benefit over price, summed over the quantity consumed.
- 3 Distinguish between cost and price and define producer surplus.**
 - Marginal cost is measured by the minimum price producers must be offered to increase production by one unit.
 - A supply curve is a marginal cost curve.
 - Opportunity cost is what producers *must* pay; price is what they *receive*.
 - Producer surplus equals the excess of price over marginal cost, summed over the quantity produced.
- 4 Evaluate the efficiency of the alternative methods of allocating resources.**
 - In a competitive equilibrium, marginal benefit equals marginal cost and resource allocation is efficient.
 - Price and quantity regulations, taxes, subsidies, externalities, public goods, common resources, monopoly, and high transactions costs lead to market failure and create deadweight loss.
- 5 Explain the main ideas about fairness and evaluate the fairness of the alternative methods of allocating scarce resources.**
 - Ideas about fairness divide into two groups: fair *results* and fair *rules*.
 - Fair rules require private property rights and voluntary exchange, and fair results require income transfers from the rich to the poor.

Key Terms

Allocative efficiency, 141
 Big tradeoff, 159
 Command system, 139
 Consumer surplus, 147

Deadweight loss, 155
 Market failure, 155
 Producer surplus, 150

Production possibilities frontier, 141
 Total surplus, 153
 Transactions costs, 157

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You can work these problems in Chapter 6 Study Plan and get instant feedback.

TABLE 1

| Price (dollars per sandwich) | Quantity demanded (sandwiches per hour) | Quantity supplied |
|------------------------------------|---|----------------------|
| 0 | 400 | 0 |
| 1 | 350 | 50 |
| 2 | 300 | 100 |
| 3 | 250 | 150 |
| 4 | 200 | 200 |
| 5 | 150 | 250 |
| 6 | 100 | 300 |
| 7 | 50 | 350 |
| 8 | 0 | 400 |

TABLE 2

| Price (dollars per bag) | Quantity demanded before flood | Quantity demanded during flood | Quantity supplied |
|-------------------------------|---|---|----------------------|
| | (thousands of bags) | | |
| 0 | 40 | 70 | 0 |
| 1 | 35 | 65 | 5 |
| 2 | 30 | 60 | 10 |
| 3 | 25 | 55 | 15 |
| 4 | 20 | 50 | 20 |
| 5 | 15 | 45 | 25 |
| 6 | 10 | 40 | 30 |
| 7 | 5 | 35 | 35 |
| 8 | 0 | 30 | 40 |

CHAPTER CHECKPOINT

Study Plan Problems and Applications

At McDonald's, no reservations are accepted; at Puck's at the St. Louis Art Museum, reservations are accepted; at the Bissell Mansion restaurant, reservations are essential. Use this information to answer Problems 1 to 3.

1. Describe the method of allocating table resources in these three restaurants.
2. Why do you think restaurants have different reservation policies, and why might each restaurant be using an efficient allocation method?
3. Why don't all restaurants use the market price to allocate their tables?

Table 1 shows the demand and supply schedules for sandwiches. Use Table 1 to work Problems 4 to 7.

4. Calculate the equilibrium price of a sandwich, the consumer surplus, and the producer surplus. What is the efficient quantity of sandwiches?
5. If the quantity demanded decreases by 100 sandwiches an hour at each price, what is the equilibrium price and what is the change in total surplus?
6. If the quantity supplied decreases by 100 sandwiches an hour at each price, what is the equilibrium price and what is the change in total surplus?
7. If Sandwiches To Go, Inc., buys all the sandwich producers and cuts production to 100 sandwiches an hour, what is the deadweight loss that is created? If Sandwiches To Go, Inc., rations sandwiches to two per person, by what view of fairness would the allocation be unfair?

Use the following information to work Problems 8 and 9.

Table 2 shows the demand and supply schedules for sandbags before and during a major flood. During the flood, suppose that the government gave all families an equal quantity of sandbags. Resale of sandbags is not permitted.

8. How would total surplus and the price of a sandbag change?
9. Would the outcome be more efficient than if the government took no action? Explain.
10. The winner of the men's or women's tennis singles at the U.S. Open is paid twice as much as the runner-up, but it takes two players to have a singles final. Is this compensation arrangement efficient? Is it fair? Explain why it might illustrate the big tradeoff.

Use the following information to work Problems 11 and 12.

eBay saves billions for bidders

On eBay, the bidder who places the highest bid wins the auction and pays only what the second highest bidder offered. Researchers Wolfgang Jank and Galit Shmueli reported that purchasers on eBay in 2003 paid \$7 billion less than their winning bids. Because each bid shows the buyer's willingness to pay, the winner receives an estimated consumer surplus of \$4 or more.

Source: *InformationWeek*, January 28, 2008

11. What method is used to allocate goods on eBay? How does an eBay auction influence consumer surplus from the good?
12. Does the seller receive a producer surplus? Are auctions on eBay efficient?

Instructor Assignable Problems and Applications

1. Panic in paradise: Are high fares the new reality for Hawaii?

On March 31, 2008, Hawaii lost 15 percent of its air service as Aloha Airlines and the cheap-flight airline ATA suddenly shut down. Stranded travelers were offered flights to West coast cities at \$1,000 one way. Within a month, the fare to west coast cities dropped to about \$200 a round trip. Stranded travelers complained of price gouging.

Source: *USA Today*, April 23, 2008

Under what conditions would the \$1,000 fare be considered “price gouging”? Under what conditions would the \$1,000 fare be an example of the market price method of allocating scarce airline seats?

Table 1 shows the demand schedule for haircuts and the supply schedule of haircuts. Use Table 1 to work Problems 2 and 3.

- What is the quantity of haircuts bought, the value of a haircut, and the total surplus from haircuts?
- Suppose that all salons agree to charge \$40 a haircut. What is the change in consumer surplus, the change in producer surplus, and the deadweight loss created?

In California, farmers pay a lower price for water than do city residents. Use this information to work Problems 4 to 6.

- What is this method of allocation of water resources? Is this allocation of water efficient? Is this use of scarce water fair? Why or why not?
- If farmers were charged the same price as city residents pay, how would the price of agricultural produce, the quantity of produce grown, consumer surplus, and producer surplus change?
- If all water in California is sold for the market equilibrium price, would the allocation of water be more efficient? Why or why not?

Use the following information to work Problems 7 and 8.

The world’s largest tulip and flower market

Every day over 19 million tulips and flowers are auctioned at the Dutch market called “The Bloemenveiling.” These Dutch auctions match buyers and sellers.

Source: Tulip-Bulbs.com

In a Dutch auction, the auctioneer announces the highest price. If no one offers to buy the flowers, the auctioneer lowers the price until a buyer is found.

- What method is used to allocate flowers at the Bloemenveiling?
- How does a Dutch flower auction influence consumer surplus and producer surplus? Are the flower auctions at the Bloemenveiling efficient?
- New Zealand’s private forests**

In the early 1990s, the government auctioned half the national forests, converting these forests from public ownership to private ownership. The government’s decision was an incentive to get the owners to operate like farmers—that is, take care of the resource and to use it to make a profit.

Source: *Reuters*, September 7, 2007

Was the timber industry efficient before the auction and did logging companies operate in the social interest or self-interest? What effect has private ownership had on efficiency of the timber industry?

Your instructor can assign these problems as homework, a quiz, or a test in [MyEconLab](#).

TABLE 1

| Price (dollars per haircut) | Quantity | |
|-----------------------------------|--------------------|----------|
| | demand | supplied |
| | (haircuts per day) | |
| 0 | 100 | 0 |
| 10 | 80 | 0 |
| 20 | 60 | 20 |
| 30 | 40 | 40 |
| 40 | 20 | 60 |
| 50 | 0 | 80 |

MyEconLab

You can work this quiz in Chapter 6 Study Plan and get instant feedback.

Multiple Choice Quiz

1. The method of allocation that most stores use during Thanksgiving sales is:
 - A. a combination of market price and lottery
 - B. first-come, first-served
 - C. a combination of contest and command
 - D. a combination of market price and first-come, first-served
2. All of the following statements are correct *except* _____.
 - A. the value of an additional unit of the good equals the marginal benefit from the good
 - B. marginal benefit is the excess of value over the price paid, summed over the quantity consumed
 - C. the maximum price willingly paid for a unit of a good is the marginal benefit from it
 - D. price is what we pay for a good but value is what we get from it
3. Choose the best statement.
 - A. An increase in the demand for a good increases producer surplus.
 - B. If producers decrease the supply of the good, their producer surplus will increase.
 - C. Producer surplus equals the total revenue from selling the good.
 - D. Producer surplus is the excess of the value of the good over the market price, summed over the quantity produced.
4. The market for a good is efficient if _____.
 - A. the marginal cost of producing the good is minimized
 - B. the marginal benefit from the good is maximized
 - C. the consumer surplus is maximized
 - D. the total surplus is maximized
5. When the marginal benefit from a good exceeds its marginal cost, _____.
 - A. there is overproduction of the good
 - B. a deadweight loss, which is the excess of marginal benefit over marginal cost, arises
 - C. producer surplus decreases and consumer surplus increases
 - D. total production increases and efficiency increases
6. Market failure arises if _____.
 - A. there is overproduction of the good but not if there is underproduction
 - B. the deadweight loss is zero
 - C. producer surplus exceeds consumer surplus
 - D. total surplus is not maximized
7. The allocation of resources is fair _____.
 - A. in the rules view if everyone has equal opportunity
 - B. in the results view if most resources are distributed to the poorest people
 - C. in the rules view if owners of the resources are protected by property rights and all transfers of resources are voluntary
 - D. in the results view if resources are transferred voluntarily so that everyone has the same quantity



Can the President repeal the laws of supply and demand?

Government Actions in Markets



CHAPTER CHECKLIST

When you have completed your study of this chapter, you will be able to

- 1 Explain how taxes change prices and quantities, are shared between buyers and sellers, and create inefficiency.
- 2 Explain how a price ceiling works and show how a rent ceiling creates a housing shortage, inefficiency, and unfairness.
- 3 Explain how a price floor works and show how the minimum wage creates unemployment, inefficiency, and unfairness.
- 4 Explain how a price support in the market for an agricultural product creates a surplus, inefficiency, and unfairness.

7.1 TAXES ON BUYERS AND SELLERS

Almost every time you buy something—a late-night order of chow mein, a plane ticket, a tank of gasoline—you pay a tax. On some items, you pay a sales tax that is added to the advertised price. On other items, you pay an excise tax—often at a high rate like the tax on gasoline—that is included in the advertised price.

But do you really pay these taxes? When a tax is added to the advertised price, isn't it obvious that *you* pay the tax? Isn't the price higher than it otherwise would be by an amount equal to the tax?

What about a tax that is buried in the price, such as that on gasoline? Who pays that tax? Does the seller just pass on the full amount of the tax to you, the buyer? Or does the seller pay the tax by taking a lower price and leaving the price you pay unchanged?

To answer these questions, let's suppose that TIFS, the Tax Illegal File Sharing lobby, has persuaded the government to collect a \$10 tax on every new MP3 player and to use the tax revenue to compensate artists. But an argument is raging between those who claim that the buyer benefits from using the MP3 player and should pay the tax and those who claim that the seller profits and should pay the tax.

■ Tax Incidence

Tax incidence

The division of the burden of a tax between the buyer and the seller.

Tax incidence is the division of the burden of a tax between the buyer and the seller. We're going to find the incidence of a \$10 tax on MP3 players with two different taxes: a tax on the buyer and a tax on the seller.

Figure 7.1 shows the market for MP3 players. With no tax, the equilibrium price is \$100 and the equilibrium quantity is 5,000 players a week.

When a good is taxed, it has two prices: a price that excludes the tax and a price that includes the tax. Buyers respond only to the price that includes the tax, because that is the price they pay. Sellers respond only to the price that excludes the tax, because that is the price they receive. The tax is like a wedge between these two prices.

Figure 7.1(a) shows what happens if the government taxes the buyer. The tax doesn't change the buyer's willingness and ability to pay. The demand curve, D , tells us the *total* amount that buyers are willing and able to pay. Because buyers must pay \$10 to the government on each item bought, the red curve $D - tax$ tells us what the buyers are willing to pay to the sellers. The red curve, $D - tax$, lies \$10 below the blue demand curve.

Market equilibrium occurs where the red $D - tax$ curve intersects the supply curve, S . The buyer pays the equilibrium net-of-tax price \$95 plus the \$10 tax: \$105. The seller receives the net-of-tax price \$95. The government collects a tax revenue of \$10 a player on 2,000 players, or \$20,000 (shown by the purple rectangle).

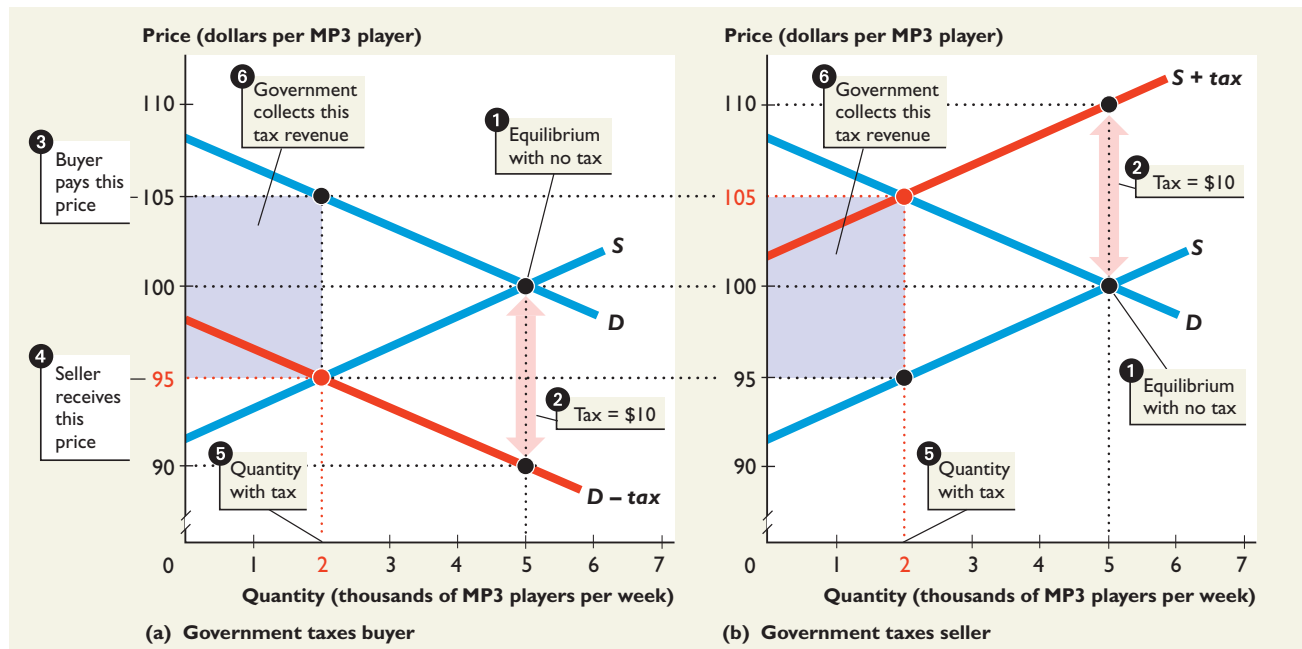
Figure 7.1(b) shows what happens if the government taxes the seller. The tax acts like an increase in the suppliers' cost, so supply decreases and the supply curve shifts to the red curve labeled $S + tax$. This curve tells us what sellers are willing to accept, given that they must pay the government \$10 on each item sold. The red curve, $S + tax$, lies \$10 above the blue supply curve.

Market equilibrium occurs where the red $S + tax$ curve intersects the demand curve, D . The buyer pays the equilibrium price \$105. The seller receives the net-of-tax price \$95. The government collects a tax revenue of \$20,000.

In both cases, the buyer and the seller split the \$10 tax and pay \$5 each.

FIGURE 7.1
A Tax on MP3 Players

MyEconLab Animation



- 1 In both parts of the figure, with no tax, the price of an MP3 player is \$100 and 5,000 players a week are bought.
- 2 In part (a), a \$10 tax on buyers of MP3 players shifts the demand curve down to $D - tax$, and in part (b), a \$10 tax on sellers of MP3 players shifts the supply curve up to $S + tax$.

In both parts of the figure:

- 3 The price paid by the buyer rises to \$105—an increase of \$5;

- 4 The price received by the seller falls to \$95—a decrease of \$5;
- 5 The quantity decreases to 2,000 players a week; and
- 6 The government collects tax revenue of \$20,000 a week—the purple rectangle.

In both cases, the burden of the tax is split equally between the buyer and the seller—each pays \$5 per player.

You can now see that the argument about making the buyer pay or the seller pay is futile. The buyer pays the same price, the seller receives the same price, and the government receives the same tax revenue on the same quantity regardless of whether the government taxes the buyer or the seller.

In this example, the buyer and the seller share the burden of the tax equally. But in most cases, the burden will be shared unequally and might even fall entirely on one side of the market. We'll explore what determines the incidence of a tax, but first, let's see how a tax creates inefficiency.

Taxes and Efficiency

You've seen that resources are used efficiently when marginal benefit equals marginal cost. You've also seen that a tax places a wedge between the price the buyer pays and the price the seller receives. But the buyer's price equals marginal benefit and the seller's price equals marginal cost. So a tax puts a wedge between marginal benefit and marginal cost. The equilibrium quantity is less than the efficient quantity, and a deadweight loss arises.

Figure 7.2 shows the inefficiency of a tax. We'll assume that the government taxes the seller. In part (a), with no tax, marginal benefit equals marginal cost and the market is efficient. In part (b), with a tax, marginal benefit exceeds marginal cost. Consumer surplus and producer surplus shrink. Part of each surplus goes to the government as tax revenue—the purple area—and part of each surplus becomes a deadweight loss—the gray area.

Because a tax creates a deadweight loss, the burden of the tax exceeds the tax revenue. To remind us of this fact, we call the deadweight loss that arises from a tax the **excess burden** of the tax. But because the government uses the tax revenue to provide goods and services that people value, only the excess burden measures the inefficiency of the tax.

In this example, the excess burden is large. You can see how large by calculating the area of the deadweight loss triangle. This area is \$15,000 ($\$10 \times 3,000 \div 2$). The tax revenue is \$20,000, so the excess burden is 75 percent of the tax revenue.

Excess burden

The amount by which the burden of a tax exceeds the tax revenue received by the government—the deadweight loss from a tax.

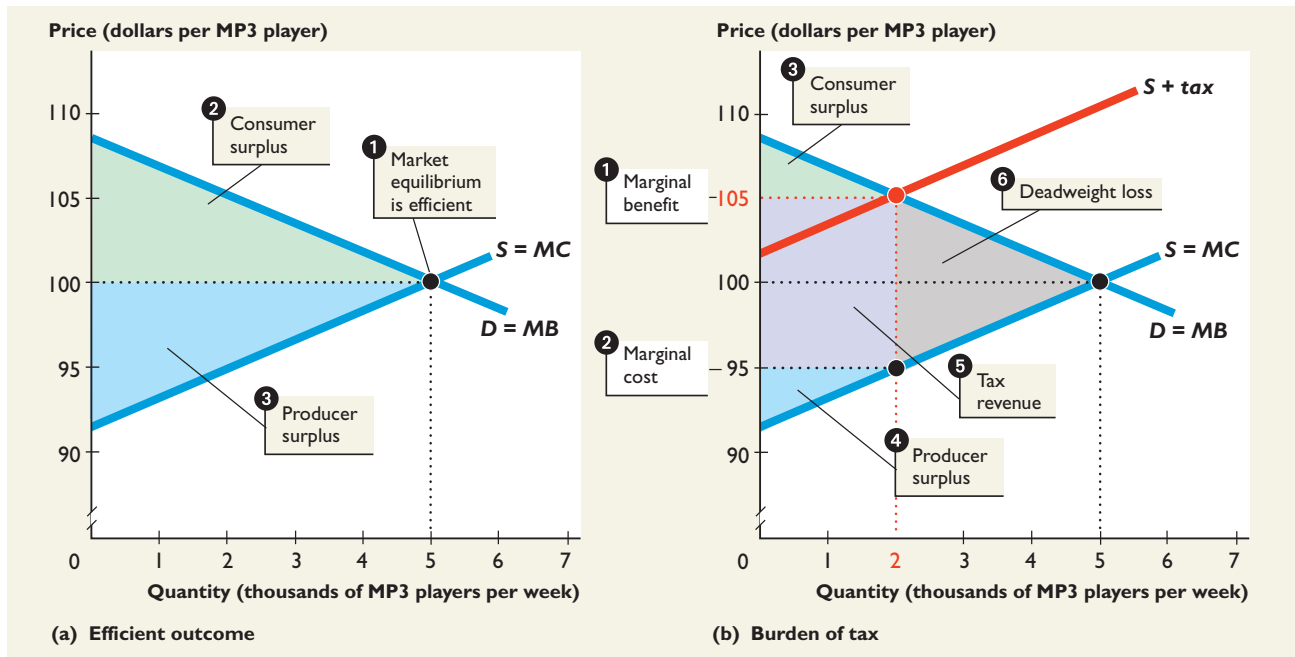
Incidence, Inefficiency, and Elasticity

In the example of a \$10 tax on MP3 players, the buyer and the seller split the tax equally and the excess burden is large. What determines how the tax is split and the size of its excess burden?

FIGURE 7.2

Taxes and Efficiency

MyEconLab Animation



1 The market is efficient with marginal benefit equal to marginal cost. Total surplus—the sum of 2 consumer surplus (green area) and 3 producer surplus (blue area)—is at its maximum possible level.

A \$10 tax drives a wedge between 1 marginal benefit and 2 marginal cost. 3 Consumer surplus and 4 producer surplus shrink by the amount of the 5 tax revenue plus the 6 deadweight loss. The deadweight loss is the excess burden of the tax.

The incidence of a tax and its excess burden depend on the elasticities of demand and supply in the following ways:

- For a given elasticity of supply, the more inelastic the demand for the good, the larger is the share of the tax paid by the buyer.
- For a given elasticity of demand, the more inelastic is the supply of the good, the larger is the share of the tax paid by the seller.
- The excess burden is smaller, the more inelastic is demand *or* supply.

Incidence, Inefficiency, and the Elasticity of Demand

To see how the division of a tax between the buyer and the seller and the size of the excess burden depend on the elasticity of demand, we'll look at two extremes.

Perfectly Inelastic Demand: Buyer Pays and Efficient

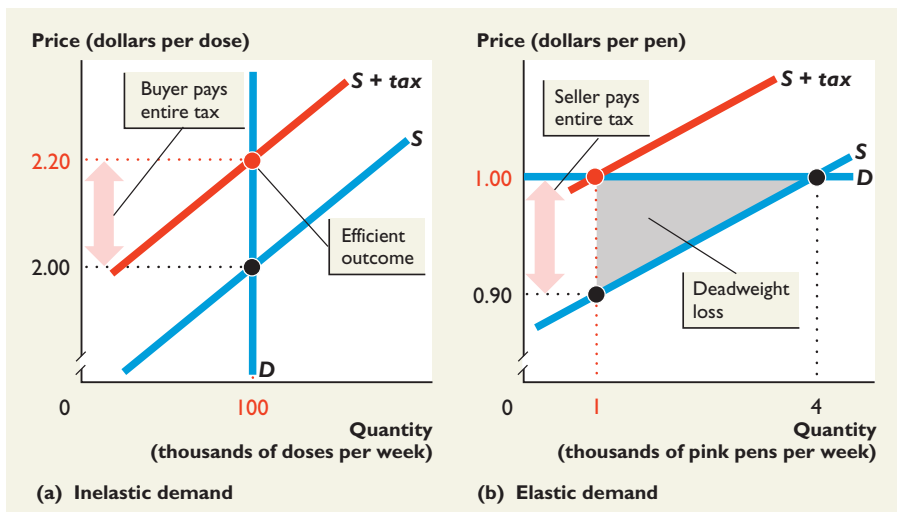
Figure 7.3(a) shows the market for insulin, a vital daily medication of diabetics. Demand is perfectly inelastic at 100,000 doses a week, as shown by the vertical demand curve. With no tax, the price is \$2 a dose. A 20¢ a dose tax raises the price to \$2.20, but the quantity does not change. The tax leaves the price received by the seller unchanged but raises the price paid by the buyer by the entire tax. The outcome is efficient (there is no deadweight loss) because marginal benefit equals marginal cost.

Perfectly Elastic Demand: Seller Pays and Inefficient

Figure 7.3(b) shows the market for pink marker pens. Demand is perfectly elastic at \$1 a pen, as shown by the horizontal demand curve. If pink pens are less expensive than other pens, everyone uses pink. If pink pens are more expensive than other pens, no one uses a pink pen. With no tax, the price of a pink pen is \$1 and the quantity is 4,000 pens a week. A 10¢ a pen tax leaves the price at \$1 a pen, but

FIGURE 7.3
Incidence, Inefficiency, and the Elasticity of Demand

MyEconLab Animation



In part (a), the demand for insulin is perfectly inelastic. A tax of 20¢ a dose raises the price by 20¢, and the buyer pays all the tax. But marginal benefit still equals marginal cost, so the outcome is efficient.

In part (b), the demand for pink marker pens is perfectly elastic. A tax of 10¢ a pen lowers the price received by the seller by 10¢, and the seller pays all the tax. Marginal benefit exceeds marginal cost, so the outcome is inefficient. The deadweight loss is the excess burden of the tax and measures its inefficiency.

the quantity decreases to 1,000 a week. The price paid by the buyer is unchanged and the seller pays the entire tax. The outcome is inefficient because marginal benefit exceeds marginal cost and a deadweight loss arises.

Incidence, Inefficiency, and the Elasticity of Supply

To see how the division of a tax between the buyer and the seller depends on the elasticity of supply, we'll again look at two extremes.

Perfectly Inelastic Supply: Seller Pays and Efficient

Figure 7.4(a) shows the market for spring water that flows at a constant rate that can't be controlled. Supply is perfectly inelastic at 100,000 bottles a week, as shown by the vertical supply curve. With no tax, the price is 50¢ a bottle and the 100,000 bottles that flow from the spring are bought. A tax of 5¢ a bottle leaves the quantity unchanged at 100,000 bottles a week. Buyers are willing to buy 100,000 bottles a week only if the price is 50¢ a bottle. The price remains at 50¢ a bottle, but the tax lowers the price received by the seller by 5¢ a bottle. The seller pays the entire tax.

Because marginal benefit equals marginal cost, there is no deadweight loss and the outcome is efficient.

Perfectly Elastic Supply: Buyer Pays and Inefficient

Figure 7.4(b) shows the market for sand from which computer-chip makers extract silicon. Supply of this sand is perfectly elastic at a price of 10¢ a pound as shown by the horizontal supply curve. With no tax, the price is 10¢ a pound and 5,000 pounds a week are bought. A 1¢ a pound sand tax raises the price to 11¢, and the quantity decreases to 3,000 pounds a week. The buyer pays the entire tax.

Because marginal benefit exceeds marginal cost, a deadweight loss arises and the outcome is inefficient.

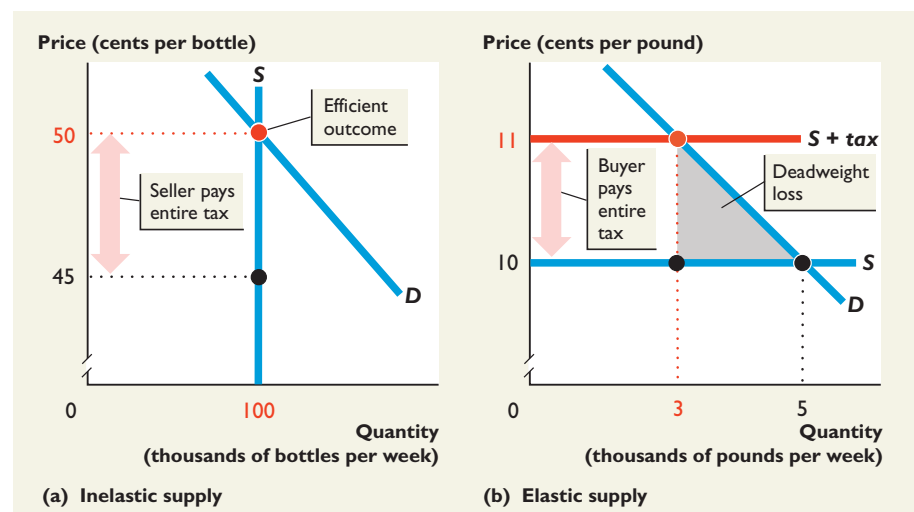
FIGURE 7.4

Incidence, Inefficiency, and the Elasticity of Supply

MyEconLab Animation

In part (a), the supply of bottled spring water is perfectly inelastic. A tax of 5¢ a bottle lowers the price received by the seller by 5¢ a bottle, and the seller pays all the tax. Marginal benefit equals marginal cost, so the outcome is efficient.

In part (b), the supply of sand is perfectly elastic. A tax of 1¢ a pound increases the price by 1¢ a pound, and the buyer pays all the tax. Marginal benefit exceeds marginal cost, so the outcome is inefficient. The deadweight loss is the excess burden of the tax and measures its inefficiency.



CHECKPOINT 7.1

Explain how taxes change prices and quantities, are shared between buyers and sellers, and create inefficiency.

Practice Problems

Figure 1 shows the market for basketballs in which basketballs are not taxed.

1. If buyers of basketballs are taxed \$6 a ball, what price does the buyer pay and how many do they buy? What is the tax revenue collected?
2. If sellers of basketballs are taxed \$6 a ball, what price does the seller receive and how many do they sell? What is the tax revenue collected?
3. If basketballs are taxed at \$6 a ball, what is the excess burden of the tax? Is the demand for basketballs or the supply of basketballs more inelastic? Explain your answer.

In the News

Biggest U.S. tax hike on tobacco takes effect

The tax on cigarettes has risen from 39¢ to \$1.01 a pack—an increase of 62¢ a pack. Before the tax hike, cigarettes were \$5 a pack. In the past, a price increase of 10 percent cut cigarette consumption by 4 percent. With this new tax, at least 1 million of the 45 million smokers are expected to quit.

Source: *USA Today*, April 3, 2009

Is the demand for cigarettes elastic or inelastic? Will the price rise to \$5.62 a pack? Who pays most of the tax increase—smokers or tobacco companies?

Solutions to Practice Problems

1. With a \$6 tax on buyers, the demand curve shifts downward by \$6 a ball as shown in Figure 2. The price that the buyer pays is \$16 a basketball and 8 million basketballs a week are bought. The tax revenue is $\$6 \times 8$ million, which is \$48 million a week (the purple rectangle in Figure 2).
2. With a \$6 tax on sellers, the supply curve shifts upward by \$6 a ball as shown in Figure 3. The price that the seller receives is \$10 a basketball and 8 million basketballs a week are sold (Figure 3). The tax revenue is $\$6 \times 8$ million, which is \$48 million a week (the purple rectangle in Figure 3).
3. The excess burden of the tax is \$12 million. Excess burden equals the deadweight loss, the gray triangle, which is $4 \text{ million balls} \times \$6 \text{ a ball} \div 2$. The \$6 tax increases the price paid by buyers by \$1 and lowers the price received by sellers by \$5. Because the seller pays the larger share of the tax, the supply of basketballs is more inelastic than the demand for basketballs.

Solution to In the News

If a 10 percent price increase decreases consumption by 4 percent, the price elasticity of demand for cigarettes is $4/10$, or 0.4. The demand for cigarettes is inelastic. With the demand inelastic, the 62¢ tax increase will not increase the price to \$5.62. The price would rise to \$5.62 only if the demand were perfectly inelastic. Buyers and sellers share the tax. Because demand is inelastic, buyers (smokers) will pay more of the 62¢ tax than the sellers (tobacco companies).

MyEconLab

You can work these problems in Study Plan 7.1 and get instant feedback.

FIGURE 1

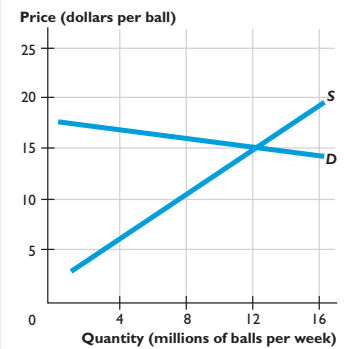


FIGURE 2

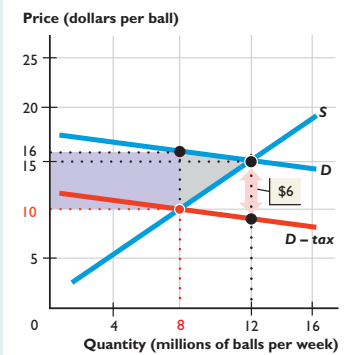
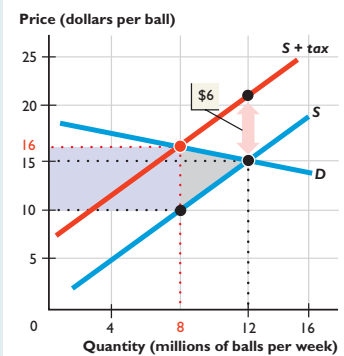


FIGURE 3



7.2 PRICE CEILINGS

Price ceiling or price cap

A government regulation that places an *upper* limit on the price at which a particular good, service, or factor of production may be traded.

A **price ceiling** (also called a **price cap**) is a government regulation that places an *upper* limit on the price at which a particular good, service, or factor of production may be traded. Trading at a higher price is illegal.

A price ceiling has been used in several markets, but the one that looms largest in everyone's budget is the housing market. The price of housing is the rent that people pay for a house or apartment. Demand and supply in the housing market determine the rent and the quantity of housing available.

Figure 7.5 illustrates the apartment rental market in Biloxi, Mississippi. The rent is \$550 a month, and 4,000 apartments are rented.

Suppose that Biloxi apartment rents have increased by \$100 a month in the past two years and that a Citizens' Action Group asks the mayor to roll rents back.

■ A Rent Ceiling

Responding to the demand, the mayor imposes a **rent ceiling**—a regulation that makes it illegal to charge more than a specified rent for housing.

The effect of a rent ceiling depends on whether it is imposed at a level above or below the equilibrium rent. In Figure 7.5, if the rent ceiling is set *above* \$550 a month, nothing would change because people are already paying \$550 a month.

But a rent ceiling that is set *below* the equilibrium rent has powerful effects on the market outcome. The reason is that the rent ceiling attempts to prevent the rent from rising high enough to regulate the quantities demanded and supplied. The law and the market are in conflict, and one (or both) of them must yield.

Rent ceiling

A regulation that makes it illegal to charge more than a specified rent for housing.

FIGURE 7.5
A Housing Market

MyEconLab Animation

The figure shows the demand curve, *D*, and the supply curve, *S*, for rental housing.

- 1 The market is in equilibrium when the quantity demanded equals the quantity supplied.
- 2 The equilibrium price (rent) is \$550 a month.
- 3 The equilibrium quantity is 4,000 units of housing.

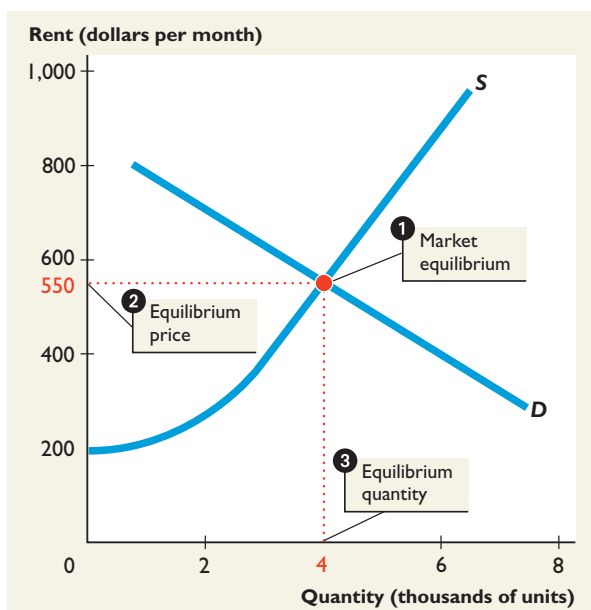


Figure 7.6 shows a rent ceiling that is set below the equilibrium rent at \$400 a month. We've shaded the area *above* the rent ceiling because any rent in this region is illegal. The first effect of a rent ceiling is a housing shortage. At a rent of \$400 a month, the quantity of housing supplied is 3,000 units and the quantity demanded is 6,000 units. So at \$400 a month, there is a shortage of 3,000 units of housing.

But the story does not end here. The 3,000 units of housing that owners are willing to make available must somehow be allocated among people who are seeking 6,000 units. This allocation might be achieved in two ways:

- A black market
- Increased search activity

A Black Market

A **black market** is an illegal market that operates alongside a government-regulated market. A rent ceiling sometimes creates a black market in housing as frustrated renters and landlords try to find ways of raising the rent above the legally imposed ceiling. Landlords want higher rents because they know that renters are willing to pay more for the existing quantity of housing. Renters are willing to pay more to jump to the front of the line.

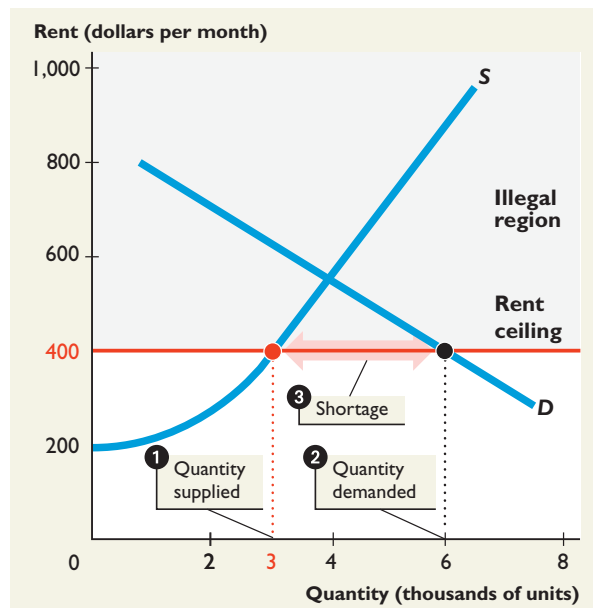
Because raising the rent is illegal, landlords and renters use creative tricks to get around the law. One of these tricks is for a new tenant to pay a high price for worthless fittings—perhaps paying \$2,000 for threadbare drapes. Another is for the tenant to pay a high price for new locks and keys—called “key money.”

Figure 7.7 shows how high the black market rent might go in Biloxi. With strict enforcement of the rent ceiling, the quantity of housing available is 3,000

Black market

An illegal market that operates alongside a government-regulated market.

FIGURE 7.6
A Rent Ceiling Creates a Shortage



A rent ceiling is imposed below the equilibrium rent. In this example, the rent ceiling is \$400 a month.

- 1 The quantity of housing supplied decreases to 3,000 units.
- 2 The quantity of housing demanded increases to 6,000 units.
- 3 A shortage of 3,000 units arises.

units. But at this quantity, renters are willing to offer as much as \$625 a month—the amount determined on the demand curve.

So a small number of landlords illegally offer housing for rents up to \$625 a month. The black market rent might be at any level between the rent ceiling of \$400 and the maximum that a renter is willing to pay of \$625.

Increased Search Activity

The time spent looking for someone with whom to do business is called **search activity**. We spend some time in search activity almost every time we buy something, and especially when we buy a big item such as a car or a home. When a price ceiling creates a shortage of housing, search activity *increases*. In a rent-controlled housing market, frustrated would-be renters scan the newspapers. Keen apartment seekers race to be first on the scene when news of a possible apartment breaks.

The *opportunity cost* of a good is equal to its price *plus* the value of the search time spent finding the good. So the opportunity cost of housing is equal to the rent plus the value of the search time spent looking for an apartment. Search activity is costly. It uses time and other resources, such as telephones, automobiles, and gasoline that could have been used in other productive ways. In Figure 7.7, to find accommodation at \$400 a month, someone who is willing to pay a rent of \$625 a month would be willing to spend on search activity an amount that is equivalent to adding \$225 a month to the rent ceiling.

A rent ceiling controls the rent portion of the cost of housing but not the search cost. So when the search cost is added to the rent, some people end up paying a higher opportunity cost for housing than they would if there were no rent ceiling.

Search activity

The time spent looking for someone with whom to do business.

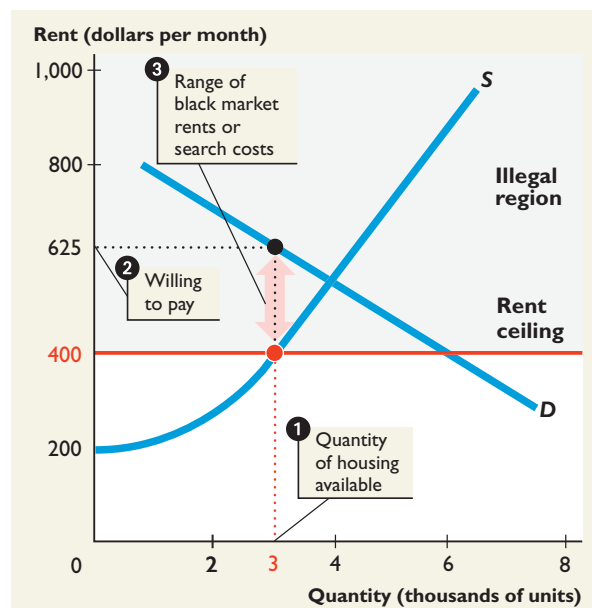
FIGURE 7.7

A Rent Ceiling Creates a Black Market and Housing Search

MyEconLab Animation

With a rent ceiling of \$400 a month,

- 1 3,000 units of housing are available.
- 2 Someone is willing to pay \$625 a month for the 3,000th unit of housing.
- 3 Black market rent might be as high as \$625 a month or search activity might be equivalent to adding \$225 a month to the rent ceiling.



Are Rent Ceilings Efficient?

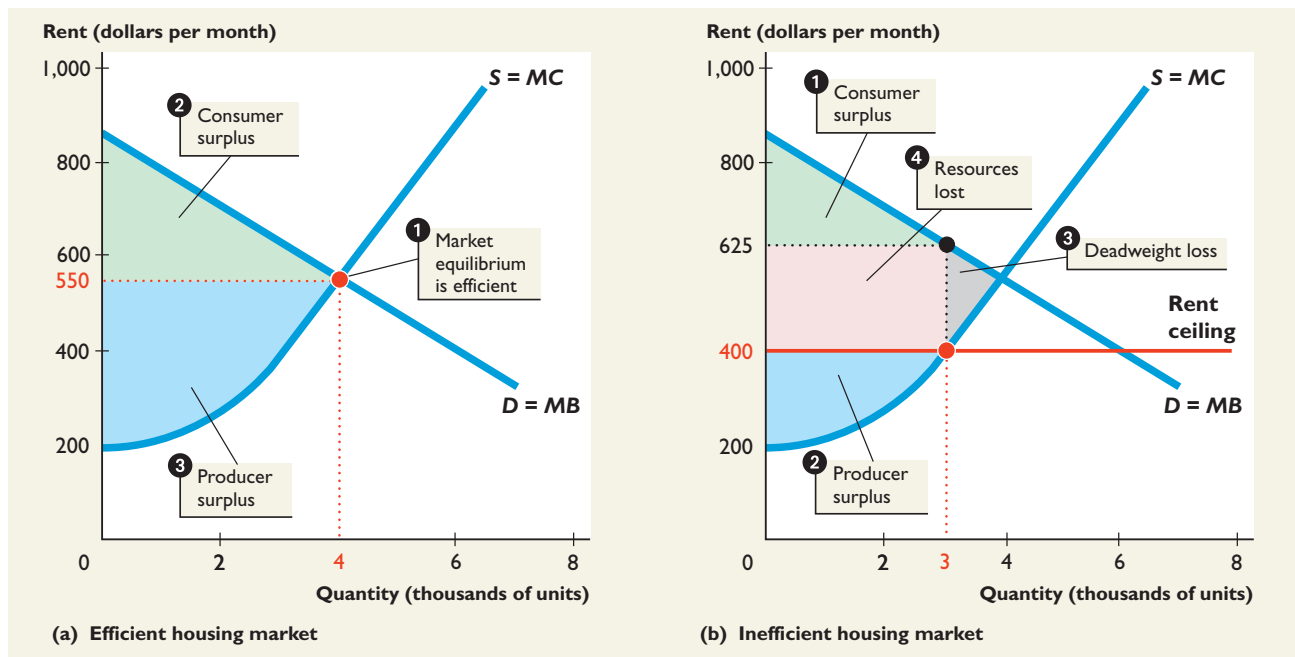
In a housing market with no rent ceiling, market forces determine the equilibrium rent. The quantity of housing demanded equals the quantity of housing supplied. In this situation, scarce housing resources are allocated efficiently because the marginal cost of housing equals the marginal benefit. Figure 7.8(a) shows this efficient outcome in the Biloxi apartment rental market. In this efficient market, total surplus—the sum of *consumer surplus* (the green area) and *producer surplus* (the blue area)—is maximized at the equilibrium rent and quantity of housing (see Chapter 6, p. 153).

Figure 7.8(b) shows that with a rent ceiling, the outcome is inefficient. Marginal benefit exceeds marginal cost. Producer surplus and consumer surplus shrink, and a deadweight loss (the gray area) arises. This loss is borne by the people who can't find housing and by landlords who can't offer housing at the lower rent ceiling.

But the total loss exceeds the deadweight loss. Resources get used in costly search activity or in evading the law in the black market. The value of these resources might be as large as the red rectangle. There is yet a further loss: the cost of enforcing the rent ceiling law. This loss, which is borne by taxpayers, is not visible in the figure.

FIGURE 7.8
The Inefficiency of a Rent Ceiling

MyEconLab Animation



1 The market equilibrium is efficient with marginal benefit equal to marginal cost. Total surplus, the sum of 2 consumer surplus (green area) and 3 producer surplus (blue area), is maximized.

A rent ceiling is inefficient. 1 Consumer surplus and 2 producer surplus shrink, a 3 deadweight loss arises, and 4 resources are lost in search activity and evading the rent ceiling law.



With rent ceilings, landlords have no incentive to maintain buildings, and both the quality and quantity of housing supplied decrease.

Although a rent ceiling creates inefficiency, not everyone loses. The people who pay the rent ceiling get an increase in consumer surplus, and landlords who charge a black market rent get an increase in producer surplus.

The costs of a rent ceiling that we've just considered are only the initial costs. With the rent below the market equilibrium rent, landlords have no incentive to maintain their buildings. So over time, both the quality and quantity of housing supplied *decrease* and the loss arising from a rent ceiling increases.

The size of the loss from a rent ceiling depends on the elasticities of supply and demand. If supply is inelastic, a rent ceiling brings a small decrease in the quantity of housing supplied. And if demand is inelastic, a rent ceiling brings a small increase in the quantity of housing demanded. So the more inelastic the supply or the demand, the smaller is the shortage of housing and the smaller is the deadweight loss.

■ Are Rent Ceilings Fair?

We've seen that rent ceilings prevent scarce resources from being allocated efficiently—resources do not flow to their highest-valued use. But don't they ensure that scarce housing resources are allocated more fairly?

You learned in Chapter 6 (pp. 159–161) that fairness is a complex idea about which there are two broad views: fair *results* versus fair *rules*. Rent controls violate the fair rules view of fairness because they block voluntary exchange. But do they deliver a fair result? Do rent ceilings ensure that scarce housing goes to the poor people whose need is greatest?

Blocking rent adjustments that bring the quantity of housing demanded into equality with the quantity supplied doesn't end scarcity. So when the law prevents the rent from adjusting and blocks the price mechanism from allocating scarce housing, some other allocation mechanism must be used. If that mechanism were one that provided the housing to the poorest, then the allocation might be regarded as fair.

But the mechanisms that get used do not usually achieve such an outcome. First-come, first-served is one allocation mechanism. Discrimination based on race, ethnicity, or sex is another. Discrimination against young newcomers and in favor of old established families is yet another. None of these mechanisms delivers a fair outcome.

Rent ceilings in New York City provide examples of these mechanisms at work. The main beneficiaries of rent ceilings in New York City are families that have lived in the city for a long time—including some rich and famous ones. These families enjoy low rents while newcomers pay high rents for hard-to-find apartments.

■ If Rent Ceilings Are So Bad, Why Do We Have Them?

The economic case against rent ceilings is now widely accepted, so *new* rent ceiling laws are rare. But when governments try to repeal rent control laws, as the New York City government did in 1999, current renters lobby politicians to maintain the ceilings. Also, people who are prevented from finding housing would be happy if they got lucky and managed to find a rent-controlled apartment. For these reasons, there is plenty of political support for rent ceilings.

Apartment owners who oppose rent ceilings are a minority, so their views are not a powerful influence on politicians. Because more people support rent ceilings than oppose them, politicians are sometimes willing to support them too.

CHECKPOINT 7.2

Explain how a price ceiling works and show how a rent ceiling creates a housing shortage, inefficiency, and unfairness.

Practice Problems

Figure 1 shows the rental market for apartments in Corsicana, Texas.

1. What is the rent and how many apartments are rented? If a rent ceiling of \$900 a month is set, what is the rent and how many apartments are rented?
2. If the city government imposes a rent ceiling of \$600 a month, what is the rent and how many apartments are rented? If a black market develops, how high could the black market rent be? Explain.
3. With a strictly enforced rent ceiling of \$600 a month, is the housing market efficient? What is the deadweight loss? Is the housing market fair? Explain.

In the News

Rising oil prices worry U.S. finance chiefs

Tupperware's CFO says rising oil prices would cause the company to pay \$15 million more for resin, which is based on oil, than it did a year ago. Resin prices are closely tied to the price of oil, which peaked at \$114 a barrel in April.

Source: *The Wall Street Journal*, June 27, 2011

If the government puts a price cap on resin at today's price (\$100 a barrel), explain why a shortage will occur. Which allocation method would most likely be used to distribute resin?

Solutions to Practice Problems

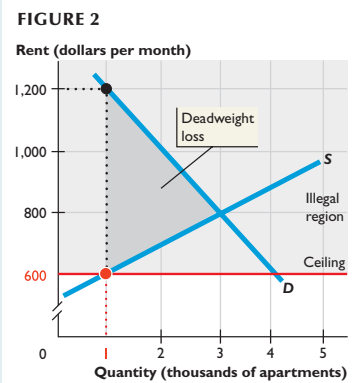
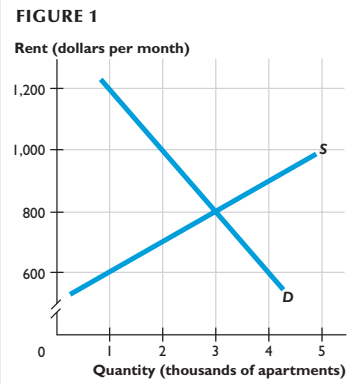
1. The equilibrium rent is \$800 a month, and 3,000 apartments are rented. A rent ceiling of \$900 a month is above the equilibrium rent, so the outcome is the market equilibrium rent of \$800 a month with 3,000 apartments rented.
2. With the rent ceiling at \$600 a month, the number of apartments rented is 1,000 and the rent is \$600 a month (Figure 2). In a black market, some people are willing to rent an apartment for more than the rent ceiling. The highest rent that someone would offer is \$1,200 a month. This rent equals someone's willingness to pay for the 1,000th apartment (Figure 2).
3. The housing market is not efficient. With 1,000 apartments rented, marginal benefit exceeds marginal cost and a deadweight loss arises (Figure 2). The deadweight loss equals the area of the gray triangle, which is $(1,200 - 600) \times (3,000 - 1,000) \div 2$. The deadweight loss is \$600,000. The allocation of housing is less fair on both views of fairness: It blocks voluntary transactions and does not provide more housing to those most in need.

Solution to In the News

Resin is made from oil, so if the price of oil increases, then the cost of making resin increases, and the supply of resin decreases. The equilibrium price of resin rises. The higher equilibrium price will exceed the price cap of \$100 a barrel, and there is a shortage of resin. Resin will most likely be allocated by first-come, first-served. Alternatively, the government could ration resin, in which case it would be allocated by command.

MyEconLab

You can work these problems in Study Plan 7.2 and get instant feedback.



7.3 PRICE FLOORS

Price floor

A government regulation that places a lower limit on the price at which a particular good, service, or factor of production may be traded.

A **price floor** is a government regulation that places a *lower* limit on the price at which a particular good, service, or factor of production may be traded. Trading at a lower price is illegal.

Price floors are used in many markets, but the one that looms largest is the labor market. The price of labor is the wage rate that people earn. Demand and supply in the labor market determine the wage rate and the quantity of labor employed.

Figure 7.9 illustrates the market for fast-food servers in Yuma, Arizona. In this market, the demand for labor curve is *D*. On this demand curve, at a wage rate of \$10 an hour, the quantity of fast-food servers demanded is zero. If A&W, Burger King, Taco Bell, McDonald's, Wendy's, and the other fast-food places had to pay servers \$10 an hour, they wouldn't hire any. They would replace servers with vending machines! But at wage rates below \$10 an hour, they would hire servers. At a wage rate of \$5 an hour, firms would hire 5,000 servers.

On the supply side of the market, no one is willing to work for \$2 an hour. To attract servers, firms must pay more than \$2 an hour.

Equilibrium in this market occurs at a wage rate of \$5 an hour with 5,000 people employed as servers.

Suppose that the government thinks that no one should have to work for a wage rate as low as \$5 an hour and decides that it wants to increase the wage rate. Can the government improve conditions for these workers by passing a minimum wage law? Let's find out.

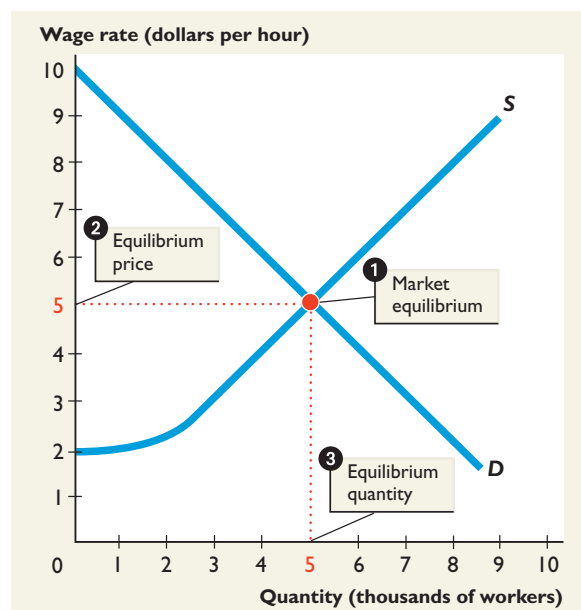
FIGURE 7.9

A Market for Fast-Food Servers

MyEconLab Animation

The figure shows the demand curve, *D*, and the supply curve, *S*, for fast-food servers.

- 1 The market is in equilibrium when the quantity demanded equals the quantity supplied.
- 2 The equilibrium price (wage rate) is \$5 an hour.
- 3 The equilibrium quantity is 5,000 servers.



■ The Minimum Wage

A **minimum wage law** is a government regulation that makes hiring labor services for less than a specified wage illegal. Firms are free to pay a wage rate that exceeds the minimum wage but may not pay less than the minimum. A minimum wage is an example of a price floor.

The effect of a price floor depends on whether it is set below or above the equilibrium price. In Figure 7.9, the equilibrium wage rate is \$5 an hour, and at this wage rate, firms hire 5,000 workers. If the government introduced a minimum wage below \$5 an hour, nothing would change. The reason is that firms are already paying \$5 an hour, and because this wage exceeds the minimum wage, the wage rate paid doesn't change. Firms continue to hire 5,000 workers.

But the aim of a minimum wage is to boost the incomes of low-wage earners. So in the markets for the lowest-paid workers, the minimum wage will exceed the equilibrium wage.

Suppose that the government introduces a minimum wage of \$7 an hour. Figure 7.10 shows the effects of this law. Wage rates below \$7 an hour are illegal, so we've shaded the illegal region *below* the minimum wage. Firms and workers are no longer permitted to operate at the equilibrium point in this market because it is in the illegal region. Market forces and political forces are in conflict.

The government can set a minimum wage, but it can't tell employers how many workers to hire. If firms must pay a wage rate of \$7 an hour, they will hire only 3,000 workers. At the equilibrium wage rate of \$5 an hour, firms hired 5,000 workers. So when the minimum wage is introduced, firms lay off 2,000 workers.

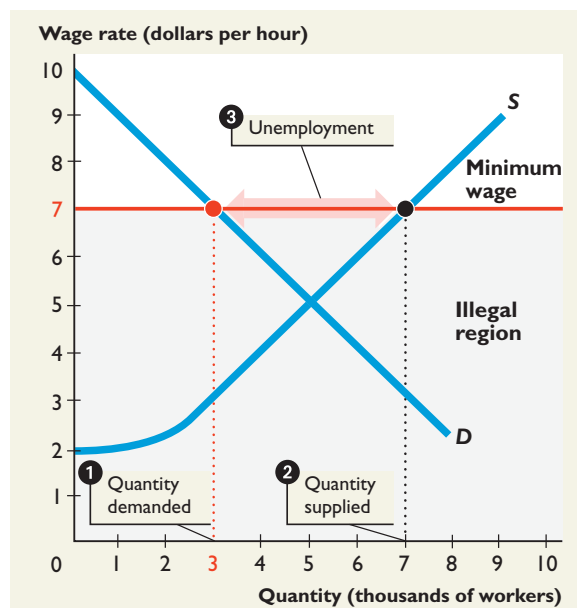
Minimum wage law

A government regulation that makes hiring labor services for less than a specified wage illegal.

■ FIGURE 7.10

A Minimum Wage Creates Unemployment

MyEconLab Animation



A minimum wage is introduced above the equilibrium wage rate. In this example, the minimum wage rate is \$7 an hour.

- ① The quantity of labor demanded decreases to 3,000 workers.
- ② The quantity of labor supplied increases to 7,000 people.
- ③ 4,000 people are unemployed.

But at a wage rate of \$7 an hour, 2,000 people who didn't want to work for \$5 an hour will now try to find work as servers. So at \$7 an hour, the quantity supplied is 7,000 people. With 2,000 workers fired and another 2,000 looking for work at the higher wage rate, 4,000 people who would like to work as servers are unemployed.

The 3,000 jobs available must somehow be allocated among the 7,000 people who are willing to work as servers. How is this allocation achieved? The answer is by increased job-search activity and illegal hiring.

Increased Job-Search Activity

Finding a good job takes a great deal of time and other resources. With a minimum wage, more people are looking for jobs than the number of jobs available. Frustrated unemployed people spend time and other resources searching for hard-to-find jobs. In Figure 7.11, to find a job that pays \$7 an hour, someone who is willing to work for \$3 an hour (on the supply curve) would be willing to spend \$4 an hour (the minimum wage rate of \$7 an hour minus \$3 an hour) on job-search activity. For a job that might last a year or more, this amount is large.

Illegal Hiring

With more people looking for work than the number of jobs available, some firms and workers might agree to do business at an illegal wage rate below the minimum wage in a black market. An illegal wage rate might be at any level between the minimum wage rate of \$7 an hour and the lowest wage rate at which someone is willing to work, \$3 an hour.

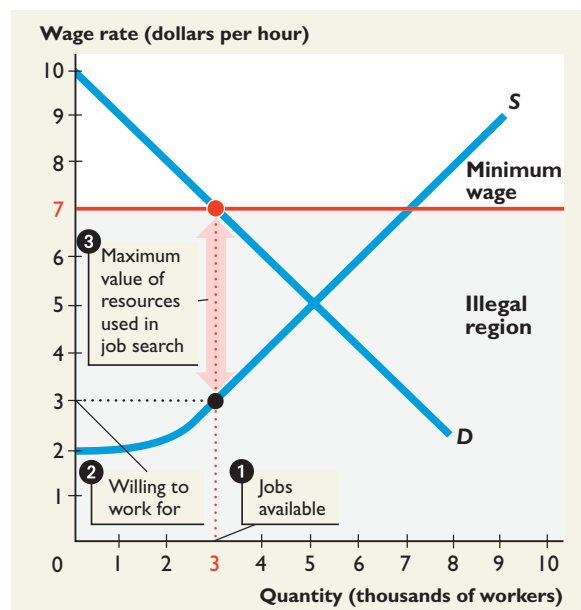
FIGURE 7.11

A Minimum Wage Creates Job Search and Illegal Hiring

MyEconLab Animation

The minimum wage rate is set at \$7 an hour:

- 1 3,000 jobs are available.
- 2 The lowest wage rate for which someone is willing to work is \$3 an hour. In a black market, illegal wage rates might be as low as \$3 an hour.
- 3 The maximum that might be spent on job search is an amount equivalent to \$4 an hour—the \$7 they would receive if they found a job minus the \$3 they are willing to work for.





EYE on the U.S. ECONOMY

The Federal Minimum Wage

The *Fair Labor Standards Act* sets the federal minimum wage, but most states set their own minimum at a higher level than the federal minimum.

The figure shows the minimum wage since 1991 in terms of what it would buy at 2011 prices.

The minimum wage creates unemployment, but how much? Between 2007 and 2009, when the minimum wage increased by 38 percent (see figure), the employment of 16 to 19 year olds fell by 28 percent. Part of that increase most likely was caused by the rise in the minimum wage.

Most economists believe that a 10 percent rise in the minimum wage decreases teenage employment by between 1 and 3 percent.

David Card of the University of California at Berkeley and Alan Krueger of Princeton University have challenged this consensus view. They say that a rise in the minimum wage in California, New Jersey, and Texas *increased* the employment rate of low-income workers. They suggest three reasons why a rise in the wage rate might increase employment:

- (1) Workers become more conscientious and productive.
- (2) Workers are less likely to quit, so costly labor turnover is reduced.
- (3) Managers make a firm's operations more efficient.

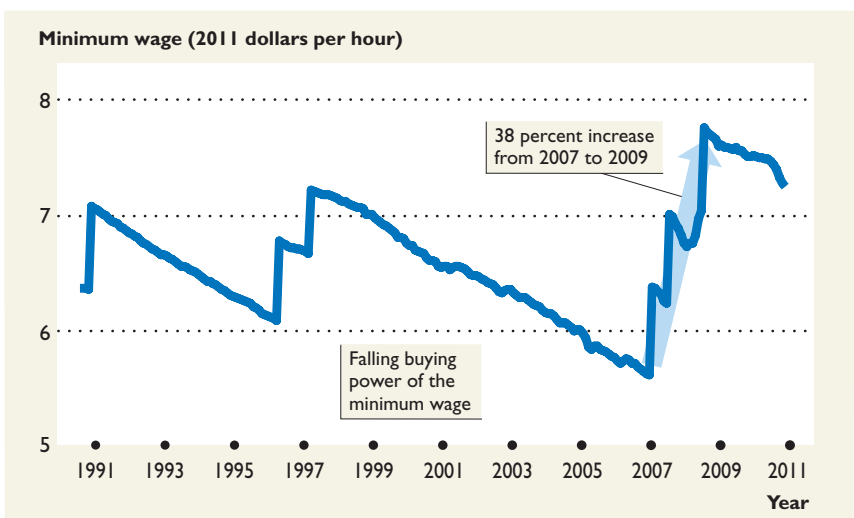
Most economists are skeptical about these ideas and say that if higher wages make workers more productive and reduce labor turnover, firms will freely pay workers a higher wage. They also argue that there are other explanations for the employment increase that Card and Krueger found.

Daniel Hamermesh of the University of Texas at Austin says that Card and Krueger got the timing wrong. Firms anticipated the wage rise and so cut employment before it occurred. Looking at employment changes after the minimum wage increased missed its main effect. Finis Welch of Texas A&M University and Kevin Murphy of the University of Chicago say that the employment effects that Card and Krueger found are caused by regional differences in economic growth, not by changes in the minimum wage.



Pizza delivery people gain from the minimum wage.

Also, looking only at employment misses the supply-side effect of the minimum wage. It brings an increase in the number of people who drop out of high school to look for work.



SOURCE OF DATA: Bureau of Labor Statistics.

■ Is the Minimum Wage Efficient?

The efficient allocation of a factor of production is similar to that of a good or service, which you studied in Chapter 6. The demand for labor tells us about the marginal benefit of labor to the firms that hire it. Firms benefit because the labor they hire produces the goods or services that they sell. Firms are willing to pay a wage rate equal to the benefit they receive from an additional hour of labor. In Figure 7.12(a), the demand curve for labor tells us the marginal benefit that the firms in Yuma receive from hiring fast-food servers. The marginal benefit minus the wage rate is a surplus for the firms.

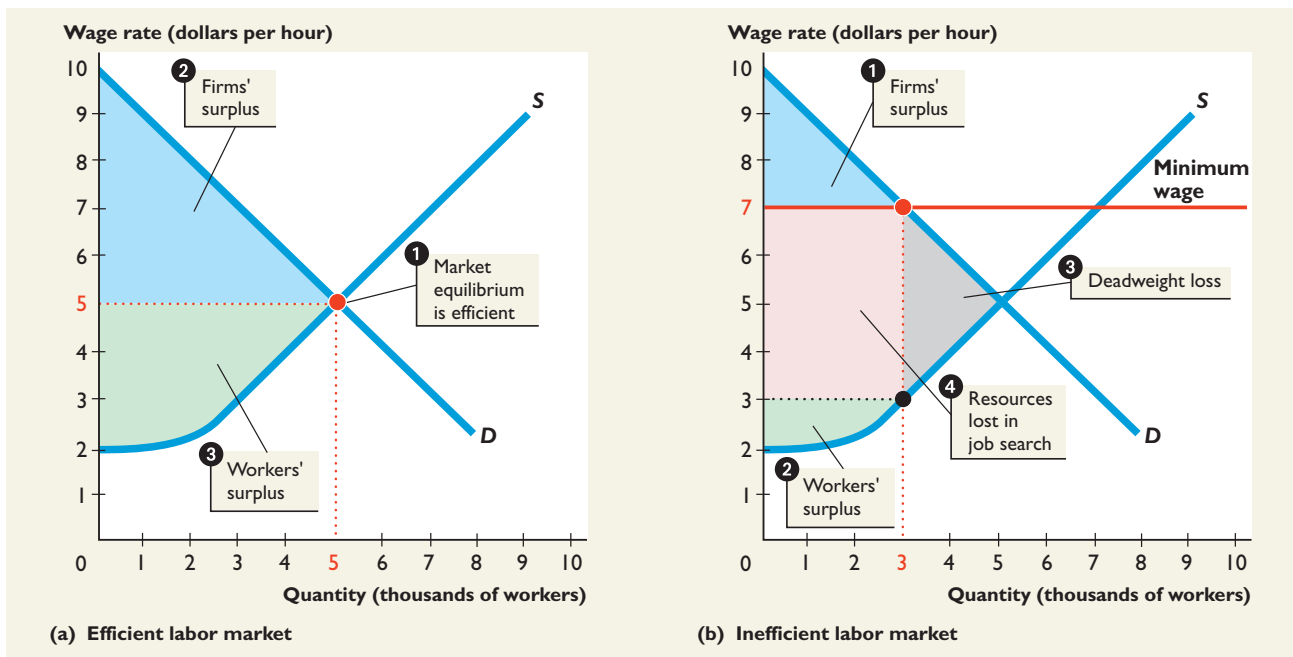
The supply of labor tells us about the marginal cost of working. To work, people must forgo leisure or working in the home, activities that they value. The wage rate received minus the marginal cost of working is a surplus for workers.

An efficient allocation of labor occurs when the marginal benefit to firms equals the marginal cost borne by workers. Such an allocation occurs in the labor market in Figure 7.12(a). Firms enjoy a surplus (the blue area), and workers enjoy a surplus (the green area). The sum of these surpluses is maximized.

Figure 7.12(b) shows the loss from a minimum wage. With a minimum wage of \$7 an hour, 3,000 workers are hired. Marginal benefit exceeds marginal cost. The firms' surplus and workers' surplus shrink, and a deadweight loss (the gray area) arises. This loss falls on the firms that cut back employment and the people who can't find jobs at the higher wage rate.

FIGURE 7.12
The Inefficiency of the Minimum Wage

MyEconLab Animation



1 The market equilibrium is efficient with marginal benefit equal to marginal cost. The sum of 2 the firms' surplus (blue area) and 3 workers' surplus (green area) is maximized.

A minimum wage is inefficient. 1 The firms' surplus and 2 workers' surplus shrink, a 3 deadweight loss arises, and 4 resources are lost in job search.

But the total loss exceeds the deadweight loss. Resources get used in costly job-search activity as each unemployed person keeps looking for a job—writing letters, making phone calls, going to interviews, and so on. The value of these resources might be as large as the red rectangle.

■ Is the Minimum Wage Fair?

The minimum wage is unfair on both views of fairness: It delivers an unfair *result* and imposes unfair *rules*. The *result* is unfair because only those people who find jobs benefit. The unemployed end up worse off than they would be with no minimum wage—and those who get the jobs were probably not the least well off. Personal characteristics, which means discrimination, allocates jobs and is another source of unfairness. The minimum wage imposes unfair *rules* because it blocks voluntary exchange. Firms are willing to hire more labor and people are willing to work more, but they are not permitted by the minimum wage law to do so.

■ If the Minimum Wage Is So Bad, Why Do We Have It?

Although the minimum wage is inefficient, not everyone loses from it. The people who find jobs at the minimum wage rate are better off. Other supporters of the minimum wage believe that the elasticities of demand and supply in the labor market are low, so not much unemployment results. Labor unions support the minimum wage because it puts upward pressure on all wage rates, including those of union workers. Nonunion labor is a substitute for union labor, so when the minimum wage rises, the demand for union labor increases.



EYE on PRICE REGULATION

Can the President Repeal the Laws of Supply and Demand?

The President has a powerful pen, but one that holds no magical powers. When the President signs a Bill or an Executive Order to bring in a new law or regulation, the outcome is not always exactly what was intended. A mismatch between intention and outcome is almost inevitable when a law or regulation seeks to block the laws of supply and demand.

You've seen the problems created by the federal minimum wage law, which leaves teenagers without jobs. There would also be problems at the other extreme of the labor market if the law tried to place a cap on executive pay.

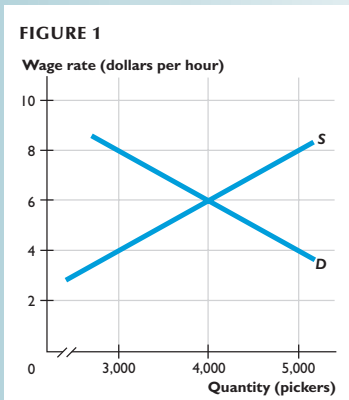
In the spring of 2009, the “Cap Executive Officer Pay Act of 2009” was introduced in the Senate. The goal of the Act was to limit the compensation of executives and directors of firms receiving government handouts. The Act defined compensation broadly as all forms of cash receipts, property, and any perks. The cap envisaged was an annual compensation no greater than that of the President of the United States.

This Act never made it to the President's desk for his signature, but you can see some of the problems that would have arisen if it had. Setting aside the difficult task of determining

the President's compensation (does it include the use of the White House and Air Force One?), placing a cap on executive pay would work like putting a ceiling on home rents that you've studied in this chapter. The quantity of executive services supplied would decrease and the most talented executives would seek jobs with the unregulated employers. The firms in the most difficulty—those receiving government funding—would face the added challenge of recruiting and keeping competent executives and directors. The deadweight loss from this action would be large. It is fortunate that the idea didn't have legs!

MyEconLab

You can work these problems in Study Plan 7.3 and get instant feedback.



CHECKPOINT 7.3

Explain how a price floor works and show how the minimum wage creates unemployment, inefficiency, and unfairness.

Practice Problems

Figure 1 shows the market for tomato pickers in southern California.

1. What is the equilibrium wage rate and how many tomato pickers are employed? If California introduces a minimum wage of \$4 an hour, how many tomato pickers are employed and how many are unemployed?
2. If California introduces a minimum wage of \$8 an hour, how many tomato pickers are employed and how many are unemployed? What is the lowest wage that some workers might be able to earn if a black market develops?
3. Is the minimum wage of \$8 an hour efficient? Who gains and who loses from the minimum wage of \$8 an hour? Is it fair?

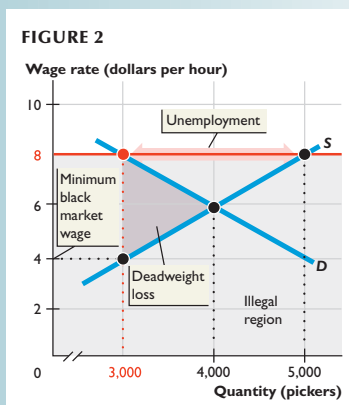
In the News

Hong Kong introduces a minimum wage

Hong Kong's first minimum wage is set at \$HK28 an hour—\$HK5 less than labor unions wanted, but \$HK5 more than the employers had offered. About 315,000 people will be affected by the new wage.

Source: *The Economist*, January 11, 2011

What will be the effects of the minimum wage if the employers' offer is equal to the equilibrium wage? What will be the effects of the minimum wage if the labor unions' demand is equal to the equilibrium wage?



Solutions to Practice Problems

1. The equilibrium wage rate is \$6 an hour, and 4,000 pickers are employed. The minimum wage of \$4 an hour is below the equilibrium wage rate, so 4,000 tomato pickers are employed and no worker is unemployed.
2. The minimum wage of \$8 an hour is above the equilibrium wage rate, so 3,000 pickers are employed (determined by the demand) and 5,000 people would like to work as pickers for \$8 an hour (determined by the supply), so 2,000 are unemployed (Figure 2). If a black market developed, the lowest wage that someone might be able to earn would be \$4 an hour (Figure 2).
3. The minimum wage of \$8 an hour is not efficient because it creates a deadweight loss—the marginal benefit to growers exceeds the marginal cost to workers. Tomato pickers who find work at \$8 an hour gain. Tomato growers and unemployed pickers lose. The minimum wage is unfair on both the fair rules and fair results views of fairness.

Solution to In the News

If the employers' offer of \$HK23 an hour is the equilibrium wage rate, then the minimum wage exceeds the equilibrium wage and some of the 315,000 workers will become unemployed. If the union's demand of \$HK33 an hour is the equilibrium wage rate, then the minimum wage is below the equilibrium wage and the minimum wage has no effect on the quantity of labor employed.

7.4 PRICE SUPPORTS IN AGRICULTURE

“The nation has got to eat,” declared President George W. Bush when he asked Congress to spend \$170 billion to support U.S. farmers. The United States is not alone among the advanced economies in spending billions of dollars each year on farm support. Governments in all the advanced economies do it, and none more than those of the European Union and Japan.

■ How Governments Intervene in Markets for Farm Products

The methods that governments use to support farms vary, but they almost always involve three elements:

- Isolate the domestic market from global competition
- Introduce a price floor
- Pay farmers a subsidy

Isolate the Domestic Market

A government can’t regulate a market price without first isolating the domestic market from global competition. If the cost of production in the rest of the world is lower than that in the domestic economy and if foreign producers are free to sell in the domestic market, the forces of demand and supply drive the price down and swamp any efforts by the government to influence the price.

To isolate the domestic market, the government restricts imports from the rest of the world.

Introduce a Price Floor

A price floor in an agricultural market is called a **price support**, because the floor is maintained by a government guarantee to buy any surplus output at that price. You saw that a price floor in the labor market—a minimum wage—creates a surplus of labor that shows up as unemployment. A price support in an agricultural market also generates a surplus. At the support price, the quantity supplied exceeds the quantity demanded. What happens to the surplus makes the effects of a price support different from those of a minimum wage. The government buys the surplus.

Price support

A price floor in an agricultural market maintained by a government guarantee to buy any surplus output at that price.

Pay Farmers a Subsidy

A **subsidy** is a payment by the government to a producer to cover part of the cost of production. When the government buys the surplus produced by farmers, it provides them with a subsidy. Without the subsidy, farmers could not cover their costs because they would not be able to sell the surplus.

Subsidy

A payment by the government to a producer to cover part of the cost of production.

Let’s see how a price support works.

■ Price Support: An Illustration

To see the effects of a price support, we’ll look at the market for sugar beets. Both the United States and the European Union have price supports for sugar beets.

Figure 7.13 shows the market. This market is isolated from rest-of-world influences. The demand curve, D , tells us the quantities demanded at each price in the domestic economy only. And the supply curve, S , tells us the quantity supplied at each price by domestic farmers.

Free Market Reference Point

With no price support, the equilibrium price is \$25 a ton and the equilibrium quantity is 25 million tons a year. The market is efficient only if the price in the rest of the world is also \$25 a ton. If the price in the rest of the world is less than \$25 a ton, it is efficient for the domestic farmers to produce less and for some sugar beets to be imported at the lower price (lower opportunity cost) available in the rest of the world. But if the price in the rest of the world exceeds \$25 a ton, it is efficient for domestic farmers to increase production and export some sugar beets.

Price Support and Subsidy

Suppose the government introduces a price support and sets the support price at \$35 a ton. To make the price support work, the government agrees to pay farmers \$35 for every ton of sugar beets they produce and can't sell in the market.

The farmers produce the quantity shown by the market supply curve. At a price of \$35 a ton, the quantity supplied is 30 million tons a year, so production increases to this amount.

Domestic users of sugar beets cut back their purchases. At \$35 a ton, the quantity demanded is 20 million tons a year, and purchases decrease to this amount.

Because farmers produce a greater quantity than domestic users are willing to buy, something must be done with the surplus. If the farmers just dumped the surplus on the market, you can see what would happen. The price would fall to that at which consumers are willing to pay for the quantity produced.

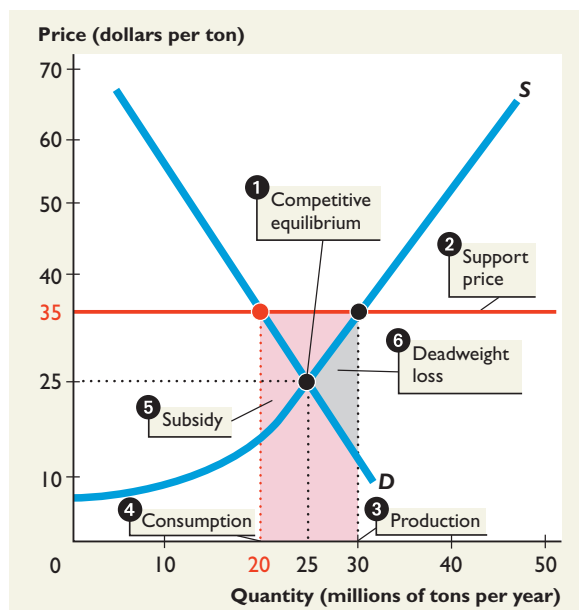
To make the price support work, the government buys the surplus. In this example, the government buys 10 million tons for \$35 a ton and provides a subsidy to the farmers of \$350 million.

FIGURE 7.13
The Domestic Market for Sugar Beets

MyEconLab Animation

The market for sugar beets is isolated from global competition.

- 1 With no intervention, the competitive equilibrium price is \$25 a ton and the equilibrium quantity is 25 million tons a year.
- 2 The government intervenes in this market and sets a support price at \$35 a ton.
- 3 The quantity produced increases to 30 million tons a year.
- 4 The quantity bought by domestic users decreases to 20 million tons a year.
- 5 The government buys the surplus of 10 million tons a year and pays farmers a subsidy of \$350 million.
- 6 A deadweight loss arises.



The price support increases farmers' total revenue. Without a subsidy, farmers would receive a total revenue of \$625 million (\$25 a ton multiplied by 25 million tons). With a subsidy, they receive a total revenue of \$1,050 million (\$35 a ton multiplied by 30 million tons).

The price support is inefficient because it creates a deadweight loss. Farmers gain but consumers, who are also the taxpayers who end up paying the subsidy, lose. And consumers' losses exceed the farmers' gains by the amount of the deadweight loss.

Effects on the Rest of the World

The rest of the world receives a double-whammy from price supports. First, import restrictions in advanced economies deny developing economies access to the food markets of the advanced economies. The result is lower prices and smaller farm production in the developing economies.

Second, the surplus produced in the advanced economies gets sold in the rest of the world. Both the price and the quantity produced in the rest of the world are depressed even further.

The subsidies received by U.S. farmers are paid not only by U.S. taxpayers and consumers but also by poor farmers in the developing economies.

We explore global markets in action in Chapter 8. There you will see other ways in which intervention in markets brings inefficiencies and redistributes the gains from trade.



EYE on YOUR LIFE

Price Ceilings and Price Floors

Price ceilings and price floors operate in many of the markets in which you trade, and they require you to take a stand as a citizen and voter.

Unless you live in New York City, you're not likely to live in a rent-controlled house or apartment. Because economists have explained the unwanted effects of rent ceilings that you've learned about in this chapter, this type of market intervention is now rare.

But you run into a price ceiling almost every time you use a freeway.

The zero price for using a freeway is a type of price ceiling. The next time you're stuck in traffic and moving at a crawl, think about how a free market in road use would cut the congestion and allow you to zip along.

In Singapore, a transponder on your dashboard would be clocking up the dollars and cents as you drive around the city. The price varies with the time of day, the traffic density, and where in the city you are. As a result, you would never be stuck in slow-moving traffic.

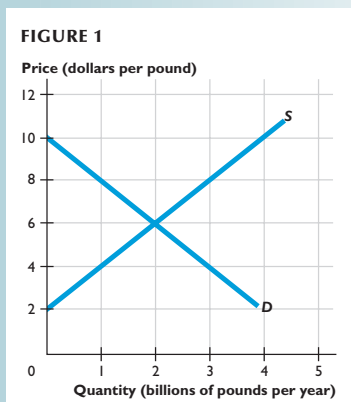
You encounter a price floor in the labor market. Have you wanted a job and been willing and available to work, but unable to get hired? Would you have taken a job for a slightly lower wage if one had been available?

You also encounter price floors (price supports) in markets for food. You pay more for tomatoes, sugar, oranges, and many other food items than the minimum cost of producing them.

Develop your own policy position on price floors and price ceilings.

MyEconLab

You can work these problems in Study Plan 7.4 and get instant feedback.



CHECKPOINT 7.4

Explain how a price support in the market for an agricultural product creates a surplus, inefficiency, and unfairness.

Practice Problems

Figure 1 shows the market for tomatoes.

1. What are the equilibrium price and quantity of tomatoes? Is the market for tomatoes efficient?
2. If the government introduces a price support at \$8 per pound, what is the quantity of tomatoes produced, the quantity demanded, and the subsidy received by tomato farmers?
3. With a price support set at \$8 per pound, is the market for tomatoes efficient? Who gains and who loses from the price support? What is the deadweight loss? Could the price support be regarded as being fair?

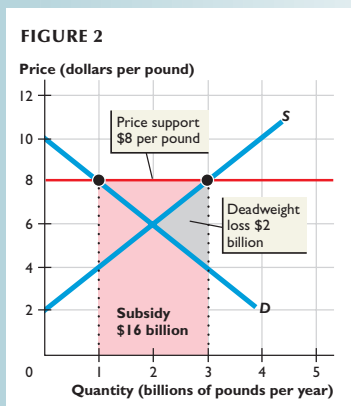
In the News

French farmers man the blockades in Brussels

Farmers want the dairy industry to guarantee a minimum (powdered) milk price of 300 euros a ton—against 210 euros a ton this month. Max Bottier, a dairy farmer in Normandy, said that he needs 300 euros a ton to break even.

Source: *The Times*, May 26, 2009

If a support price for milk is set at 300 euros a ton, how will the quantity of milk produced and the quantity bought by consumers change? Who buys the surplus? Will the European milk market be more or less efficient than it is today?



Solutions to Practice Problems

1. The equilibrium price is \$6 a pound; the equilibrium quantity is 2 billion pounds. The market is efficient—marginal benefit equals marginal cost.
2. At a support price of \$8 a pound, 3 billion pounds are produced and 1 billion pounds are demanded, so there is a surplus of 2 billion pounds (Figure 2). The subsidy is \$8 per pound on 2 billion pounds, which is \$16 billion.
3. The market is not efficient because at the quantity produced, the marginal benefit (on the demand curve) is less than the marginal cost (on the supply curve). Farmers gain. They produce more and receive a higher price on what they sell in the market as well as the government subsidy. Consumers/taxpayers lose. They pay more for tomatoes and pay taxes to fund the subsidy. The deadweight loss is \$2 billion (the area of the gray triangle). The outcome is unfair on both views of fairness unless farmers are poorer than consumers, in which case it might be fair to boost farmers' incomes.

Solution to In the News

The market price of powdered milk is 210 euros a ton. A support price of 300 euros a ton will increase the quantity supplied, decrease the quantity demanded, and create a surplus of milk. To maintain the price at 300 euros a ton, the government will have to buy the surplus at the support price. The market will be less efficient because it creates a deadweight loss.

CHAPTER SUMMARY

Key Points

- 1 Explain how taxes change prices and quantities, are shared by buyers and sellers, and create inefficiency.**
 - A tax on buyers has the same effect as a tax on sellers. It increases the price paid by the buyer and lowers the price received by the seller.
 - A tax creates inefficiency by driving a wedge between marginal benefit and marginal cost and creating a deadweight loss.
 - The less elastic the demand or the more elastic the supply, the greater is the price increase and the larger is the share of the tax paid by the buyer.
- 2 Explain how a price ceiling works and show how a rent ceiling creates a housing shortage, inefficiency, and unfairness.**
 - A price ceiling set above the equilibrium price has no effects.
 - A price ceiling set below the equilibrium price creates a shortage and increased search activity or a black market.
 - A price ceiling is inefficient and unfair.
 - A rent ceiling is an example of a price ceiling.
- 3 Explain how a price floor works and show how the minimum wage creates unemployment, inefficiency, and unfairness.**
 - A price floor set below the equilibrium price has no effects.
 - A price floor set above the equilibrium price creates a surplus and increased search activity or illegal trading.
 - A price floor is inefficient and unfair.
 - A minimum wage is an example of a price floor.
- 4 Explain how a price support in the market for an agricultural product creates a surplus, inefficiency, and unfairness.**
 - A price support increases the quantity produced, decreases the quantity consumed, and creates a surplus.
 - To maintain the support price, the government buys the surplus and subsidizes the producer.
 - A price support benefits the producer but costs the consumer/taxpayer more than the producer gains—it creates a deadweight loss.
 - A price support is inefficient and is usually unfair.

Key Terms

| | | |
|-----------------------|--------------------|----------------------|
| Black market, 175 | Price ceiling, 174 | Search activity, 176 |
| Excess burden, 170 | Price floor, 180 | Subsidy, 187 |
| Minimum wage law, 181 | Price support, 187 | Tax incidence, 168 |
| Price cap, 174 | Rent ceiling, 174 | |

MyEconLab

You can work these problems in Chapter 7 Study Plan and get instant feedback.

TABLE 1

| Price (dollars per month) | Quantity demanded (units per month) | Quantity supplied |
|---------------------------|-------------------------------------|-------------------|
| 0 | 30 | 0 |
| 10 | 25 | 10 |
| 20 | 20 | 20 |
| 30 | 15 | 30 |
| 40 | 10 | 40 |

FIGURE 1

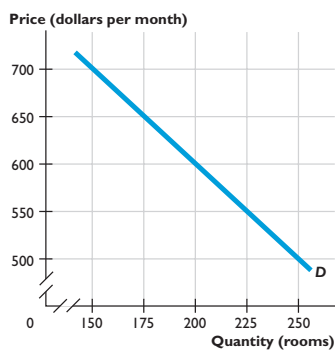


TABLE 2

| Wage rate (dollars per hour) | Quantity demanded (student workers) | Quantity supplied |
|------------------------------|-------------------------------------|-------------------|
| 10.00 | 600 | 300 |
| 10.50 | 500 | 350 |
| 11.00 | 400 | 400 |
| 11.50 | 300 | 450 |
| 12.00 | 200 | 500 |
| 12.50 | 100 | 550 |

TABLE 3

| Price (dollars per pound) | Quantity demanded (pounds per week) | Quantity supplied |
|---------------------------|-------------------------------------|-------------------|
| 1.00 | 5,000 | 2,000 |
| 2.00 | 4,500 | 2,500 |
| 3.00 | 4,000 | 3,000 |
| 4.00 | 3,500 | 3,500 |
| 5.00 | 3,000 | 4,000 |
| 6.00 | 2,500 | 4,500 |

CHAPTER CHECKPOINT

Study Plan Problems and Applications

1. In Florida, sunscreen and sunglasses are vital items. If the tax on sellers of these items is doubled from 5.5 percent to 11 percent, who will pay most of the tax increase: the buyer or the seller? Will the tax increase halve the quantity of sunscreen and sunglasses bought?
2. Suppose that the government imposes a \$2 a cup tax on coffee. What determines by how much Starbucks will raise its price? How will the quantity of coffee bought in coffee shops change? Will this tax raise much revenue?
3. Table 1 illustrates the market for Internet service. What is the market price of Internet service? If the government taxes Internet service \$15 a month, what is the price the buyer pays? What is the price the seller receives? Does the buyer or the seller pay more of the tax?

Use Figure 1, which shows the demand for on-campus housing, to work Problems 4 to 6. The college has 200 rooms to rent.

4. If the college puts a rent ceiling on rooms of \$650 a month, what is the rent, how many rooms are rented, and is the on-campus housing market efficient?
5. If the college puts a strictly enforced rent ceiling on rooms of \$550 a month, what is the rent, how many rooms are rented, and is the on-campus housing market efficient? Explain why or why not.
6. Suppose that with a strictly enforced rent ceiling on rooms of \$550 a month, a black market develops. How high could the black market rent be and would the on-campus housing market be fair? Explain your answer.
7. Table 2 shows the demand and supply schedules for student workers at on-campus venues. If the college introduces a strictly enforced minimum wage of \$11.50 an hour, who gains and who loses from the minimum wage, and is the campus labor market efficient or fair?
8. Table 3 shows the demand and supply schedules for mushrooms. Suppose that the government introduces a price support for mushrooms of \$6 per pound. Who gains and who loses? What are the quantity of mushrooms produced, the surplus of mushrooms, and the deadweight loss?

Use the following news clip to work Problems 9 and 10.

Coal shortage at China plants

The government of China has set price controls on coal and gasoline in an attempt to shield poor families and farmers from rising world energy prices. Chinese power plants have run short of coal, sales of luxury, gas-guzzling cars have increased, and gasoline consumption has risen. Oil refiners are incurring losses and plan to cut production.

Source: CNN, May 20, 2008

9. Are China's price controls price floors or price ceilings? Draw a graph to illustrate the shortages of coal and gasoline created by the price controls.
10. Explain how China's price controls have changed consumer surplus, producer surplus, total surplus, and the deadweight loss in the markets for coal and gasoline. Draw a graph to illustrate your answer.

Instructor Assignable Problems and Applications



- Suppose that Congress caps executive pay at a level below the equilibrium.
 - Explain how the quantity of executives demanded, the quantity supplied, and executive pay will change, and explain why the outcome is inefficient.
 - Draw a graph of the market for corporate executives. On your graph, show the market equilibrium, the pay cap, the quantity of executives supplied and the quantity demanded at the pay cap, and the deadweight loss created. Also show the highest pay that an executive might be offered in a black market.

Use the following information to work Problems 2 and 3.

The supply of luxury boats is perfectly elastic, the demand for luxury boats is unit elastic, and with no tax on luxury boats, the price is \$1 million and 240 luxury boats a week are bought. Now luxury boats are taxed at 20 percent.

- What is the price that buyers pay? How is the tax split between the buyer and the seller? What is the government's tax revenue?
- On a graph, show the excess burden of this tax. Is this tax efficient?
- Figure 1 shows the demand for and supply of chocolate bars. Suppose that the government levies a \$1.50 tax on a chocolate bar. What is the change in the quantity of chocolate bars bought, who pays most of the tax, and what is the deadweight loss?

Use the following information to work Problems 5 and 6.

Concerned about the political fallout from rising gas prices, suppose that the U.S. government imposes a price ceiling of \$3.00 a gallon on gasoline.

- Explain how the market for gasoline would react to this price ceiling if the oil-producing nations increased production and drove the equilibrium price of gasoline to \$2.50 a gallon. Would the U.S. gasoline market be efficient?
- Explain how the market for gasoline would react to this price ceiling if a global shortage of oil sent the equilibrium price of gasoline to \$3.50 a gallon. Would the U.S. gasoline market be efficient?
- Suppose the government introduced a ceiling on lawyers' fees. How would the amount of work done by lawyers, the consumer surplus of people who hire lawyers, and the producer surplus of law firms change? Would this fee ceiling result in an efficient and fair use of resources? Why or why not?

Use the following information to work Problems 8 and 9.

Crop prices erode farm subsidy program

High corn and soybean prices mean farmers are making the most money in their lives. The reason: Grain prices are far too high to trigger payouts under the U.S. primary farm-subsidy program's "price support" formula. The market has done what Congress couldn't do and that is "slash farm subsidies."

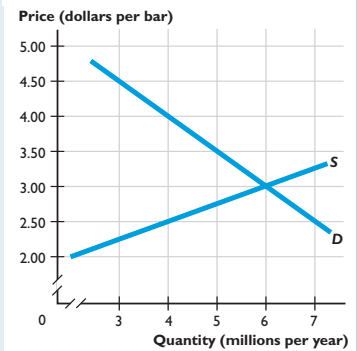
Source: *The Wall Street Journal*, July 25, 2011

- Draw a graph to illustrate the soybean market when the soybean price was low. Show the quantity of soybeans produced, the subsidy farmers received, and the deadweight loss created.
- In the market for corn with a price support, explain why the corn price has risen and ended up being too high to "trigger payouts."

MyEconLab

Your instructor can assign these problems as homework, a quiz, or a test in [MyEconLab](#).

FIGURE 1



MyEconLab

You can work this quiz in Chapter 7 Study Plan and get instant feedback.

Multiple Choice Quiz

1. If a tax of \$1 a can is imposed on the buyers of sugary drinks, the demand for sugary drinks _____ and the price that buyers pay _____.
 - A. doesn't change; doesn't change
 - B. doesn't change; rises by \$1 a can
 - C. decreases; rises by more than \$1 a can
 - D. decreases; rises by less than \$1 a can
2. A tax on candy will be paid by _____.
 - A. only buyers if the demand for candy is inelastic
 - B. only sellers if the supply of candy is inelastic
 - C. buyers and sellers if the demand for candy is elastic
 - D. only buyers if the supply of candy is elastic
3. A price ceiling imposed below the equilibrium price _____.
 - A. creates a black market in which the price might equal or exceed the equilibrium price
 - B. creates a black market in which the price equals the price ceiling
 - C. leads to increased search activity, which reduces the shortage of the good
 - D. increases the demand for the good, which makes the shortage even larger
4. A price ceiling is _____ if it is set _____ the market equilibrium price.
 - A. efficient and fair; below
 - B. unfair but efficient; equal to
 - C. efficient and unfair; above
 - D. inefficient and unfair; below
5. A price floor influences the outcome of a market if it is _____.
 - A. set below the equilibrium price
 - B. set above the equilibrium price
 - C. an incentive for buyers to increase demand for the good
 - D. an incentive for sellers to decrease supply of the good
6. A minimum wage set above the market equilibrium wage rate _____.
 - A. increases both employment and the quantity of labor supplied
 - B. decreases unemployment and raises the wage rate of those employed
 - C. raises the wage rate of those employed and increases the supply of jobs
 - D. increases unemployment and decreases employment
7. A support price set above the equilibrium price _____.
 - A. creates a shortage, increases farmers' total revenue, and is efficient
 - B. creates a surplus, which the government buys and dumps on the rest of the world to keep the U.S. price equal to the support price
 - C. is inefficient because farmers' marginal cost exceeds U.S. consumers' marginal benefit
 - D. is efficient because farmers' marginal cost equals U.S. consumers' marginal benefit
8. Choose the best statement.
 - A. A subsidy to peanut growers lowers peanut growers' costs, lowers the market price of peanuts, and increases the demand for peanuts.
 - B. A price support for peanut growers is a guaranteed price for peanuts, which increases the quantity of peanuts produced.
 - C. A price support and a subsidy to peanut growers will make the peanut market more efficient if the support price is below the market price.
 - D. For a support price set above the equilibrium price to increase peanut growers' incomes, they must also receive a subsidy.



Who wins and who loses from globalization?

Global Markets in Action

When you have completed your study of this chapter, you will be able to

- 1 Explain how markets work with international trade.
- 2 Identify the gains from international trade and its winners and losers.
- 3 Explain the effects of international trade barriers.
- 4 Explain and evaluate arguments used to justify restricting international trade.



CHAPTER CHECKLIST

Imports

The goods and services that firms in one country buy from people and firms in other countries.

Exports

The goods and services that people and firms in one country sell to firms in other countries.

8.1 HOW GLOBAL MARKETS WORK

Because we trade with people in other countries, the goods and services that we buy and consume are not limited by what we produce. The goods and services that we buy from people and firms in other countries are our **imports**; the goods and services that we sell to firms in other countries are our **exports**.

■ International Trade Today

Global trade today is enormous. In 2009, global exports and imports (the two numbers are the same because what one country exports another imports) were about \$15 trillion, which is 27 percent of the value of global production. The United States is the world's largest international trader and accounts for 10 percent of world exports and 15 percent of world imports. Germany and China, which rank 2 and 3 behind the United States, lag by a large margin.

In 2009, total U.S. exports were \$1.5 trillion, which is about 11 percent of the value of U.S. production. Total U.S. imports were \$1.9 trillion, which is about 13 percent of the value of total expenditure in the United States.

The United States trades both goods and services. In 2009, exports of services were \$0.5 trillion (33 percent of total exports) and imports of services were \$0.4 trillion (21 percent of total imports).

Our largest exports are services such as royalties, license fees, banking, business consulting, and other private services. Our largest exports of goods are chemicals and plastics and airplanes. Our largest imports are crude oil and automobiles. *Eye on the U.S. Economy* (p. 197) provides a bit more detail on our ten largest exports and imports.

■ What Drives International Trade?

Comparative advantage is the fundamental force that drives international trade. We defined comparative advantage in Chapter 3 (p. 74) as the ability of a person to perform an activity or produce a good or service at a lower opportunity cost than anyone else. This same idea applies to nations. We can define *national comparative advantage* as the ability of a *nation* to perform an activity or produce a good or service at a lower opportunity cost than *any other nation*.

The opportunity cost of producing a T-shirt is lower in China than in the United States, so China has a comparative advantage in producing T-shirts. The opportunity cost of producing an airplane is lower in the United States than in China, so the United States has a comparative advantage in producing airplanes.

You saw in Chapter 3 how Liz and Joe reaped gains from trade by specializing in the production of the good at which they have a comparative advantage and then trading. Both were better off. This same principle applies to trade among nations. Because China has a comparative advantage at producing T-shirts and the United States has a comparative advantage at producing airplanes, the people of both countries can gain from specialization and trade. China can buy airplanes from the United States at a lower opportunity cost than that at which it can produce them. And Americans can buy T-shirts from China for a lower opportunity cost than that at which U.S. firms can produce them. Also, through international trade, Chinese producers can get higher prices for their T-shirts and Boeing can sell airplanes for a higher price. Both countries gain from international trade.

Let's now illustrate the gains from trade that we've just described by studying demand and supply in the global markets for T-shirts and airplanes.



EYE on the U.S. ECONOMY

U.S. Exports and Imports

The blue bars in part (a) of the figure show the ten largest U.S. exports and the red bars in part (b) show the ten largest U.S. imports. The values are graphed as *net exports* and *net imports* because we both export and import items in most of the categories.

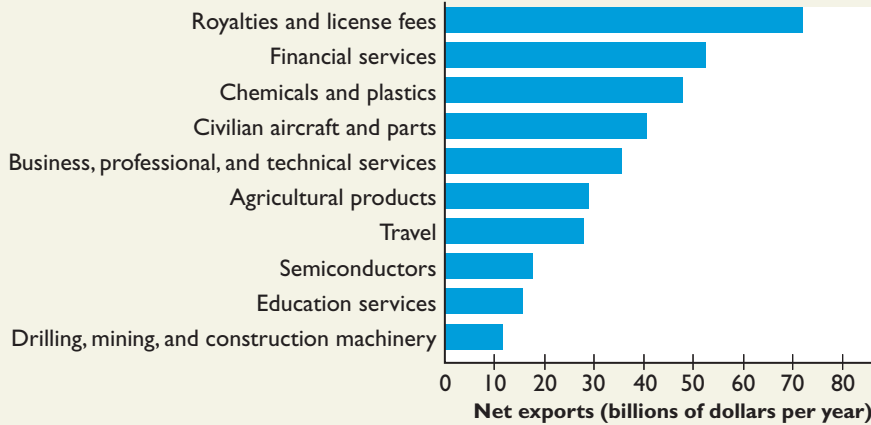
Five of our top ten exports are services—royalties and license fees (such as fees received by Hollywood movie producers on films shown abroad); financial services; business, profes-

sional, and technical services (such as the sale of advertising by Google to Adidas, a European sportswear maker); travel (such as the expenditure on a Florida vacation by a visitor from England); and education services (foreign students in our colleges and universities).

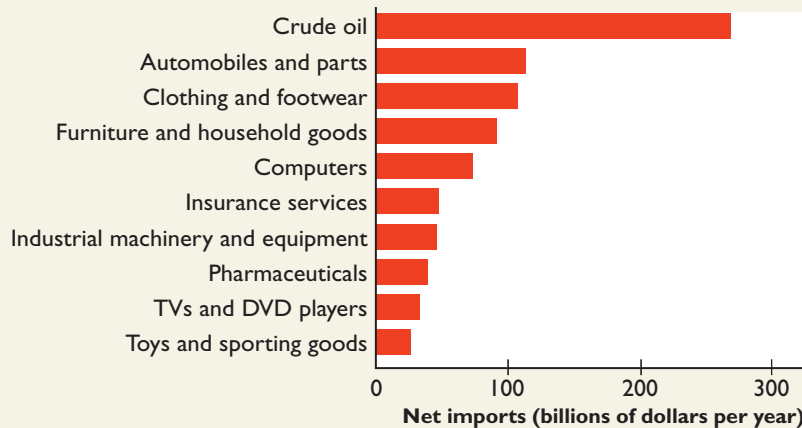
Automobiles and the fuel that runs them are our largest imports. We also import large quantities of clothing, furniture, TVs, DVD players, computers;

and industrial machinery and equipment. Insurance services also feature in our ten largest imports.

Although we import a large quantity of computers, we export many of the semiconductors (computer chips) inside those computers. The Intel chip in a Lenovo laptop built in China and imported into the United States is an example. This chip is made in the United States and exported to China.



(a) The 10 largest U.S. exports



(b) The 10 largest U.S. imports



The United States exports airplanes ...



and imports crude oil.

SOURCE OF DATA: Bureau of Economic Analysis.

■ Why the United States Imports T-Shirts

Figure 8.1 illustrates the effects of international trade in T-shirts. The demand curve D_{US} and the supply curve S_{US} show the demand and supply in the U.S. domestic market only. The demand curve tells us the quantity of T-shirts that Americans are willing to buy at various prices. The supply curve tells us the quantity of T-shirts that U.S. garment makers are willing to sell at various prices.

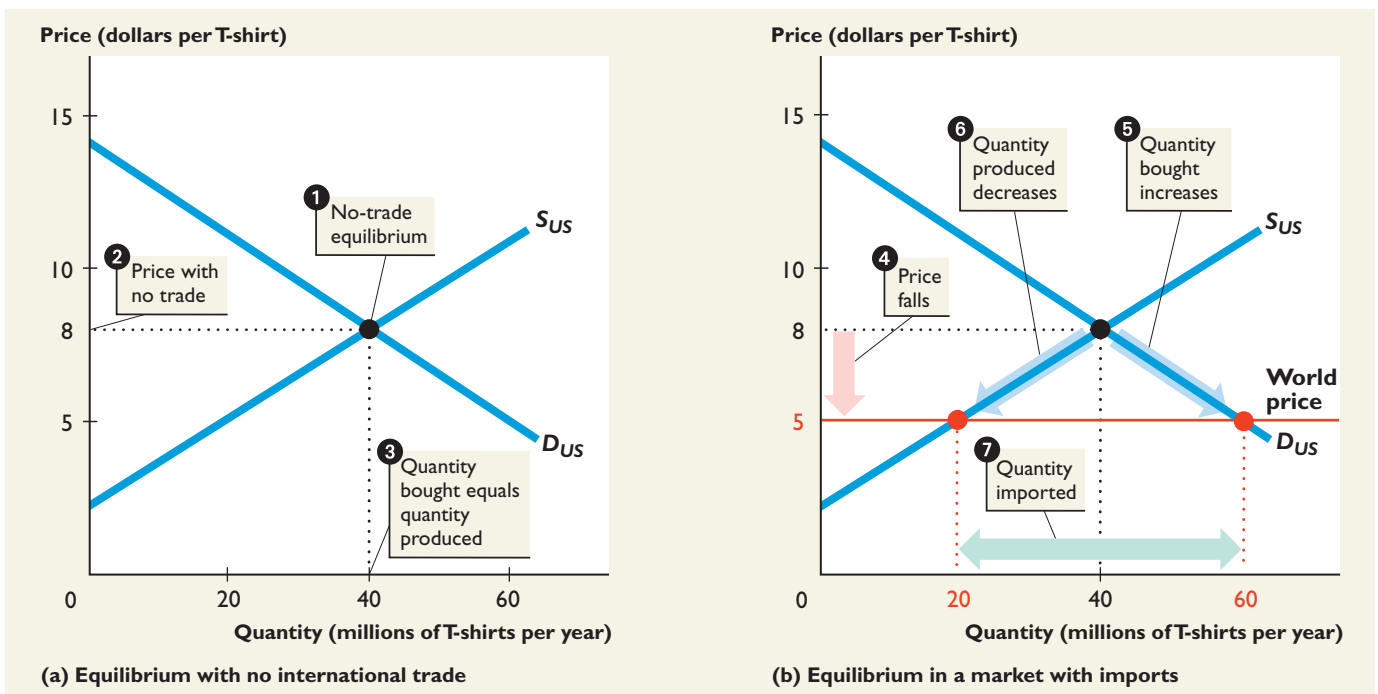
Figure 8.1(a) shows what the U.S. T-shirt market would be like with no international trade. The price of a T-shirt would be \$8 and 40 million T-shirts a year would be produced by U.S. garment makers and bought by U.S. consumers.

Figure 8.1(b) shows the market for T-shirts *with* international trade. Now the price of a T-shirt is determined in the world market, not the U.S. domestic market. The world price is *less than* \$8 a T-shirt, which means that the rest of the world has a comparative advantage in producing T-shirts. The world price line shows the world price as \$5 a T-shirt.

The U.S. demand curve, D_{US} , tells us that at \$5 a T-shirt, Americans buy 60 million T-shirts a year. The U.S. supply curve, S_{US} , tells us that at \$5 a T-shirt, U.S. garment makers produce 20 million T-shirts. To buy 60 million T-shirts when only 20 million are produced in the United States, we must import T-shirts from the rest of the world. The quantity of T-shirts imported is 40 million a year.

FIGURE 8.1
A Market with Imports

MyEconLab Animation



With no international trade, in part (a), ① domestic demand and domestic supply determine ② the equilibrium price at \$8 a T-shirt and ③ the quantity at 40 million T-shirts a year.

With international trade, in part (b), world demand and world supply

determine the world price, which is \$5 per T-shirt. ④ The domestic price falls to \$5 a T-shirt. ⑤ Domestic purchases increase to 60 million T-shirts a year, and ⑥ domestic production decreases to 20 million T-shirts a year. ⑦ 40 million T-shirts a year are imported.

■ Why the United States Exports Airplanes

Figure 8.2 illustrates the effects of international trade in airplanes. The demand curve D_{US} and the supply curve S_{US} show the demand and supply in the U.S. domestic market only. The demand curve tells us the quantity of airplanes that U.S. airlines are willing to buy at various prices. The supply curve tells us the quantity of airplanes that U.S. aircraft makers are willing to sell at various prices.

Figure 8.2(a) shows what the U.S. airplane market would be like with no international trade. The price of an airplane would be \$100 million and 400 airplanes a year would be produced by U.S. aircraft makers and bought by U.S. airlines.

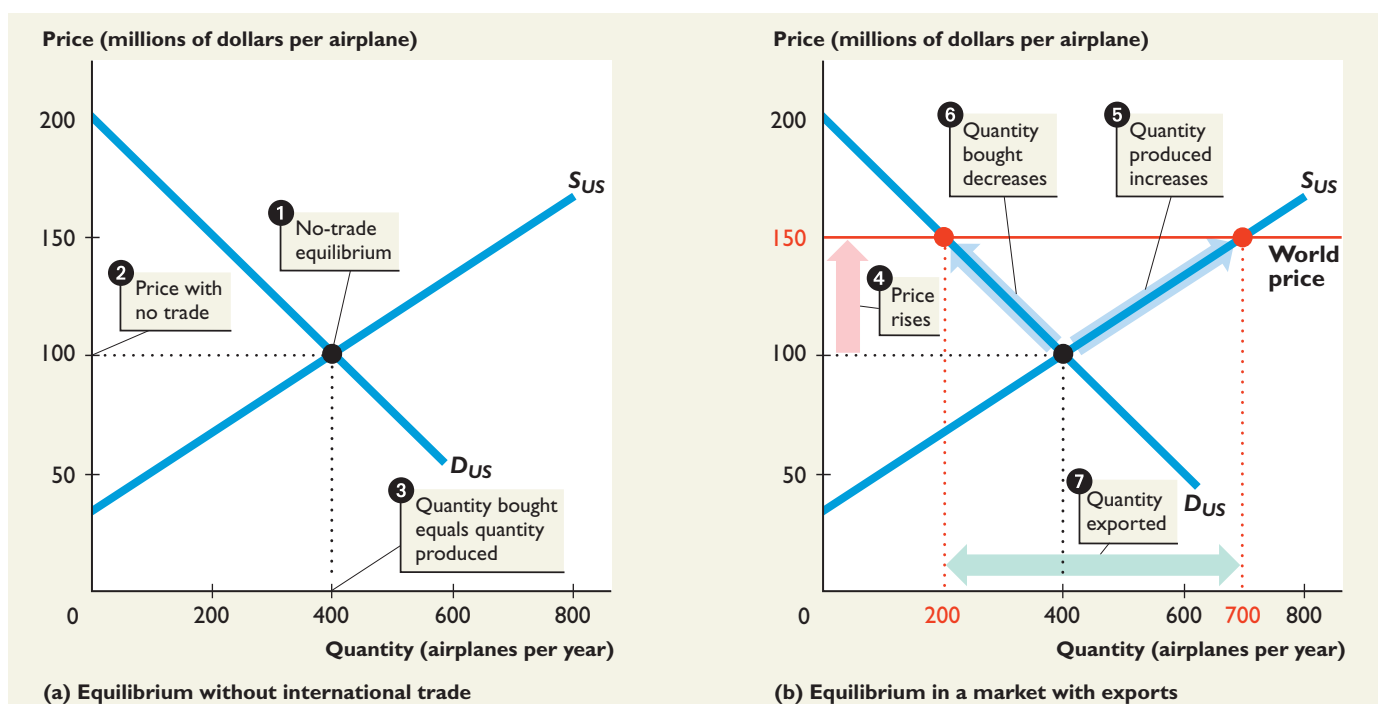
Figure 8.2(b) shows the U.S. airplane market *with* international trade. Now the price of an airplane is determined in the world market, not the U.S. domestic market. The world price is *higher than* \$100 million, which means that the United States has a comparative advantage in producing airplanes. The world price line shows the world price as \$150 million.

The U.S. demand curve, D_{US} , tells us that at \$150 million an airplane, U.S. airlines buy 200 airplanes a year. The U.S. supply curve, S_{US} , tells us that at \$150 million an airplane, U.S. aircraft makers produce 700 airplanes a year. The quantity produced in the United States (700 a year) minus the quantity purchased by U.S. airlines (200 a year) is the quantity of U.S. exports, which is 500 airplanes a year.

■ FIGURE 8.2

A Market with Exports

MyEconLab Animation



With no international trade, in part (a), ① domestic demand and domestic supply determine ② the equilibrium price at \$100 million an airplane and ③ the quantity at 400 airplanes a year.

With international trade, in part (b), world demand and world sup-

ply determine the world price, which is \$150 million an airplane. ④ The domestic price rises. ⑤ Domestic production increases to 700 airplanes a year, ⑥ domestic purchases decrease to 200 airplanes a year, and ⑦ 500 airplanes a year are exported.

MyEconLab

You can work these problems in Study Plan 8.1 and get instant feedback.



CHECKPOINT 8.1

Explain how markets work with international trade.

Practice Problems

- Suppose that the world price of sugar is 10 cents a pound, the United States does *not* trade internationally, and the U.S. equilibrium price of sugar is 20 cents a pound. The United States then begins to trade internationally.
 - How does the price of sugar in the United States change?
 - Do U.S. consumers buy more or less sugar?
 - Do U.S. sugar growers produce more or less sugar?
 - Does the United States export or import sugar?
- Suppose that the world price of steel is \$100 a ton, India does *not* trade internationally, and the equilibrium price of steel in India is \$60 a ton. India then begins to trade internationally.
 - How does the price of steel in India change?
 - How does the quantity of steel produced in India change?
 - How does the quantity of steel bought by India change?
 - Does India export or import steel?

In the News

Underwater oil discovery to transform Brazil into a major exporter

The discovery of a huge oil field could make Brazil a large exporter of gasoline. Until two years ago Brazil imported oil; then it became self-sufficient in oil. With this discovery, Brazil will become a major exporter of oil.

Source: *The New York Times*, January 11, 2008

Describe Brazil's comparative advantage in producing oil, and explain why its comparative advantage has changed.

Solutions to Practice Problems

- With no international trade, the U.S. domestic price of sugar exceeds the world price so we know that the rest of the world has a comparative advantage at producing sugar. With international trade, the price of sugar in the United States falls to the world price, U.S. consumers buy more sugar, and U.S. sugar growers produce less sugar. The United States imports sugar.
- With no international trade, the domestic price of steel in India is below the world price so we know that India has a comparative advantage at producing steel. With international trade, the price of steel in India rises to the world price, steel mills in India increase the quantity they produce, and the quantity of steel bought by Indians decreases. India exports steel.

Solution to In the News

Before 2008, Brazil did not have a comparative advantage in producing oil. Its cost of producing a barrel of oil was higher than the world market price, so Brazil imported oil. With the discovery of the new oil field, the cost of producing a barrel of oil in Brazil will be below the world price. Now Brazil will have a comparative advantage in the production of oil. With this new comparative advantage, Brazil will become an exporter of oil.

8.2 WINNERS, LOSERS, AND NET GAINS FROM TRADE

You've seen how international trade lowers the price of an imported good and raises the price of an exported good. Buyers of imported goods benefit from lower prices, and sellers of exported goods benefit from higher prices. But some people complain about international competition: Not everyone gains. We're now going to see who wins and who loses from free international trade. You will then be able to understand who complains about international competition and why.

We'll also see why we never hear the consumers of imported goods complaining and why we never hear exporters complaining, except when they want greater access to foreign markets. And we'll see why we *do* hear complaints from producers about cheap foreign imports.



EYE on GLOBALIZATION

Who Wins and Who Loses from Globalization

Economists generally agree that the gains from globalization vastly outweigh the losses. But there are both winners and losers.

The U.S. consumer is a big winner. Globalization has brought iPods, Wii games, Nike shoes, and a wide range of other products to our shops at ever lower prices.

The Indian (and Chinese and other Asian) worker is another big winner. Globalization has brought a wider range of more interesting jobs and higher wages.

The U.S. (and European) textile workers and furniture makers are big losers. Their jobs have disappeared and many of them have struggled to find new jobs even when they've been willing to take a pay cut.

But one of the biggest losers is the African farmer. Blocked from global food markets by trade restrictions and subsidies in the United States and Europe, globalization is leaving much of Africa on the sidelines.



The U.S. consumer ...



and Indian workers gain from globalization.



But some U.S. workers and ...



African farmers lose.

■ Gains and Losses from Imports

We measure the gains and losses from imports by examining their effect on consumer surplus, producer surplus, and total surplus. The winners are those whose surplus increases and the losers are those whose surplus decreases.

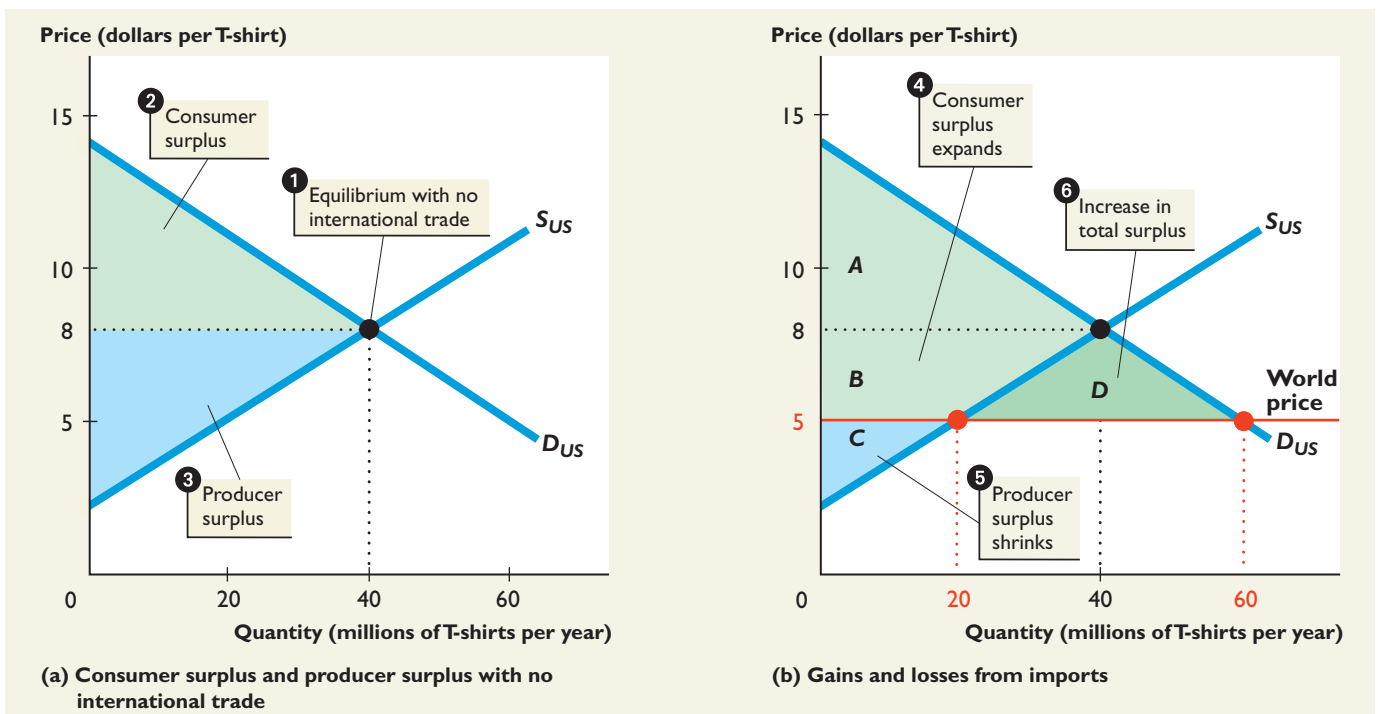
Figure 8.3(a) shows what consumer surplus and producer surplus would be with no international trade. Domestic demand, D_{US} , and domestic supply, S_{US} , determine the price and quantity. The green area shows consumer surplus and the blue area shows producer surplus. Total surplus is the sum of consumer surplus and producer surplus.

Figure 8.3(b) shows how these surpluses change when the market opens to imports. The price falls to the world price. The quantity purchased increases to the quantity demanded at the world price, and consumer surplus expands to the larger green area $A + B + D$. The quantity produced decreases to the quantity supplied at the world price, and producer surplus shrinks to the smaller blue area C .

Part of the gain in consumer surplus, the area B , is a loss of producer surplus—a redistribution of total surplus. But the other part of the increase in consumer surplus, the area D , is a net gain. This increase in total surplus is the gain from imports and results from the lower price and increased purchases.

FIGURE 8.3
Gains and Losses in a Market with Imports

MyEconLab Animation



With no international trade, ① equilibrium at the intersection of the domestic demand and domestic supply curves determines the price and quantity. ② The green area shows the consumer surplus and ③ the blue area shows the producer surplus.

With international trade, the domestic price falls to the world price. ④ Consumer surplus expands to the area $A + B + D$. Area B is a transfer of surplus from producers to consumers, and ⑤ producer surplus shrinks to area C . ⑥ Area D is an increase in total surplus.

■ Gains and Losses from Exports

We measure the gains and losses from exports just like we measured those from imports, by examining their effect on consumer surplus, producer surplus, and total surplus.

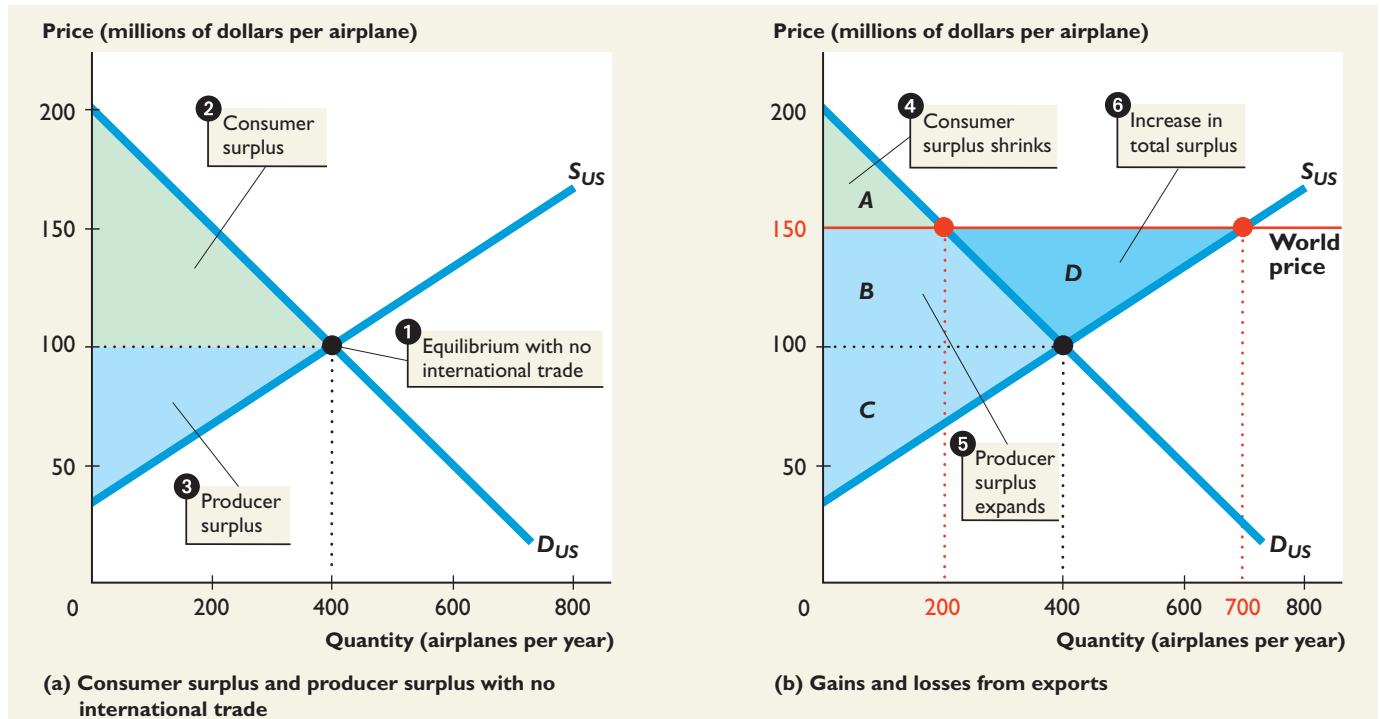
Figure 8.4(a) shows what the consumer surplus and producer surplus would be with no international trade. Domestic demand, D_{US} , and domestic supply, S_{US} , determine the price and quantity. The green area shows consumer surplus and the blue area shows producer surplus. The two surpluses sum to total surplus.

Figure 8.4(b) shows how the consumer surplus and producer surplus change when the good is exported. The price rises to the world price. The quantity bought decreases to the quantity demanded at the world price, and the consumer surplus shrinks to the green area A. The quantity produced increases to the quantity supplied at the world price, and the producer surplus expands from the blue area C to the larger blue area $B + C + D$.

Part of the gain of producer surplus, the area B, is a loss in consumer surplus—a redistribution of the total surplus. But the other part of the increase in producer surplus, the area D, is a net gain. This increase in total surplus is the gain from exports and results from the higher price and increased production.

FIGURE 8.4
Gains and Losses in a Market with Exports

MyEconLab Animation



With no international trade, **1** equilibrium at the intersection of the domestic demand and domestic supply curves determines the price and quantity. **2** The green area shows the consumer surplus and **3** the blue area shows the producer surplus.

With international trade, the domestic price rises to the world price. **4** Consumer surplus shrinks to the area A. **5** Producer surplus expands to the area $B + C + D$. Area B is transferred from consumers to producers. **6** Area D is an increase in total surplus.

MyEconLab

You can work these problems in Study Plan 8.2 and get instant feedback.

CHECKPOINT 8.2

Identify the gains from international trade and its winners and losers.

Practice Problems

Before the 1980s, China did not trade internationally: It was self-sufficient in coal and shoes. Then China began to trade internationally. The world price of coal was less than China's domestic price and the world price of shoes was higher than its domestic price.

1. Does China import or export coal? Who, in China, gains and who loses from international trade in coal? Does China gain from this trade in coal? On a graph of the market for coal in China show the gains, losses, and net gain or loss from international trade in coal.
2. Does China import or export shoes? Who, in China, gains and who loses from international trade in shoes? Does China gain from this trade in shoes? On a graph of the market for shoes in China, show the gains, losses, and net gain or loss from international trade in shoes.

In the News

Commodities post big drop

World commodity prices have fallen in the past six weeks. Crude oil prices dropped 7%, beef prices fell 5%, and corn prices fell 4%.

Source: *Global Commodity Watch*, June 15, 2011

The United States imports crude oil and exports beef. How do these price falls change the U.S. gains from trade in each good and the distribution of the gains?

FIGURE 1

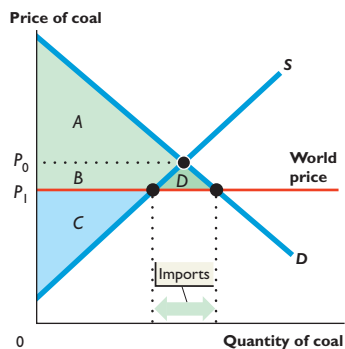
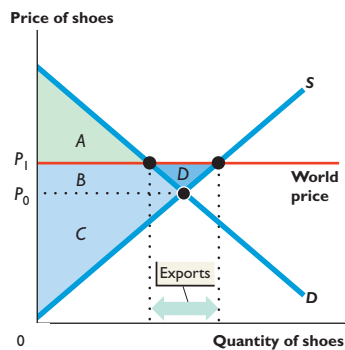


FIGURE 2



Solutions to Practice Problems

1. The rest of the world has a comparative advantage in producing coal. China imports coal, Chinese coal users gain, and Chinese coal producers lose. The gains exceed the losses: China gains from international trade in coal. Figure 1 shows the market for coal in China. The price before trade is P_0 . With trade, the price falls to the world price, P_1 . Consumers gain the area $B + D$, producers lose the area B , and the net gain from trade in coal is D .
2. China has a comparative advantage in producing shoes. China exports shoes, Chinese shoe producers gain, and Chinese shoe consumers lose. The gains exceed the losses: China gains from international trade in shoes. Figure 2 shows the shoe market in China. The price before trade is P_0 . With trade, the price rises to the world price, P_1 . Producers gain the area $B + D$, consumers lose the area B , and the net gain from trade in shoes is area D .

Solution to In the News

The United States does not have a comparative advantage in producing crude oil, so the fall in the world price increases imports and decreases U.S. production. Consumer surplus increases, producer surplus decreases, but consumers gain more than producers lose. The United States has a comparative advantage in producing beef, so the fall in the world price decreases U.S. production. Producer surplus decreases, consumer surplus increases, but producers lose more than consumers gain.

8.3 INTERNATIONAL TRADE RESTRICTIONS

Governments use four sets of tools to influence international trade and protect domestic industries from foreign competition. They are

- Tariffs
- Import quotas
- Other import barriers
- Export subsidies

Tariffs

A **tariff** is a tax that is imposed on a good when it is imported. For example, the government of India imposes a 100 percent tariff on wine imported from California. When an Indian firm imports a \$10 bottle of Californian wine, it pays the Indian government a \$10 import duty.

The incentive for governments to impose tariffs is strong. First, they provide revenue to the government. Second, they enable the government to satisfy the self-interest of people who earn their incomes in import-competing industries. As you will see, tariffs and other restrictions on free international trade decrease the gains from trade and are not in the social interest. Let's see how.

Tariff

A tax imposed on a good when it is imported.

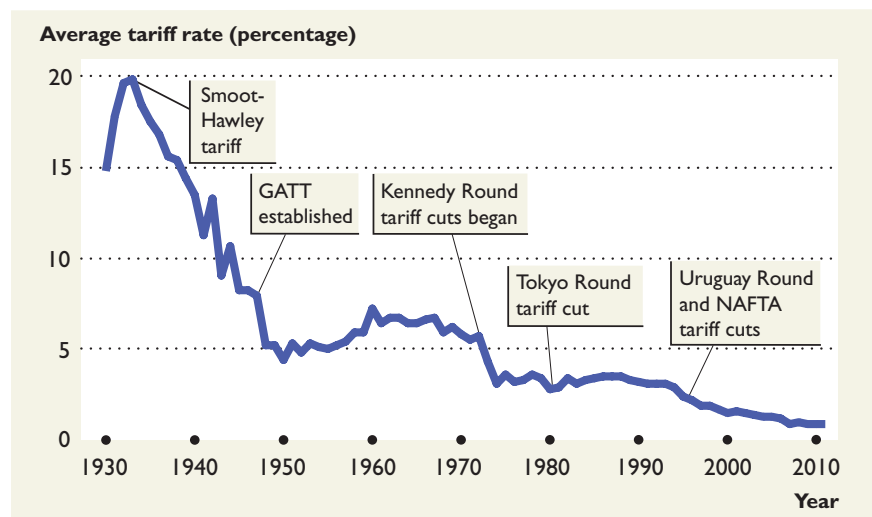


EYE on the PAST

The History of U.S. Tariffs

The figure shows the average tariff rate on U.S. imports since 1930. Tariffs peaked during the 1930s when Congress passed the Smoot-Hawley Act. With other nations, the United States signed the General Agreement on Tariffs and Trade (GATT) in 1947. In a series of rounds of negotiations, GATT achieved widespread tariff cuts for the United States and many other nations. Today, the World Trade Organization (WTO) continues the work of GATT and seeks to promote unrestricted trade among all nations.

The United States is a party to many trade agreements with individual countries or regions. These include the North American Free Trade Agreement (NAFTA) and the



SOURCES OF DATA: The Budget for Fiscal Year 2006, Historical Tables, Table 2.5 and Bureau of Economic Analysis.

Central American Free Trade Agreement (CAFTA). These agreements have eliminated tariffs on most

goods traded between the United States and the countries of Central and North America.

The Effects of a Tariff

To see the effects of a tariff, let's return to the example in which, with international free trade, the United States imports T-shirts. The T-shirts are imported and sold at the world price. Then, under pressure from U.S. garment makers, the U.S. government imposes a tariff on imported T-shirts. Buyers of T-shirts must now pay the world price plus the tariff. Several consequences follow in the market for T-shirts. Figure 8.5 illustrates these consequences.

Figure 8.5(a) is the same as Figure 8.1(b) and shows the situation with free international trade. The United States produces 20 million T-shirts and imports 40 million T-shirts a year at the world price of \$5 a T-shirt.

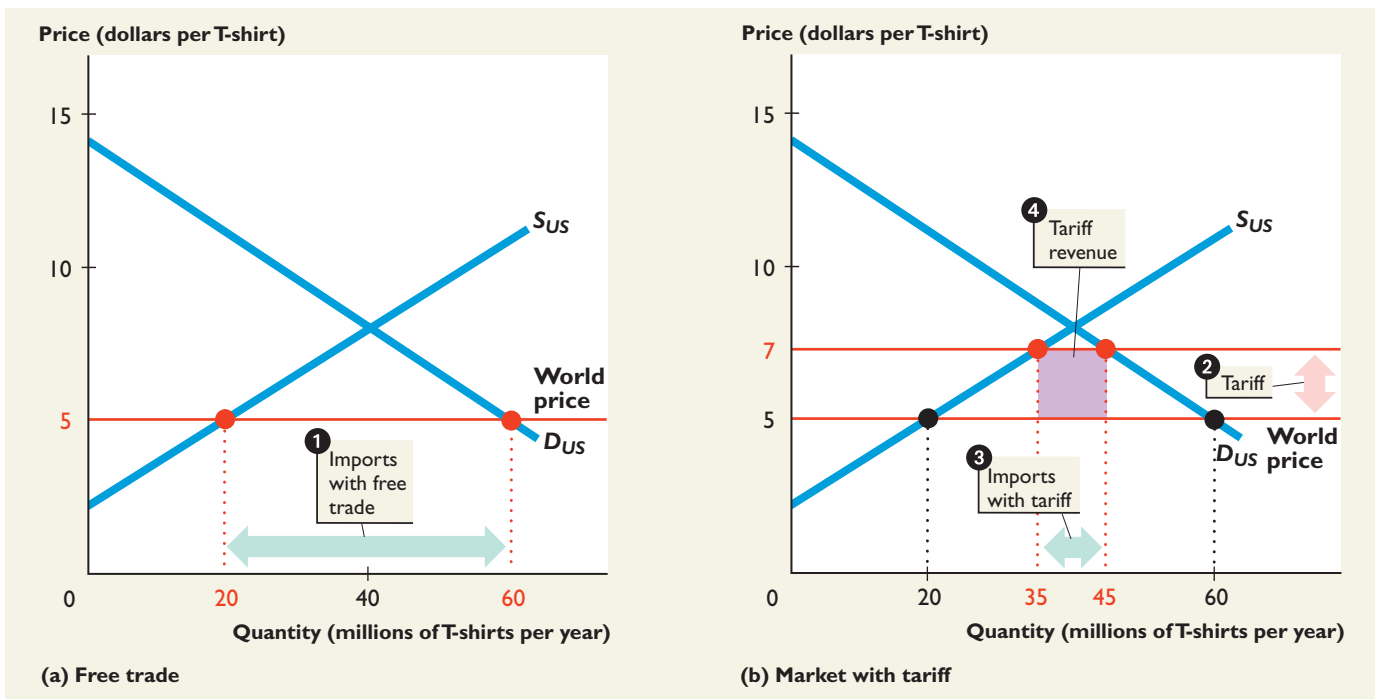
Figure 8.5(b) shows what happens with a tariff, which is set at \$2 per T-shirt. The following changes occur in the U.S. market for T-shirts:

- The price of a T-shirt in the United States rises by \$2.
- The quantity of T-shirts bought in the United States decreases.
- The quantity of T-shirts produced in the United States increases.
- The quantity of T-shirts imported into the United States decreases.
- The U.S. government collects a tariff revenue.

FIGURE 8.5

The Effects of a Tariff

MyEconLab Animation



The world price of a T-shirt is \$5. With free trade, in part (a), Americans buy 60 million T-shirts. The United States produces 20 million T-shirts and **1** imports 40 million T-shirts.

2 With a tariff of \$2 per T-shirt in part (b), the domestic price rises

to \$7 a T-shirt (the world price plus the tariff). Domestic production increases, purchases decrease, and **3** the quantity imported decreases. **4** The U.S. government collects tariff revenue of \$2 on each T-shirt imported, which is shown by the purple rectangle.

Rise in Price of a T-Shirt To buy a T-shirt, Americans must pay the world price plus the tariff, so the price of a T-shirt rises by \$2 to \$7. Figure 8.5(b) shows the new domestic price line, which lies \$2 above the world price line.

Decrease in Purchases The higher price of a T-shirt brings a decrease in the quantity demanded, which Figure 8.5(b) shows as a movement along the demand curve from 60 million T-shirts at \$5 a T-shirt to 45 million T-shirts at \$7 a T-shirt.

Increase in Domestic Production The higher price of a T-shirt stimulates domestic production, which Figure 8.5(b) shows as a movement along the supply curve from 20 million T-shirts at \$5 a T-shirt to 35 million T-shirts at \$7 a T-shirt.

Decrease in Imports T-shirt imports decrease by 30 million from 40 million to 10 million a year. Both the decrease in purchases and the increase in domestic production contribute to this decrease in imports.

Tariff Revenue The government's tariff revenue is \$20 million—\$2 per T-shirt on 10 million imported T-shirts—shown by the purple rectangle.

Winners, Losers, and the Social Loss from a Tariff

A tariff on an imported good creates winners and losers. When the U.S. government imposes a tariff on an imported good,

- U.S. producers of the good gain.
- U.S. consumers of the good lose.
- U.S. consumers lose more than U.S. producers gain.

U.S. Producers of the Good Gain Because the price of an imported T-shirt rises by the tariff, U.S. T-shirt producers are now able to sell their T-shirts for a higher price—the world price plus the tariff. As the price of a T-shirt rises, U.S. producers increase the quantity supplied. Because the marginal cost of producing a T-shirt in the United States is less than the higher price of all the T-shirts sold except for the marginal T-shirt, producer surplus increases. This increase in producer surplus is the gain to U.S. producers.

U.S. Consumers of the Good Lose Because the price of a T-shirt in the United States rises, the quantity of T-shirts demanded decreases. The combination of a higher price and smaller quantity bought decreases consumer surplus. This loss of consumer surplus represents the loss to U.S. consumers that arises from a tariff.

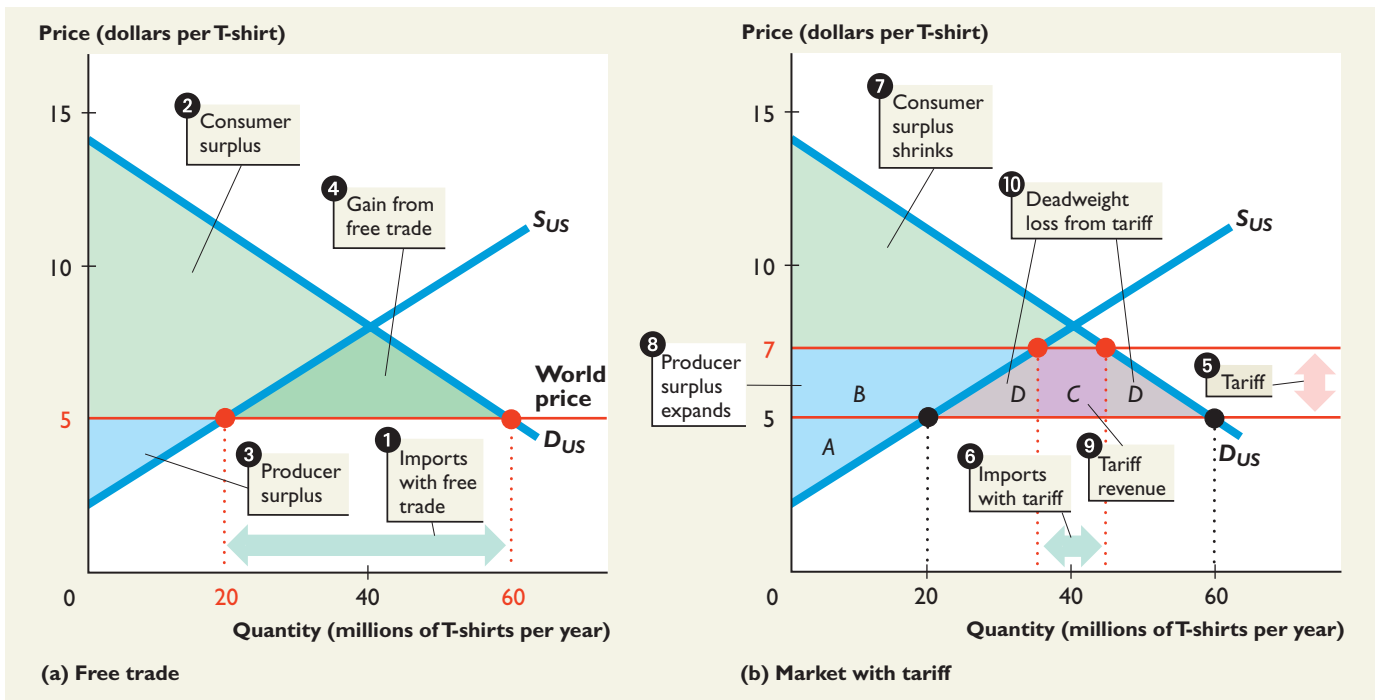
U.S. Consumers Lose More Than U.S. Producers Gain You've just seen that consumer surplus decreases and producer surplus increases, but which changes by more? Do consumers lose more than producers gain, or do producers gain more than consumers lose? Or is there just a straight transfer from consumers to producers? To answer these questions, we need to return to the demand and supply analysis of the market for T-shirts and compare the changes in consumer surplus and producer surplus.

Figure 8.6(a) is the same as Figure 8.3(b) and shows the consumer surplus and producer surplus with free international trade in T-shirts. The dark green area is the increase in total surplus that comes from free international trade. By comparing

FIGURE 8.6

The Winners and Losers from a Tariff

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The world price of a T-shirt is \$5. With free trade, **1** the United States imports 40 million T-shirts. **2** Consumer surplus, **3** producer surplus, and **4** the gains from free international trade are as large as possible. **5** A tariff of \$2 per T-shirt raises the price of a

T-shirt to \$7. **6** The quantity imported decreases. **7** Consumer surplus shrinks by the areas B, C, and D. **8** Producer surplus expands by area B. **9** The government's tariff revenue is area C, and **10** the tariff creates a deadweight loss equal to the areas D.

Figure 8.6(b) with Figure 8.6(a), you can see how a \$2 tariff on imported T-shirts changes the surpluses. Producer surplus—the blue area—increases by the area labeled B. The increase in producer surplus is the gain by U.S. producers from the tariff. Consumer surplus—the green area—shrinks.

The decrease in consumer surplus divides into three parts. First, some of the consumer surplus is transferred to producers. The blue area B represents this loss of consumer surplus (and gain of producer surplus). Second, part of the consumer surplus is transferred to the government. The purple area C represents this loss of consumer surplus (and gain of government revenue). When the tariff revenue is spent, both consumers and producers receive some benefit, but there is no expectation that the buyers of T-shirts will receive the benefits of the expenditure of this tariff revenue from T-shirts. The tariff revenue is a loss to buyers of T-shirts.

The third part of the loss of consumer surplus is a transfer to no one: it is a *deadweight loss*. Consumers buy a smaller quantity at a higher price. The two gray areas labeled D represent this loss of consumer surplus. Total surplus decreases by this amount, which is the social loss from the tariff.

Let's now look at the second tool for restricting trade: quotas.

■ Import Quotas

An **import quota** is a quantitative restriction on the import of a good that limits the maximum quantity of a good that may be imported in a given period. The United States imposes import quotas on many items, including sugar, bananas, and textiles.

Quotas enable the government to satisfy the self-interest of people who earn their incomes in import-competing industries. You will see that like a tariff, a quota on imports decreases the gains from trade and is not in the social interest.

Import quota

A quantitative restriction on the import of a good that limits the maximum quantity of a good that may be imported in a given period.

The Effects of an Import Quota

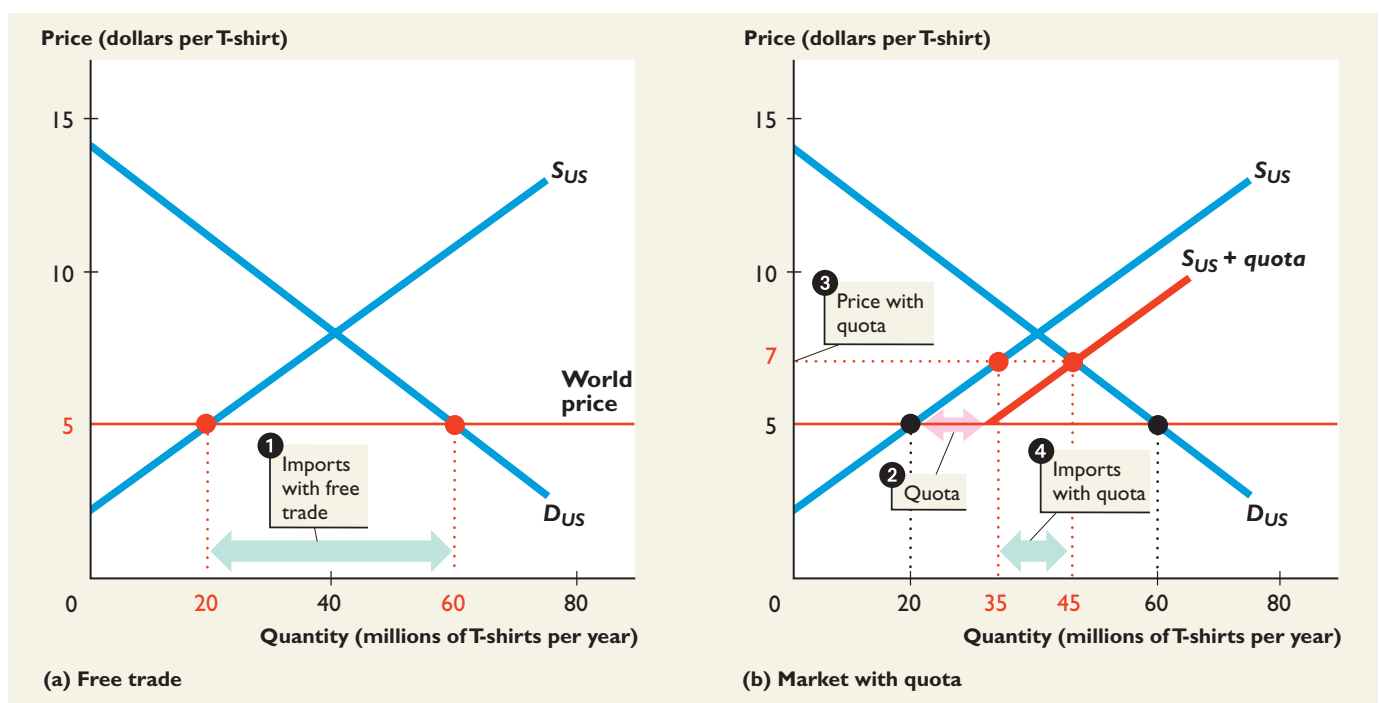
The effects of an import quota are similar to those of a tariff. The price rises, the quantity bought decreases, and the quantity produced in the United States increases. Figure 8.7 illustrates the effects.

Figure 8.7(a) shows the situation with free international trade. Figure 8.7(b) shows what happens with a quota that limits imports to 10 million T-shirts a year. The U.S. supply curve of T-shirts becomes the domestic supply curve, S_{US} , plus the quantity that the quota permits to be imported. So the U.S. supply curve becomes the curve labeled $S_{US} + quota$. The price of a T-shirt rises to \$7, the

■ FIGURE 8.7

The Effects of an Import Quota

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With free trade, in part (a), Americans buy 60 million T-shirts at the world price. The United States produces 20 million T-shirts and 1 imports 40 million T-shirts. 2 With an import quota of 10 mil-

lion T-shirts, in part (b), the U.S. supply curve becomes $S_{US} + quota$. 3 The price rises to \$7 a T-shirt. Domestic production increases, purchases decrease, and 4 the quantity imported decreases.

producer surplus is the gain by U.S. producers from the import quota. Consumer surplus—the green area—shrinks. This decrease is the loss to consumers from the import quota.

The decrease in consumer surplus divides into three parts. First, some of the consumer surplus is transferred to producers. The blue area *B* represents this loss of consumer surplus (and gain of producer surplus). Second, part of the consumer surplus is transferred to importers who buy T-shirts for \$5 (the world price) and sell them for \$7 (the domestic price). The blue areas *C* represent this loss of consumer surplus and profit for importers.

The third part of the loss of consumer surplus is a transfer to no one: it is a *deadweight loss*. Consumers buy a smaller quantity at a higher price. The two gray areas labeled *D* represent this loss of consumer surplus. Total surplus decreases by this amount, which is the social loss from the import quota.

You can now see the one difference between an import quota and a tariff. A tariff brings in revenue for the government while an import quota brings a profit for the importer. All the other effects are the same, provided the quota is set at the same level of imports that results from the tariff.

■ Other Import Barriers

Two sets of policies that influence imports are

- Health, safety, and regulation barriers
- Voluntary export restraints

Health, Safety, and Regulation Barriers

Thousands of detailed health, safety, and other regulations restrict international trade. For example, U.S. food imports are examined by the Food and Drug Administration to determine whether the food is “pure, wholesome, safe to eat, and produced under sanitary conditions.” The discovery of BSE (mad cow disease) in just one U.S. cow in 2003 was enough to close down international trade in U.S. beef. The European Union bans imports of most genetically modified foods, such as U.S.-produced soybeans. Although regulations of the type we’ve just described are not designed to limit international trade, they have that effect.

Voluntary Export Restraints

A *voluntary export restraint* is like a quota allocated to a foreign exporter of the good. A voluntary export restraint decreases imports just like an import quota does, but the foreign exporter gets the profit from the gap between the domestic price and the world price.

■ Export Subsidies

A **subsidy** is a payment by the government to a producer. An *export subsidy* is a payment by the government to the producer of an exported good. The U.S. and European Union governments subsidize farm products. These subsidies stimulate the production and export of farm products, but they make it harder for producers in other countries, notably in Africa and Central and South America, to compete in global markets. Export subsidies bring gains to domestic producers, but they result in overproduction in the domestic economy and underproduction in the rest of the world and so create a deadweight loss (see Chapter 6, p. 155).

Subsidy

A payment by the government to a producer.

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You can work these problems in Study Plan 8.3 and get instant feedback.

CHECKPOINT 8.3

Explain the effects of international trade barriers.

Practice Problems

Before 1995, the United States imposed tariffs on goods imported from Mexico and Mexico imposed tariffs on goods imported from the United States. In 1995, Mexico joined NAFTA. U.S. tariffs on imports from Mexico and Mexican tariffs on imports from the United States are gradually being removed.

1. Explain how the price that U.S. consumers pay for goods imported from Mexico and the quantity of U.S. imports from Mexico have changed. Who, in the United States, are the winners and losers from this free trade?
2. Explain how the quantity of U.S. exports to Mexico and the U.S. government's tariff revenue from trade with Mexico have changed.
3. Suppose that this year, tomato growers in Florida lobby the U.S. government to impose an import quota on Mexican tomatoes. Explain who, in the United States, would gain and who would lose from such a quota.

In the News

Indonesians bemoan Hollywood blockbuster blackout

Four months ago Indonesia imposed an import tariff on Hollywood movies. The tariff was meant "to protect local film makers." The major Hollywood studios responded by withdrawing their films from Indonesia.

Source: *The Jakarta Post*, July 6, 2011

Explain how this tariff influences the price of seeing a movie in Indonesia, the quantity of movies produced in Indonesia, and Indonesia's gains from trade with the United States. Who, in Indonesia, gains from the tariff and who loses?

Solutions to Practice Problems

1. The price that U.S. consumers pay for goods imported from Mexico has fallen and the quantity of U.S. imports from Mexico has increased. The winners are U.S. consumers of goods imported from Mexico and the losers are U.S. producers of goods imported from Mexico.
2. The quantity of U.S. exports to Mexico has increased and the U.S. government's tariff revenue from trade with Mexico has fallen.
3. With an import quota, the price of tomatoes in the United States would rise and the quantity bought would decrease. Consumer surplus would decrease. Growers would receive a higher price, produce a larger quantity, and producer surplus would increase. The U.S. total surplus in the tomato market would be redistributed from consumers to producers, but it would decrease.

Solution to In the News

The tariff raises the price of seeing a movie in Indonesia. The production of movies in Indonesia increases, and imports of Hollywood movies fall to zero. Indonesia's gains from trade with the United States decrease. With the higher price, consumer surplus decreases—consumers lose. Producer surplus increases—producers gain. The government collected zero tariff revenue.

8.4 THE CASE AGAINST PROTECTION

For as long as nations and international trade have existed, people have debated whether free international trade or protection from foreign competition is better for a country. The debate continues, but most economists believe that free trade promotes prosperity for all countries while protection reduces the potential gains from trade. We've seen the most powerful case for free trade: All countries benefit from their comparative advantage. But there is a broader range of issues in the free trade versus protection debate. Let's review these issues.

■ Three Traditional Arguments for Protection

Three traditional arguments for protection and restricting international trade are

- The national security argument
- The infant-industry argument
- The dumping argument

Let's look at each in turn.

The National Security Argument

The national security argument is that a country must protect industries that produce defense equipment and armaments and those on which the defense industries rely for their raw materials and other intermediate inputs. This argument for protection can be taken too far.

First, it is an argument for international isolation, for in a time of war, there is no industry that does not contribute to national defense. Second, if the case is made for boosting the output of a strategic industry—say aerospace—it is more efficient to achieve this outcome with a subsidy financed out of taxes than with a tariff or import quota. A subsidy would keep the industry operating at the scale that is judged appropriate, and free international trade would keep the prices faced by consumers at their world market levels.

The Infant-Industry Argument

The **infant-industry argument** is that it is necessary to protect a new industry to enable it to grow into a mature industry that can compete in world markets. The argument is based on an idea called *learning-by-doing*. By working repeatedly at a task, workers become better at that task and can increase the amount they produce in a given period.

There is nothing wrong with the idea of learning-by-doing. It is a powerful engine of human capital accumulation and economic growth. Learning-by-doing can change comparative advantage. If on-the-job experience lowers the opportunity cost of producing a good, a country might develop a comparative advantage in producing that good. Learning-by-doing does not justify protection.

It is in the self-interest of firms and workers who benefit from learning-by-doing to produce the efficient quantities. If the government protected these firms to boost their production, there would be an inefficient overproduction (just like the overproduction in Chapter 6, p. 155).

The historical evidence is against the protection of infant industries. Countries in East Asia that have not given such protection have performed well. Countries that have protected infant industries, as India once did, have performed poorly.

Infant-industry argument

The argument that it is necessary to protect a new industry to enable it to grow into a mature industry that can compete in world markets.

Dumping

When a foreign firm sells its exports at a lower price than its cost of production.

The Dumping Argument

Dumping occurs when a foreign firm sells its exports at a lower price than its cost of production. You might be wondering why a firm would ever want to sell any of its output at a price below the cost of production. Wouldn't such a firm be better off either selling nothing, or, if it could do so, raising its price to at least cover its costs? Two possible reasons why a firm might sell at a price below cost and therefore engage in dumping are

- Predatory pricing
- Subsidy

Predatory Pricing A firm that engages in *predatory pricing* sets its price below cost in the hope that it can drive its competitors out of the market. If a firm in one country tries to drive out competitors in another country, it will be *dumping* its product in the foreign market. The foreign firm sells its output at a price below its cost to drive domestic firms out of business. When the domestic firms have gone, the foreign firm takes advantage of its monopoly position and charges a higher price for its product. The higher price will attract new competitors, which makes it unlikely that this strategy will be profitable. For this reason, economists are skeptical that this type of dumping occurs.

Subsidy A *subsidy* is a payment by the government to a producer. A firm that receives a subsidy is able to sell profitably for a price below cost. Subsidies are very common in almost all countries. The United States and the European Union subsidize the production of many agricultural products and dump their surpluses on the world market. This action lowers the prices that farmers in developing nations receive and weakens the incentive to expand farming in poor countries. India and Europe have been suspected of dumping steel in the United States.

Whatever its source, dumping is illegal under the rules of the WTO, NAFTA, and CAFTA and is regarded as a justification for temporary tariffs. Consequently, anti-dumping tariffs have become important in today's world.

But there are powerful reasons to resist the dumping argument for protection. First, it is virtually impossible to detect dumping because it is hard to determine a firm's costs. As a result, the test for dumping is whether a firm's export price is below its domestic price. This test is a weak one because it can be rational for a firm to charge a lower price in markets in which the quantity demanded is highly sensitive to price and a higher price in a market in which demand is less price-sensitive.

Second, it is hard to think of a good that is produced by a single firm. Even if all the domestic firms were driven out of business in some industry, it would always be possible to find several and usually many alternative foreign sources of supply and to buy at prices determined in competitive markets.

Third, if a good or service were a truly global natural monopoly, the best way to deal with it would be by regulation—just as in the case of domestic monopolies. Such regulation would require international cooperation.

The three arguments for protection that we've just examined have an element of credibility. The counterarguments are in general stronger, so these arguments do not make the case for protection. They are not the only arguments that you might encounter. There are many others, four of which we'll now examine.

■ Four Newer Arguments for Protection

Four newer and commonly made arguments for restricting international trade are that protection

- Saves jobs
- Allows us to compete with cheap foreign labor
- Brings diversity and stability
- Penalizes lax environmental standards

Saves Jobs

When Americans buy imported goods such as shoes from Brazil, U.S. workers who produce shoes lose their jobs. With no earnings and poor prospects, these workers become a drain on welfare and spend less, which creates a ripple effect of further job losses. The proposed solution is to protect U.S. jobs by banning imports of cheap foreign goods. The proposal is flawed for the following reasons.

First, free trade does cost some jobs, but it also creates other jobs. It brings about a global rationalization of labor and allocates labor resources to their highest-valued activities. Because of international trade in textiles, tens of thousands of workers in the United States have lost jobs because textile mills and other factories have closed. Tens of thousands of workers in other countries now have jobs because textile mills have opened there. And tens of thousands of U.S. workers now have better-paying jobs than as textile workers because other export industries have expanded and created more jobs than have been destroyed.

Second, imports create jobs. They create jobs for retailers that sell imported goods and for firms that service those goods. They also create jobs by creating incomes in the rest of the world, some of which are spent on imports of U.S.-made goods and services.

Protection saves some particular jobs, but it does so at a high cost. For example, until 2005, textile jobs in the United States were protected by import quotas imposed under an international agreement called the Multifiber Arrangement (or MFA). The U.S. International Trade Commission (ITC) estimated that because of import quotas, 72,000 jobs existed in textiles that would otherwise disappear and annual clothing expenditure in the United States was \$15.9 billion (\$160 per family) higher than it would be with free trade. An implication of the ITC estimate is that each textile job saved cost consumers \$221,000 a year. The end of the MFA led to the destruction of a large number of textile jobs in the United States and Europe in 2005.

Allows Us to Compete with Cheap Foreign Labor

With the removal of protective tariffs in U.S. trade with Mexico, some people said that jobs would be sucked into Mexico and that the United States would not be able to compete with its southern neighbor. Let's see what's wrong with this view.

Labor costs depend on the wage rate and the quantity a worker produces. For example, if a U.S. auto worker earns \$30 an hour and produces 15 units of output an hour, the average labor cost of a unit of output is \$2. If a Mexican auto worker earns \$3 an hour and produces 1 unit of output an hour, the average labor cost of a unit of output is \$3. Other things remaining the same, the greater the output a worker produces, the higher is the worker's wage rate. High-wage workers produce a large output. Low-wage workers produce a small output.

Although high-wage U.S. workers are more productive, on the average, than lower-wage Mexican workers, there are differences across industries. U.S. labor is relatively more productive in some activities than in others. For example, the productivity of U.S. workers in producing movies, financial services, and customized computer chips is relatively higher than their productivity in the production of metals and some standardized machine parts. The activities in which U.S. workers are relatively more productive than their Mexican counterparts are those in which the United States has a comparative advantage. By engaging in free trade, increasing our production and exports of the goods and services in which we have a comparative advantage, and decreasing our production and increasing our imports of the goods and services in which our trading partners have a comparative advantage, we can make ourselves and the citizens of other countries better off.

Brings Diversity and Stability

A diversified investment portfolio is less risky than one that has all of its eggs in one basket. The same is true for an economy's production. A diversified economy fluctuates less than an economy that produces only one or two goods.

Most economies, whether the rich, advanced United States, Japan, and Europe or the developing China and Brazil, have diversified production and do not have this type of stability problem. A few economies, such as Saudi Arabia, have a comparative advantage that leads to the specialized production of only one good. But even these economies can stabilize their income and consumption by investing in a wide range of production activities in other countries.

Penalizes Lax Environmental Standards

A new argument for protection is that many poorer countries, such as Mexico, do not have the same environmental standards that we have, and because they are willing to pollute and we are not, we cannot compete with them without tariffs. If these countries want free trade with the richer and "greener" countries, then they must raise their environmental standard.

This argument for trade restrictions is not entirely convincing. A poor country is less able than a rich one to devote resources to achieving high environmental standards. If free trade helps a poor country to become richer, then it will also help that country to develop the means to improve its environment. But there probably is a case for using the negotiation of free trade agreements such as NAFTA and CAFTA to hold member countries to higher environmental standards. There is an especially large payoff from using such bargaining to try to avoid irreversible damage to resources such as tropical rainforests.

So the four common arguments that we've just considered do not provide overwhelming support for protection. They all have flaws and leave the case for free international trade a strong one.

■ Why Is International Trade Restricted?

Why, despite all the arguments against protection, is international trade restricted? One reason that applies to developing nations is that the tariff is a convenient source of government revenue, but this reason does not apply to the United States where the government has access to income taxes and sales taxes.

Political support for international trade restrictions in the United States and most other developed countries arises from rent seeking. **Rent seeking** is lobbying and other political activity that seeks to capture the gains from trade. You've seen that free trade benefits consumers but shrinks the producer surplus of firms that compete in markets with imports.

The winners from free trade are the millions of consumers of low-cost imports, but the benefit per individual consumer is small. The losers from free trade are the producers of import-competing items. Compared to the millions of consumers, there are only a few thousand producers.

Now think about imposing a tariff on clothing. Millions of consumers will bear the cost in the form of a smaller consumer surplus and a few thousand garment makers and their employees will share the gain in producer surplus.

Because the gain from a tariff is large, producers have a strong incentive to incur the expense of lobbying *for* a tariff and *against* free trade. On the other hand, because each consumer's loss is small, consumers have little incentive to organize and incur the expense of lobbying *for* free trade. The gain from free trade for any one person is too small for that person to spend much time or money on a political organization to lobby for free trade. The loss from free trade will be seen as being so great by those bearing that loss that they will find it profitable to join a political organization to prevent free trade. Each group weighs benefits against costs and chooses the best action for themselves, but the anti-free-trade group will undertake more political lobbying than will the pro-free-trade group.

Rent seeking

Lobbying and other political activity that aims to capture the gains from trade.



EYE on YOUR LIFE

International Trade

International trade plays an extraordinarily large role in your life in three broad ways. It affects you as a

- Consumer
- Producer
- Voter

As a *consumer*, you benefit from the availability of a wide range of low-cost, high-quality goods and services that are produced in other countries.

Look closely at the labels on the items you buy. Where was your computer made? Where were your shirt and your shoes made? Where are the fruits and vegetables that you buy, especially in winter, grown?

The answers to all these questions are most likely Asia, Mexico, or South America. A few items were produced in Europe, Canada, and the United States.

As a *producer* (or as a potential producer if you don't yet have a job), you benefit from huge global markets for U.S. products. Your job prospects would be much dimmer if the firm for which you work didn't have global markets in which to sell its products.

People who work in the aircraft industry, for example, benefit from the huge global market for large passenger jets. Airlines from Canada to China are buying Boeing 777 aircraft as fast as they can be pushed out of the production line.

Even if you were to become a college professor, you would benefit from international trade in education services when your school admits foreign students.

As a *voter*, you have a big stake in the politics of free trade versus protection. As a buyer, your self-interest is hurt by tariffs and quotas on imported goods. Each time you buy a \$20 sweater, you contribute \$5 to the government in tariff revenue. But as a worker, your self-interest might be hurt by offshoring and by freer access to U.S. markets for foreign producers.

So as you decide how to vote, you must figure out what trade policy serves your self-interest and what best serves the social interest.

MyEconLab

You can work these problems in Study Plan 8.4 and get instant feedback.

CHECKPOINT 8.4

Explain and evaluate arguments used to justify restricting international trade.

Practice Problems

1. Japan sets an import quota on rice. California rice growers would like to export more rice to Japan. What are Japan's arguments for restricting imports of Californian rice? Are these arguments correct? Who loses from this restriction in trade?
2. The United States has, from time to time, limited imports of steel from Europe. What argument has the United States used to justify this quota? Who wins from this restriction? Who loses?
3. The United States maintains an import quota on sugar. What is the argument for this import quota? Is this argument flawed? If so, explain why.

In the News

Indonesians bemoan Hollywood blockbuster blackout

The Indonesian import tariff on Hollywood movies was meant "to protect local film makers," but major Hollywood studios withdrew their films.

Source: *The Jakarta Post*, July 6, 2011

What argument is Indonesia using against free trade with the United States? What is wrong with Indonesia's argument?

Solutions to Practice Problems

1. The main arguments are that Japanese rice is a better quality rice and that the quota limits competition faced by Japanese farmers. The arguments are not correct. If Japanese consumers do not like the quality of Californian rice, they will not buy it. The quota does limit competition and the quota allows Japanese farmers to use their land less efficiently. The big losers are the Japanese consumers who pay about three times the U.S. price for rice.
2. The U.S. argument is that European producers dump steel on the U.S. market. With an import quota, U.S. steel producers will face less competition and U.S. jobs will be saved. Workers in the steel industry and owners of steel companies will win at the expense of U.S. buyers of steel.
3. The argument is that the import quota protects the jobs of U.S. workers. The argument is flawed because the United States does not have a comparative advantage in producing sugar and so an import quota allows the U.S. sugar industry to be inefficient. With free international trade in sugar, the U.S. sugar industry would exist but it would be much smaller and more efficient.

Solution to In the News

Indonesia is using the infant-industry argument: Protection is needed to allow its movie industry to mature and, through learning-by-doing, Indonesia will develop a comparative advantage in movie production. What's wrong with this argument is that protected industries generally perform poorly and the country does not develop the comparative advantage.

CHAPTER SUMMARY

Key Points

1 Explain how markets work with international trade.

- Comparative advantage drives international trade.
- When the world price of a good is lower than the price that balances domestic demand and supply, a country gains by decreasing production and importing the good.
- When the world price of a good is higher than the price that balances domestic demand and supply, a country gains by increasing production and exporting the good.

2 Identify the gains from international trade and its winners and losers.

- Compared to a no-trade situation, in a market with imports, consumer surplus is larger, producer surplus is smaller, and total surplus is larger with free international trade.
- Compared to a no-trade situation, in a market with exports, consumer surplus is smaller, producer surplus is larger, and total surplus is larger with free international trade.

3 Explain the effects of international trade barriers.

- Countries restrict international trade by imposing tariffs, import quotas, other import barriers, and export subsidies.
- Trade restrictions raise the domestic price of imported goods, lower the quantity imported, decrease consumer surplus, increase producer surplus, and create a deadweight loss.

4 Explain and evaluate arguments used to justify restricting international trade.

- The arguments that protection is necessary for national security, for infant industries, and to prevent dumping are weak.
- Arguments that protection saves jobs, allows us to compete with cheap foreign labor, makes the economy diversified and stable, and is needed to penalize lax environmental standards are flawed.
- Trade is restricted because protection brings small losses to a large number of people and large gains to a small number of people.

Key Terms

Dumping, 214

Exports, 196

Import quota, 209

Imports, 196

Infant-industry argument, 213

Rent seeking, 217

Subsidy, 211

Tariff, 205

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You can work these problems in Chapter 8 Study Plan and get instant feedback.

FIGURE 1 U.S. SHOE MARKET

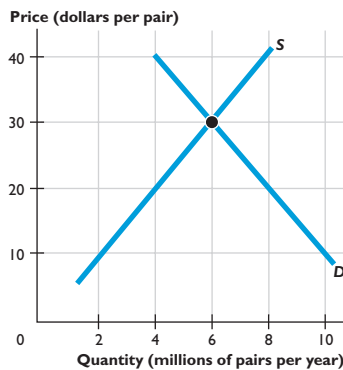
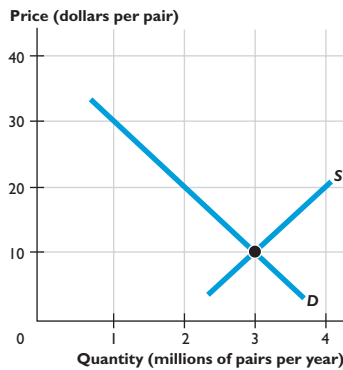


FIGURE 2 BRAZIL'S SHOE MARKET



CHAPTER CHECKPOINT

Study Plan Problems and Applications

Use Figures 1 and 2 to work Problems 1 to 4. Figure 1 shows the U.S. market for shoes and Figure 2 shows Brazil's market for shoes if there is no international trade in shoes between the United States and Brazil.

1. Which country has a comparative advantage in producing shoes? With international trade, explain which country would export shoes and how the price of shoes in the importing country and the quantity produced by the importing country would change. Explain which country gains from this trade.
2. The world price of a pair of shoes is \$20. Explain how consumer surplus and producer surplus in the United States change as a result of international trade. On the graph, show the change in U.S. consumer surplus (label it *A*) and the change in U.S. producer surplus (label it *B*).
3. The world price of a pair of shoes is \$20. Explain how consumer surplus and producer surplus in Brazil change as a result of international trade. Show the change in Brazil's consumer surplus (label it *C*) and the change in Brazil's producer surplus (label it *D*).
4. Who in the United States loses from free trade in shoes with Brazil? Explain why.

Use the following information to work Problems 5 to 7.

5. The supply of roses in the United States is made up of U.S. grown roses and imported roses. Draw a graph to illustrate the U.S. rose market with free international trade. On your graph, mark the price of roses and the quantities of roses bought, produced, and imported into the United States.
6. Who in the United States loses from this trade in roses and would lobby for a restriction on the quantity of imported roses? If the U.S. government put a tariff on rose imports, show on your graph the U.S. consumer surplus that is redistributed to U.S. producers and also the government's tariff revenue.
7. Suppose that the U.S. government puts an import quota on roses. Show on your graph the consumer surplus that is redistributed to producers and importers and also the deadweight loss created by the import quota.

Use the following information to work Problems 8 to 10.

U.S. expands China paper anti-dumping tariff

The U.S. Commerce Department has raised the tariff on glossy paper imports from China up to 99.65 percent, as a result of complaints by NewPage Corp. of Dayton, Ohio. Imports from China increased 166 percent from 2005 to 2006. This glossy paper is used in art books, high-end magazines, and textbooks.

Source: *Reuters*, May 30, 2007

8. Explain who, in the United States, gains and who loses from this tariff on paper. How do you expect the prices of magazines and textbooks to change?
9. What is dumping? Who in the United States loses from China's dumping of glossy paper?
10. Explain what an anti-dumping tariff is. What argument might NewPage Corp. have used to persuade the U.S. Commerce Department to impose a 99.65 percent tariff?

Instructor Assignable Problems and Applications

Use the following information to work Problems 1 and 2.

The future of U.S.–India relations

In May 2009, Secretary of State Hillary Clinton gave a major speech covering all the issues in U.S.–India relations. On economic and trade relations she noted that India maintains significant barriers to U.S. trade. The United States also maintains barriers against Indian imports such as textiles. Mrs. Clinton, President Obama, and Anand Sharma, the Indian Minister of Commerce and Industry, say they want to dismantle these trade barriers.

Source: www.state.gov

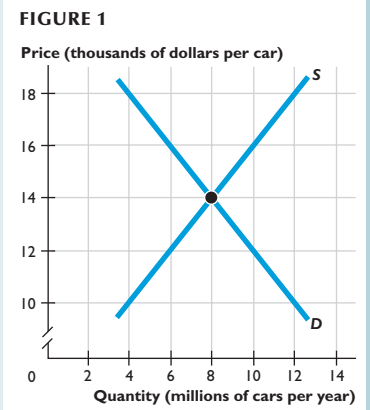
1. Explain who in the United States would gain and who might lose from dismantling trade barriers between the United States and India.
2. Draw a graph of the U.S. market for textiles and show how removing a tariff would change producer surplus, consumer surplus, and the deadweight loss from the tariff.
3. The United States exports wheat. Draw a graph to illustrate the U.S. wheat market if there is free international trade in wheat. On your graph, mark the price of wheat and the quantities bought, produced, and exported by the United States.
4. Suppose that the world price of sugar is 20 cents a pound, Brazil does not trade internationally, and the equilibrium price of sugar in Brazil is 10 cents a pound. Brazil then begins to trade internationally.
 - How does the price of sugar in Brazil change? Do Brazilians buy more or less sugar? Do Brazilian sugar growers produce more or less sugar?
 - Does Brazil export or import sugar and why?
5. The United States exports services and imports coffee. Why does the United States gain from exporting services and importing coffee? How do economists measure the net gain from this international trade?

Use Figure 1 and the following information to work Problems 6 to 8.

Figure 1 shows the car market in Mexico when Mexico places no restriction on the quantity of cars imported. The world price of a car is \$10,000.

6. If the government of Mexico introduces a \$2,000 tariff on car imports, what will be the price of a car in Mexico, the quantity of cars produced in Mexico, the quantity imported into Mexico, and the government's tariff revenue?
7. If the government of Mexico introduces an import quota of 4 million cars a year, what will be the price of a car in Mexico, the quantity of cars produced in Mexico, and the quantity imported?
8. What argument might be used to encourage the government of Mexico to introduce a \$2,000 tariff on car imports from the United States? Who will gain and who will lose as a result of Mexico's tariff?
9. In the 1950s, Ford and General Motors established a small car-producing industry in Australia and argued for a high tariff on car imports. The tariff has remained through the years. Until 2000, the tariff was 22.5 percent. What might have been Ford's and General Motors' argument for the high tariff? Is the tariff the best way to achieve the goals of the argument?

Your instructor can assign these problems as homework, a quiz, or a test in [MyEconLab](#).



MyEconLab

You can work this quiz in Chapter 8 Study Plan and get instant feedback.

Multiple Choice Quiz

- The fundamental force driving international trade is comparative _____.
 - advantage: a country exports those goods that have high prices
 - abundance: the country that produces more than it needs exports the good
 - advantage: the country with the lower opportunity cost of production exports the good
 - cost: a country trades with other countries that produce cheaper goods
- A country will export wheat if, with no international trade, _____.
 - it produces a surplus of wheat
 - its opportunity cost of producing wheat is below the world price
 - it's domestic price of wheat exceeds the world price
 - other countries have a shortage of wheat
- With free trade between the United States and Canada, the United States exports tomatoes and Canada exports maple syrup. U.S. consumers _____.
 - of tomatoes gain and Canadian consumers of maple syrup lose
 - of both tomatoes and maple syrup gain more than either producer
 - of maple syrup gain more than U.S. producers of maple syrup lose
 - of tomatoes gain more than U.S. producers of tomatoes lose
- With free trade between China and the United States, the winners are _____ and the losers are _____.
 - U.S. consumers of U.S. imports; U.S. producers of the U.S. import good
 - China's consumers of China's imports; China's producers of its export good
 - U.S. producers of the U.S. export good; U.S. consumers of U.S. imports
 - China's consumers of China's export good; China's producers of its imported good
- The U.S. tariff on paper ____ the U.S. price of paper, ____ U.S. production of paper and _____ the U.S. gains from trade.
 - raises; increases; increases
 - doesn't change; increases; increases
 - doesn't change; doesn't change; decreases
 - raises; increases; decreases
- If Korea imposes an import quota on U.S. oranges, losers include Korean _____ of oranges and U.S. _____ of oranges.
 - consumers; consumers
 - consumers; producers
 - producers; consumers
 - producers; producers
- The people who support restricted international trade say that _____.
 - protection saves jobs, in both the U.S. and foreign economies
 - U.S. firms won't be able to compete with low-wage foreign labor if trade is free
 - outsourcing sends jobs abroad, which brings diversification and makes our economy more stable
 - protection is needed to enable U.S. firms to produce the things at which they have a comparative advantage



How can we limit climate change?
Does health care need fixing?

Externalities: Pollution, Education, and Health Care



CHAPTER CHECKLIST

When you have completed your study of this chapter, you will be able to

- 1 Explain why negative externalities lead to inefficient overproduction and how property rights, pollution charges, and taxes can achieve a more efficient outcome.
- 2 Explain why positive externalities lead to inefficient underproduction and how public provision, subsidies, and vouchers can achieve a more efficient outcome.

EXTERNALITIES IN OUR DAILY LIVES

Externality

A cost or a benefit that arises from production and that falls on someone other than the producer or a cost or benefit that arises from consumption and that falls on someone other than the consumer.

Negative externality

A production or consumption activity that creates an external cost.

Positive externality

A production or consumption activity that creates an external benefit.

An **externality** is a cost or a benefit that arises from production and that falls on someone other than the producer or a cost or a benefit that arises from consumption and that falls on someone other than the consumer. Before we embark on the two main tasks of this chapter, we're going to review the range of externalities, classify them, and give some everyday examples.

First, an externality can arise from either a production activity or a consumption activity. Second, it can be either a **negative externality**, which imposes an external cost, or a **positive externality**, which provides an external benefit. So there are four types of externalities:

- Negative production externalities
- Positive production externalities
- Negative consumption externalities
- Positive consumption externalities

■ Negative Production Externalities

When the U.S. Open tennis tournament is being played at Flushing Meadows, players, spectators, and television viewers around the world share a negative production externality that many New Yorkers experience every day: the noise of airplanes taking off from LaGuardia Airport. Aircraft noise imposes a large cost on millions of people who live under the flight paths to airports in every major city.

Logging and the clearing of forests are sources of another negative production externality. These activities destroy the habitat of wildlife and influence the amount of carbon dioxide in the atmosphere, which has a long-term effect on temperature. So these external costs are borne by everyone and by future generations.

Pollution, which we examine in more detail in the next section, is a major example of this type of externality.

■ Positive Production Externalities

To produce orange blossom honey, Honey Run Honey of Chico, California, locates beehives next to an orange orchard. The honeybees collect pollen and nectar from the orange blossoms to make the honey. At the same time, they transfer pollen



Negative production externality.



Positive production externality.

between the blossoms, which helps to fertilize the blossoms. Two positive production externalities are present in this example. Honey Run Honey gets a positive production externality from the owner of the orange orchard; and the orange grower gets a positive production externality from Honey Run.

■ Negative Consumption Externalities

Negative consumption externalities are a source of irritation for most of us. Smoking tobacco in a confined space creates fumes that many people find unpleasant and that pose a health risk. So smoking in restaurants and on airplanes generates a negative externality. To avoid this negative externality, many restaurants and all airlines ban smoking. But while a smoking ban avoids a negative consumption externality for most people, it imposes a negative external cost on smokers who would prefer to enjoy the consumption of tobacco while dining or taking a plane trip.

Noisy parties and outdoor rock concerts are other examples of negative consumption externalities. They are also examples of the fact that a simple ban on an activity is not a solution. Banning noisy parties avoids the external cost on sleep-seeking neighbors, but it results in the sleepers imposing an external cost on the fun-seeking partygoers.

Permitting dandelions to grow in lawns, not picking up leaves in the fall, allowing a dog to bark loudly or to foul a neighbor's lawn, and letting a cell phone ring in class are other examples of negative consumption externalities.

■ Positive Consumption Externalities

When you get a flu vaccination, you lower your risk of being infected. If you avoid the flu, your neighbor, who didn't get vaccinated, has a better chance of remaining healthy. Flu vaccinations generate positive consumption externalities.

When the owner of a historic building restores it, everyone who sees the building gets pleasure from it. Similarly, when someone erects a spectacular home—such as those built by Frank Lloyd Wright during the 1920s and 1930s—or other exciting building—such as the Chrysler and Empire State Buildings in New York or the Opera House in Sydney, Australia—an external consumption benefit flows to everyone who has an opportunity to view it.

Education, which we examine in more detail in this chapter, is a major example of this type of externality.



Negative consumption externality.



Positive consumption externality.

9.1 NEGATIVE EXTERNALITIES: POLLUTION

Pollution is an example of a *negative externality*. Both production and consumption activities create pollution. Here, we'll focus on pollution as a negative production externality. When a chemical factory dumps waste into a river, the people who live by the river and use it for fishing and boating bear the cost of the pollution. The chemical factory does not consider the cost of pollution when it decides the quantity of chemicals to produce. The factory's supply curve is based on its own costs, not on the costs that it inflicts on others. You're going to see that when external costs are present, we produce more output than the efficient quantity and we get more pollution than the efficient quantity.

Pollution and other environmental problems are not new. Preindustrial towns and cities in Europe had severe sewage disposal problems that created cholera epidemics and plagues that killed millions. Nor is the desire to find solutions to environmental problems new. The development in the fourteenth century of a pure water supply and the hygienic disposal of garbage and sewage are examples of early efforts to improve the quality of the environment.

Popular discussions about pollution focus on physical aspects of the environment, not on costs and benefits. A common assumption is that activities that damage the environment are wrong and must cease. An economic study of the environment emphasizes costs and benefits and economists talk about the efficient amount of pollution or environmental damage. This emphasis on costs and benefits does not mean that economists, as citizens, don't have the same goals as others and value a healthy environment. Nor does it mean that economists have the right answers and everyone else has the wrong ones. Rather, economics provides a set of tools and principles that help to clarify the issues.

The starting point for an economic analysis of the environment is the distinction between private costs and social costs.

■ Private Costs and Social Costs

A *private cost* of production is a cost that is borne by the producer of a good or service. *Marginal cost* is the cost of producing an *additional unit* of a good or service. So **marginal private cost (MC)** is the cost of producing an additional unit of a good or service that is borne by the producer of that good or service.

You've seen that an *external cost* is a cost of producing a good or service that is *not* borne by the producer but borne by other people. A **marginal external cost** is the cost of producing an additional unit of a good or service that falls on people other than the producer.

Marginal social cost (MSC) is the marginal cost incurred by the entire society—by the producer and by everyone else on whom the cost falls—and is the sum of marginal private cost and marginal external cost. That is,

$$MSC = MC + \text{Marginal external cost.}$$

We express costs in dollars, but we must always remember that a cost is an opportunity cost—the best thing we give up to get something. A marginal external cost is what someone other than the producer of a good or service must give up when the producer makes one more unit of the item. Something real that people value, such as a clean river or clean air, is given up.

Marginal private cost

The cost of producing an additional unit of a good or service that is borne by the producer of that good or service.

Marginal external cost

The cost of producing an additional unit of a good or service that falls on people other than the producer.

Marginal social cost

The marginal cost incurred by the entire society—by the producer and by everyone else on whom the cost falls. It is the sum of marginal private cost and marginal external cost.

Valuing an External Cost

Economists use market prices to put a dollar value on the cost of pollution. For example, suppose that there are two similar rivers, one polluted and the other clean. Five hundred identical homes are built along the side of each river. The homes on the clean river rent for \$2,500 a month, and those on the polluted river rent for \$1,500 a month. If the pollution is the only detectable difference between the two rivers and the two locations, the rent decrease of \$1,000 per month is the cost of the pollution. For the 500 homes, the external cost is \$500,000 a month.

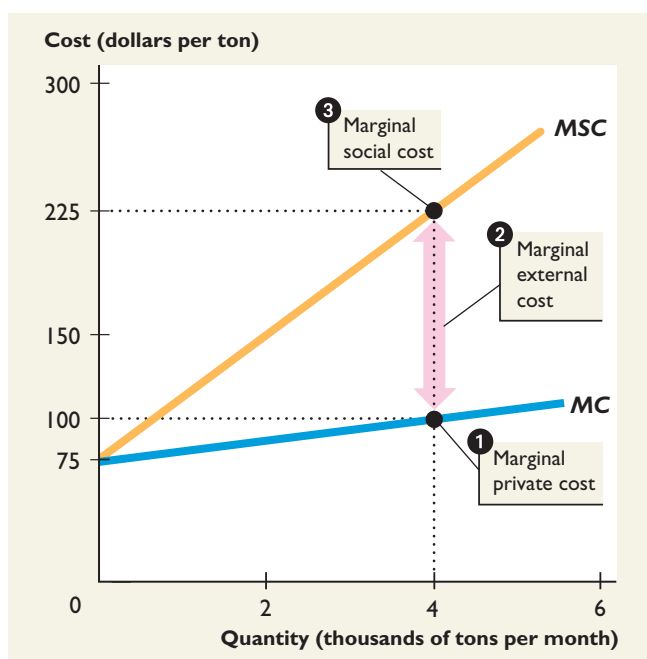
External Cost and Output

Figure 9.1 shows an example of the relationship between output and cost in a chemical industry that pollutes. The marginal cost curve, MC , describes the private marginal cost borne by the firms that produce the chemical. Marginal cost increases as the quantity of the chemical produced increases. If the firms dump waste into a river, they impose an external cost that increases with the amount of the chemical produced. The marginal social cost curve, MSC , is the sum of marginal private cost and marginal external cost. For example, when firms produce 4,000 tons of chemical a month, marginal private cost is \$100 a ton, marginal external cost is \$125 a ton, and marginal social cost is \$225 a ton.

In Figure 9.1, as the quantity of the chemical produced increases, the amount of pollution increases and the external cost of pollution increases. The quantity of the chemical produced and the pollution created depend on how the market for the chemical operates. First, we'll see what happens when the industry is free to pollute.

FIGURE 9.1
An External Cost

MyEconLab Animation



The MC curve shows the marginal private cost borne by the factories that produce a chemical. The MSC curve shows the sum of marginal private cost and marginal external cost.

When the quantity of chemical produced is 4,000 tons a month, ① marginal private cost is \$100 a ton, ② marginal external cost is \$125 a ton, and ③ marginal social cost is \$225 a ton.

■ Production and Pollution: How Much?

When an industry is unregulated, the amount of pollution it creates depends on the market equilibrium price and quantity of the good produced. Figure 9.2 illustrates the outcome in the market for a pollution-creating chemical.

The demand curve for the chemical is D . This curve also measures the marginal benefit, MB , to the buyers of the chemical (see Chapter 6, p. 146). The supply curve is S . This curve also measures the marginal private cost, MC , of the producers (see Chapter 6, p. 149). The supply curve is the marginal private cost curve because when firms make their production and supply decisions, they consider only the costs that they will bear. Market equilibrium occurs at a price of \$100 a ton and a quantity of 4,000 tons of chemical a month.

This equilibrium is inefficient. You learned in Chapter 6 that the allocation of resources is efficient when marginal benefit equals marginal cost. But we must count all the costs—private and external—when we compare marginal benefit and marginal cost. With an external cost, the allocation is efficient when marginal benefit equals marginal *social* cost. This outcome occurs when the quantity of the chemical produced is 2,000 tons a month. The market equilibrium *overproduces* by 2,000 tons of chemical a month and creates a deadweight loss, the gray triangle.

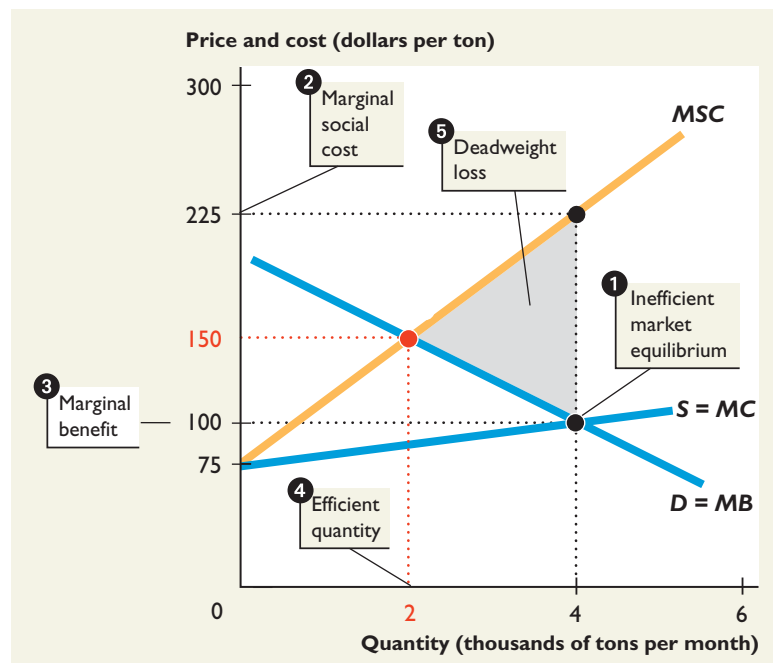
Because the pollution creates a deadweight loss, reducing the amount of pollution and eliminating the deadweight loss brings potential gains for everyone. If some method can be found to achieve this outcome, everyone—the owners of the factories and the residents of the riverside homes—can gain. How can the people who live by the polluted river get the chemical factories to decrease their output of the chemical and create less pollution? Let's explore some solutions.

FIGURE 9.2
Inefficiency with an External Cost

MyEconLab Animation

The market supply curve is the marginal private cost curve, $S = MC$. The demand curve is the marginal benefit curve, $D = MB$. The marginal social cost curve is MSC .

- 1 Market equilibrium at a price of \$100 a ton and 4,000 tons of chemical a month is inefficient because 2 marginal social cost exceeds 3 marginal benefit.
- 4 The efficient quantity of chemical is 2,000 tons a month where marginal benefit equals marginal social cost.
- 5 The gray triangle shows the deadweight loss created by the pollution externality.



■ Property Rights

Sometimes it is possible to reduce the inefficiency arising from an externality by establishing a property right where one does not currently exist. **Property rights** are legally established titles to the ownership, use, and disposal of factors of production and goods and services that are enforceable in the courts.

Suppose that the chemical factories own the river and the 500 homes alongside it. The rent that people are willing to pay depends on the amount of pollution. Using the earlier example, suppose that people are willing to pay \$2,500 a month to live alongside a pollution-free river but only \$1,500 a month to live with the pollution created by 4,000 tons of chemical a month. If the factories produce this quantity of chemical, they forgo \$1,000 a month for each home and a total of \$500,000 a month.

Because they own the homes of the people who suffer from the pollution, the chemical factories are now confronted with the cost of their pollution decision. They might still decide to pollute, but if they do, they face the opportunity cost of their actions—forgone rent from the people who live by the river.

Figure 9.3 illustrates the outcome. With property rights in place, the marginal cost curve in Figure 9.2 no longer measures all the factories' costs of producing the chemical. It excludes the pollution cost that they must now bear. The former *MSC* curve now becomes the marginal private cost curve *MC*. The market supply curve is based on all the marginal costs and is the curve labeled $S = MC$.

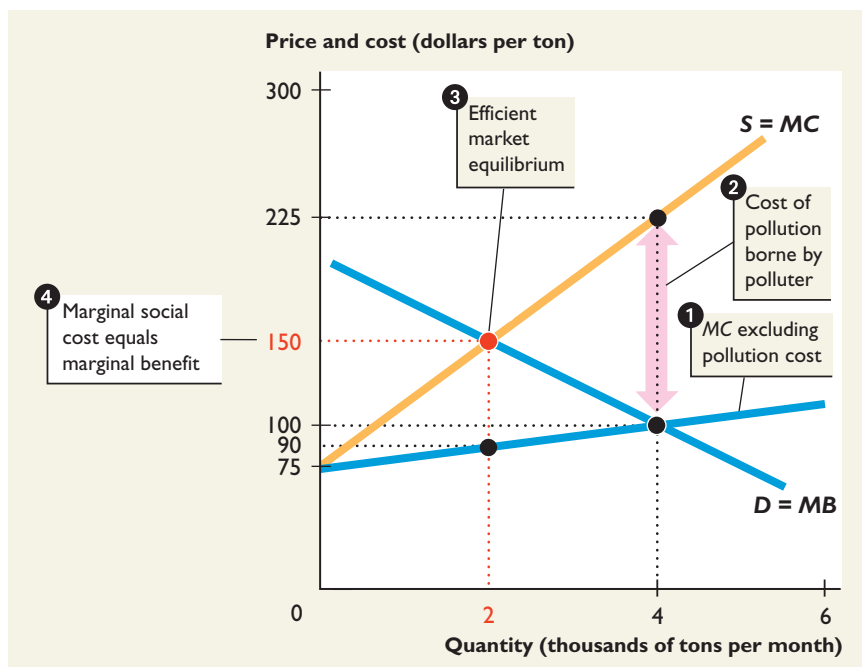
Market equilibrium now occurs at a price of \$150 a ton and a quantity of 2,000 tons a month. This outcome is efficient. The factories still produce some pollution, but it is the efficient quantity.

Property rights

Legally established titles to the ownership, use, and disposal of factors of production and goods and services that are enforceable in the courts.

FIGURE 9.3
Property Rights Achieve an Efficient Outcome

MyEconLab Animation



- 1 With property rights, the marginal cost curve that excludes the cost of pollution shows only part of the producers' marginal cost.

The marginal private cost curve includes 2 the cost of pollution, so the supply curve is $S = MC$.

- 3 Market equilibrium is at a price of \$150 a ton and a quantity of 2,000 tons of chemical a month and is efficient because 4 marginal social cost equals marginal benefit.

■ The Coase Theorem

Does it matter how property rights are assigned? Does it matter whether the polluter or the victim of the pollution owns the resource that might be polluted? Until 1960, everyone—including economists who had thought long and hard about the problem—thought that it did matter. But in 1960, Ronald Coase had a remarkable insight, now called the Coase theorem.

The **Coase theorem** is the proposition that if property rights exist, only a small number of parties are involved, and transactions costs are low, then private transactions are efficient. There are no externalities because the transacting parties take all the costs and benefits into account. Furthermore, it doesn't matter who has the property rights.

Coase theorem

The proposition that if property rights exist, only a small number of parties are involved, and transactions costs are low, then private transactions are efficient and the outcome is not affected by who is assigned the property right.

Application of the Coase Theorem

Let's apply the Coase theorem to the polluted river. In the example that we've just studied, the factories own both the river and the homes. Suppose that instead, the residents own both their homes and the river. Now the factories must pay a fee to the homeowners for the right to dump their waste. The greater the quantity of waste dumped into the river, the more the factories must pay. Again, the factories face the opportunity cost of the pollution they create. The quantity of chemical produced and the amount of waste dumped are the same, whoever owns the homes and the river. If the factories own them, they bear the cost of pollution because they receive a lower income from home rents. And if the residents own the homes and the river, the factories bear the cost of pollution because they must pay a fee to the homeowners. In both cases, the factories bear the cost of their pollution and dump the efficient amount of waste into the river.

The Coase solution works only when transactions costs are low. **Transactions costs** are the opportunity costs of conducting a transaction. For example, when you buy a house, you incur a series of transactions costs. You might pay a real estate agent to help you find the best place and a financial planner to help you get the best loan, and you pay a lawyer to run checks that assure you that the seller owns the property and that after you've paid for it, the ownership has been properly transferred to you.

In the example of the homes alongside a river, the transactions costs that are incurred by a small number of chemical factories and a few homeowners might be low enough to enable them to negotiate the deals that produce an efficient outcome. But in many situations, transactions costs are so high that it would be inefficient to incur them. In these situations, the Coase solution is not available.

Suppose, for example, that everyone owns the airspace above their homes up to, say, 10 miles. If someone pollutes your airspace, you can charge a fee. But to collect the fee, you must identify who is polluting your airspace and persuade them to pay you. Imagine the cost to you and the 50 million people who live in your part of the United States (and perhaps in Canada or Mexico) of negotiating and enforcing agreements with the several thousand factories that emit sulfur dioxide and create acid rain that falls on your property!

In this situation, we use public choices through governments to cope with externalities. Public choices avoid the private transactions costs that would arise if we used the Coase solution. But public choices are costly to make and monitor, so attempts by the government to deal with externalities offer no easy solution. Let's look at some of these attempts.

Transactions costs

The opportunity costs of conducting a transaction.

■ Government Actions in the Face of External Costs

The three main methods that governments use to cope with external costs are

- Pollution limits
- Pollution charges or taxes
- Marketable pollution permits (cap-and-trade)

Pollution Limits

A pollution limit seeks an efficient outcome by placing a quantity limit on a polluting activity. The 1990 Clean Air Act administered by the Environmental Protection Agency (EPA) employs this method and Figure 9.4 shows how it works. If the quantity produced is limited to the efficient quantity, the price rises so that marginal benefit equals marginal social cost. But because price exceeds marginal private cost, MC , a producer surplus arises.

Pollution limits are difficult to implement. The overall limit must be translated into a limit for each firm and compliance is costly to monitor. Also, because price exceeds marginal private cost, each firm has an incentive to increase its producer surplus by producing a quantity that exceeds the limit. The other two methods overcome some of these problems.

Pollution Charges or Taxes

Pollution charges or pollution taxes seek an efficient outcome by making a polluter pay the marginal external cost of pollution. Pollution charges have been used only modestly in the United States, but are common in Europe.

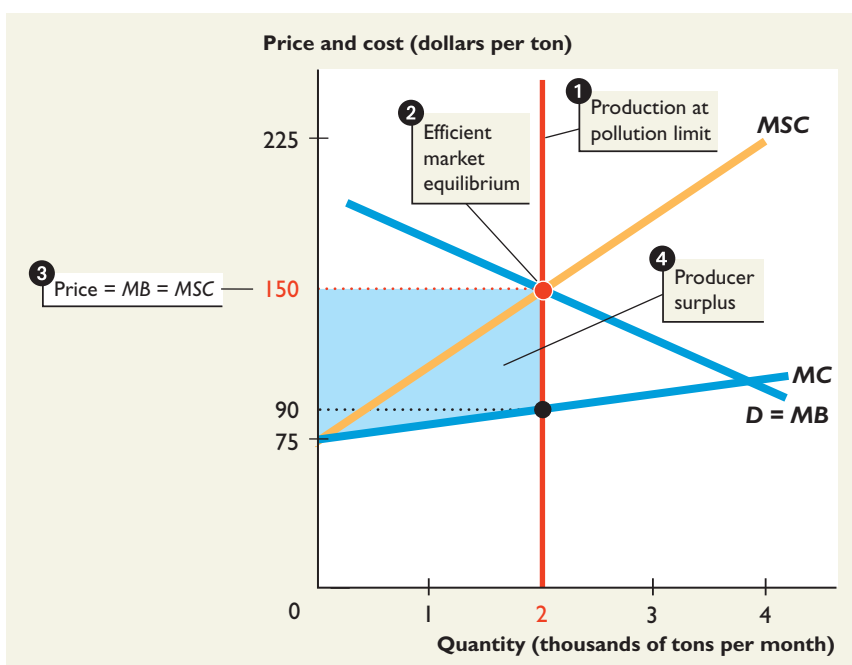


Pollution limits, charges or taxes, and cap-and-trade aim to curb greenhouse gas emissions.

■ FIGURE 9.4

A Pollution Limit

MyEconLab Animation



- 1 A pollution limit is imposed that restricts production to the efficient quantity.
- 2 The efficient market equilibrium is achieved.
- 3 The market price is equal to marginal benefit, MB , and marginal social cost, MSC .
- 4 Because the price exceeds marginal cost, producers get a producer surplus equal to the area of the blue rectangle.

Figure 9.5 illustrates the effects of a pollution charge or pollution tax. By charging or taxing the producer at a rate equal to marginal external cost, the marginal social cost curve becomes the market supply curve. The market price rises, the quantity produced decreases to the efficient quantity, and the government collects a tax or pollution charge revenue shown by the purple rectangle.

Marketable Pollution Permits (Cap-and-Trade)

Marketable pollution permits (also called cap-and-trade) seek an efficient outcome by assigning or selling pollution rights to individual producers who are then free to trade permits with each other. The 1990 Clean Air Act and the 1994 Regional Clean Air Incentives Market (RECLAIM) in the Los Angeles basin successfully use this method of dealing with air pollution. This approach is also the centerpiece of a proposed American Clean Energy and Security Act of 2009 (see p. 234).

If marginal external cost is assessed correctly, an efficient outcome is achieved with any of the methods. But governments cannot make an accurate determination of external costs. Also, more importantly, some producers have a lower marginal cost of avoiding pollution than others.

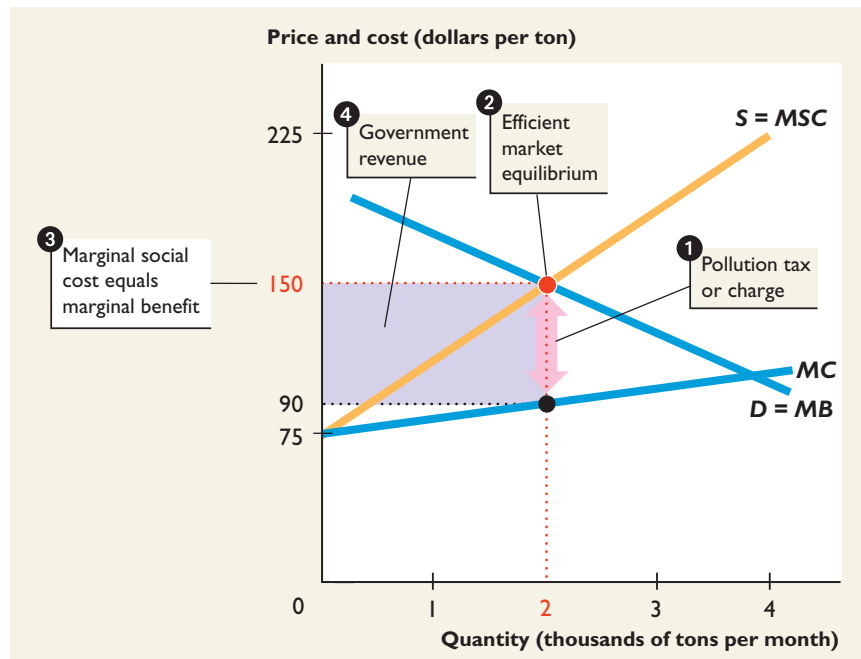
In practice, pollution limits and pollution charges and taxes end up failing to achieve an efficient outcome because they confront all producers with the same incentives to avoid pollution. Cap-and-trade overcomes this problem and is the most effective of the three methods. Cap-and-trade requires an accurate determination of the overall quantity of pollution that brings efficiency, but it provides the strongest available incentive to individual producers to find cost effective technologies that achieve the pollution targets.

FIGURE 9.5

A Pollution Charge or Pollution Tax

MyEconLab Animation

- 1 A pollution charge or tax is imposed that is equal to the marginal external cost of pollution. Because the pollution charge or tax equals the marginal external cost, the supply curve is the marginal social cost curve: $S = MSC$.
- 2 Market equilibrium is efficient because 3 marginal social cost equals marginal benefit.
- 4 The government collects tax revenue equal to the area of the purple rectangle.



■ Switching to Clean Technologies

In explaining the effects of alternative ways of coping with negative externalities, we have focused on getting the efficient quantity of production of a polluting activity. There is another way of coping with negative externalities: change the technology from one that pollutes to one that is clean.

Most of the improvements in the quality of our air (described in *Eye on the U.S. Economy* below) have come from improved technologies rather than from producing less. These trend improvements in air quality have occurred despite increases in transportation and electricity production, two of the main polluters.

Confronted with the marginal external cost of their actions by any of the means we have described above, if the marginal cost of production using a clean technology is lower than the marginal *social* cost of using the polluting technology, producers will adopt the clean technology.

The switch to electric cars and trucks to avoid the pollution that comes from burning gasoline and diesel is already happening. But unless we produce the electricity used by these vehicles with a clean technology, we're not gaining much.

Whether the cost of producing electricity with clean technologies such as solar, wind, and tidal power is lower than the social cost of using natural gas, coal, and oil is hard to say and controversial. There is no agreed estimate of the marginal external cost of carbon emissions. There is no doubt that the external costs are present and possibly large. But we need precise measurement to determine the efficient mix of polluting and clean technologies.



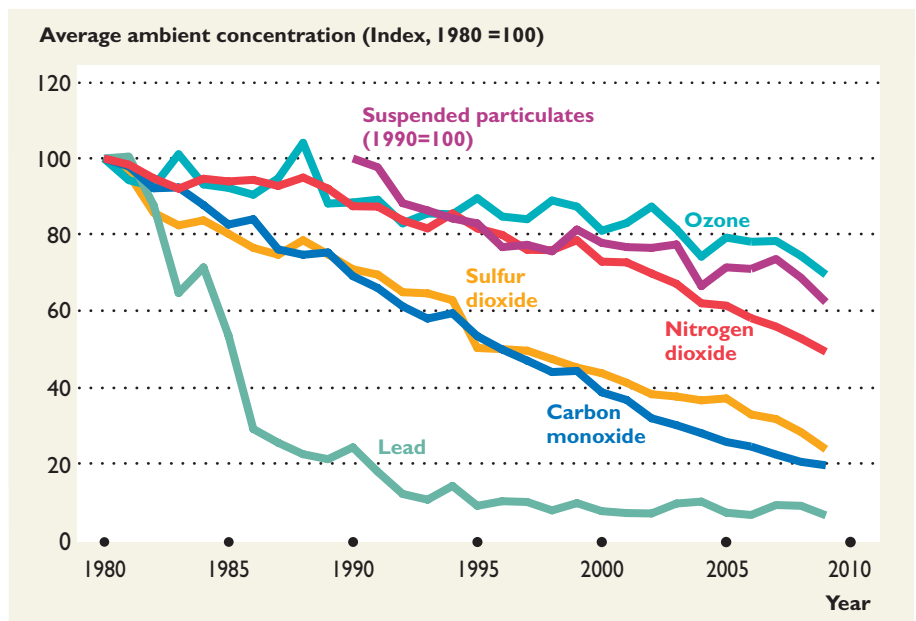
EYE on the U.S. ECONOMY

U.S. Air Pollution Trends

Air quality in the United States has improved. The figure shows the trends since 1980 for the atmospheric concentrations of five main air pollutants monitored by the Environmental Protection Agency (EPA) and a sixth pollutant (suspended particulates) monitored since 1990.

By using a mix of regulation, pollution limits, economic incentives, and permit trading, the EPA has almost eliminated lead and has substantially decreased sulfur dioxide, carbon monoxide, nitrogen dioxide, and suspended particulates.

Ozone is harder to eliminate, but it has nonetheless fallen to 70 percent of its 1980 level.



SOURCE OF DATA: Environmental Protection Agency, <http://www.epa.gov/airtrends>.



EYE on CLIMATE CHANGE

How Can We Limit Climate Change?

The average temperature of the Earth is rising and so is the atmospheric concentration of carbon dioxide, CO₂. The top figure shows these upward trends.

Scientists debate the contribution of human economic activity to the trends, but most believe it to be the source. Economists debate the costs and benefits of alternative ways of slowing CO₂ and other greenhouse gas (GHG) emissions, but most favor action.

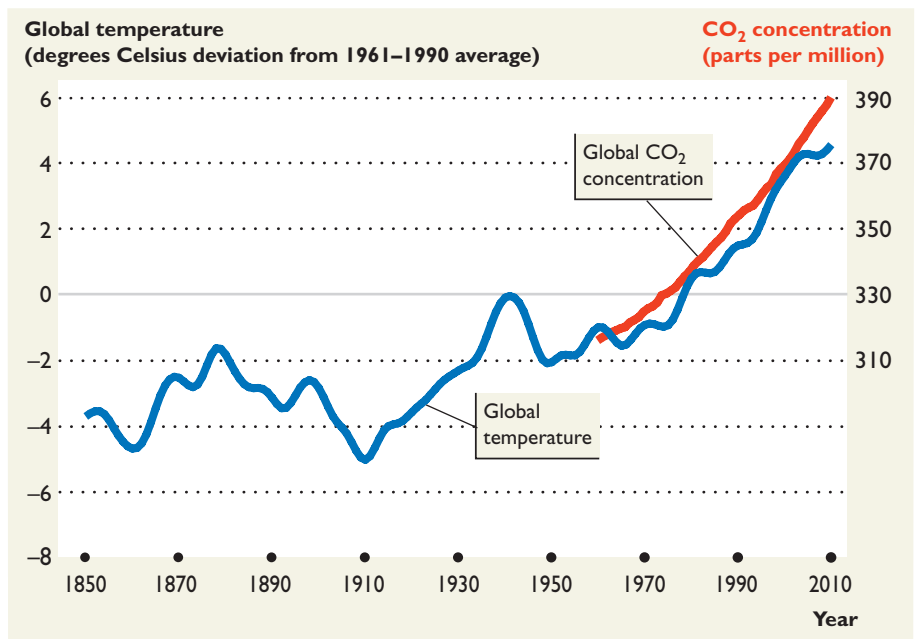
Economists agree that lowering GHG emissions requires *incentives* to change.

One idea is to cap emissions and issue tradeable emissions permits, a system called *cap-and-trade*. Carbon emission permits are already priced on a global carbon trading market.

The idea also has backers in Congress. On May 15, 2009, Representative Henry Waxman introduced the American Clean Energy and Security Act of 2009, which would use a cap-and-trade scheme. With 2005 levels as the base, GHG emissions would be capped at 97 percent by 2012, 83 percent by 2020, 58 percent by 2030, and 17 percent by 2050.

The Congressional Budget Office estimates that in 2020, a permit to emit one ton of GHG would cost \$28 and the cost of the scheme would be about \$175 per household per year.

Another incentive might be a hike in the tax on gasoline. Americans pay a much lower gas tax than Europeans pay. The bottom figure shows the stark difference between the United States and the United Kingdom.

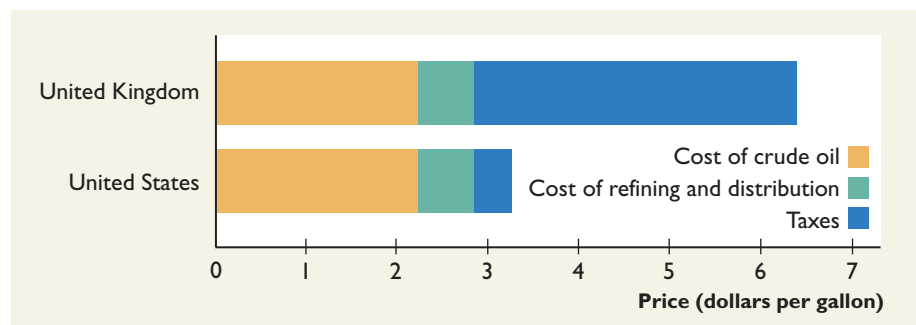


SOURCES OF DATA: Met Office Hadley Centre and Scripps Institution of Oceanography.

Why don't we have more aggressive caps and stronger incentives to encourage a larger reduction in GHG emissions? There are three reasons.

First, many people don't accept the scientific evidence that emissions produce global warming; second, the costs

are certain and would be borne now, while the benefits would come many years in the future; and third, if current trends persist, by 2050, three quarters of carbon pollution will come not from the United States but from the developing economies.



SOURCES OF DATA: Energy Information Administration, Automobile Association, and authors' assumptions.

CHECKPOINT 9.1

Explain why negative externalities lead to inefficient overproduction and how property rights, pollution charges, and taxes can achieve a more efficient outcome.

Practice Problems

Figure 1 illustrates the unregulated market for a pesticide. When factories produce pesticide, they also create waste, which they dump into a lake on the edge of the town. The marginal external cost of the dumped waste is equal to the marginal private cost of producing the pesticide (that is, the marginal social cost of producing the pesticide is double the marginal private cost).

1. What is the quantity of pesticide produced if no one owns the lake and what is the efficient quantity of pesticide? What is the deadweight loss?
2. If the town owns the lake, what is the quantity of pesticide produced and how much does the town charge the factories to dump waste?
3. If the pesticide factories own the lake, how much pesticide is produced?
4. If no one owns the lake and the government levies a pollution tax, what is the tax per ton of pesticide that achieves the efficient outcome?

In the News

New power-plant rule aids Northeast

A new Obama air pollution rule requires coal-fired power plants to reduce both smog and acid-rain causing pollutants. The coal industry says this rule is among the most expensive ever imposed by the EPA.

Source: *The Wall Street Journal*, July 7, 2011

Explain how a pollution limit will change the quantity of electricity produced. For whom would the pollution limit be expensive?

Solutions to Practice Problems

1. In Figure 2, production is 30 tons a week, the efficient quantity is 20 tons a week, and the deadweight loss is the area of the gray triangle.
2. The quantity of pesticide produced is the efficient quantity, 20 tons a week, and the town charge the factories \$50 a ton of pesticide, which is the marginal external cost of the pollution produced by that quantity.
3. The factories produce the efficient quantity: 20 tons a week.
4. A pollution tax of \$50 a ton paid by the factories achieves the efficient quantity of pesticide because the pollution tax equals the external cost.

Solution to In the News

To reduce the amount of pollution, power plants must produce less. The quantity of electricity decreases and the price that consumers pay for electricity rises. The outcome is efficient if the quantity of electricity produced is that at which the marginal social cost of electricity equals its marginal benefit.

MyEconLab

You can work these problems in Study Plan 9.1 and get instant feedback.

FIGURE 1

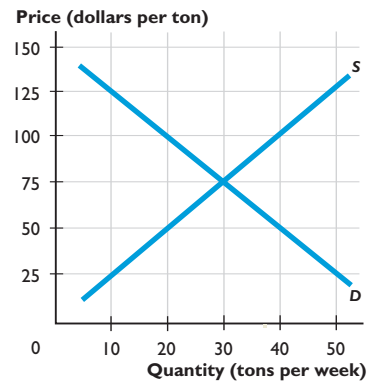
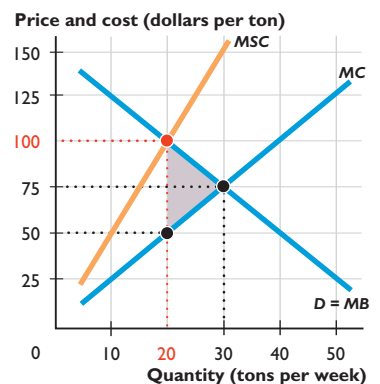


FIGURE 2



9.2 POSITIVE EXTERNALITIES: EDUCATION AND HEALTH CARE

Education and health care create positive externalities: Those who receive either service benefit, and so do the many other people with whom they interact. We'll use college education as the main example, and then apply the ideas to health care. To begin we must distinguish between its private benefits and its social benefits.

■ Private Benefits and Social Benefits

A *private benefit* is a benefit that the consumer of a good or service receives. The **marginal private benefit (MB)** is the benefit from an additional unit of a good or service that the consumer of that good or service receives.

An *external benefit* is a benefit from a good or service that someone other than the consumer receives. A **marginal external benefit** is the benefit from an additional unit of a good or service that people other than the consumer enjoy.

Marginal social benefit (MSB) is the marginal benefit enjoyed by society—by the consumers of a good or service (marginal private benefit) and by everyone else who benefits from it (the marginal external benefit). That is,

$$MSB = MB + \text{Marginal external benefit.}$$

Figure 9.6 illustrates these benefit concepts using as an example college education. (The same principles apply to all levels of education.) The marginal benefit curve, *MB*, describes the marginal private benefit—such as expanded job opportunities and higher incomes—enjoyed by college graduates. Marginal private benefit decreases as the quantity of education increases.

Marginal private benefit

The benefit from an additional unit of a good or service that the consumer of that good or service receives.

Marginal external benefit

The benefit from an additional unit of a good or service that people other than the consumer of that good or service enjoy.

Marginal social benefit

The marginal benefit enjoyed by society—by the consumer of a good or service and by everyone else who benefits from it. It is the sum of marginal private benefit and marginal external benefit.

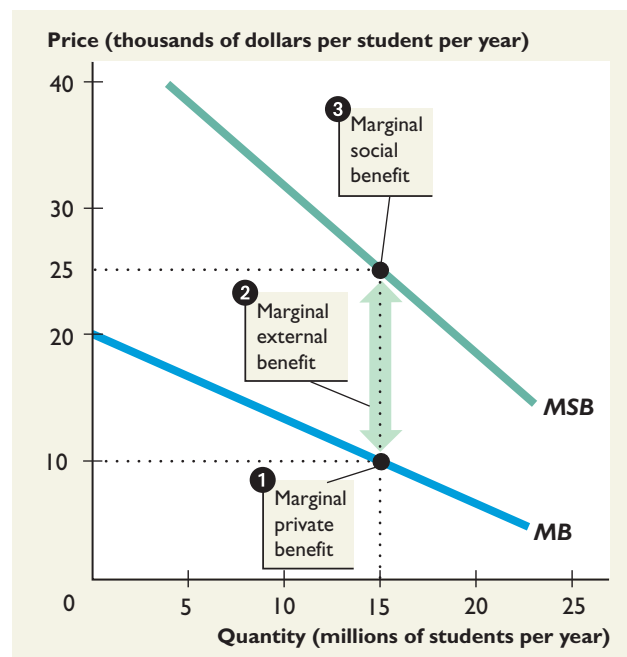
■ FIGURE 9.6

An External Benefit

MyEconLab Animation

The *MB* curve shows the marginal private benefit enjoyed by the people who receive a college education. The *MSB* curve shows the sum of marginal private benefit and marginal external benefit.

When 15 million students attend college, ① marginal private benefit is \$10,000 per student, ② marginal external benefit is \$15,000 per student, and ③ marginal social benefit is \$25,000 per student.



But college graduates generate external benefits. On the average, college graduates communicate more effectively with others and tend to be better citizens. Their crime rates are lower, and they are more tolerant of the views of others. A society with a large number of college graduates can support activities such as high-quality music, theater, and other organized social activities.

In the example in Figure 9.6, the marginal external benefit is \$15,000 per student per year when 15 million students enroll in college. Marginal social benefit is the sum of marginal private benefit and marginal external benefit. For example, when 15 million students a year enroll in college, the marginal private benefit is \$10,000 per student and the marginal external benefit is \$15,000 per student, so the marginal social benefit is \$25,000 per student.

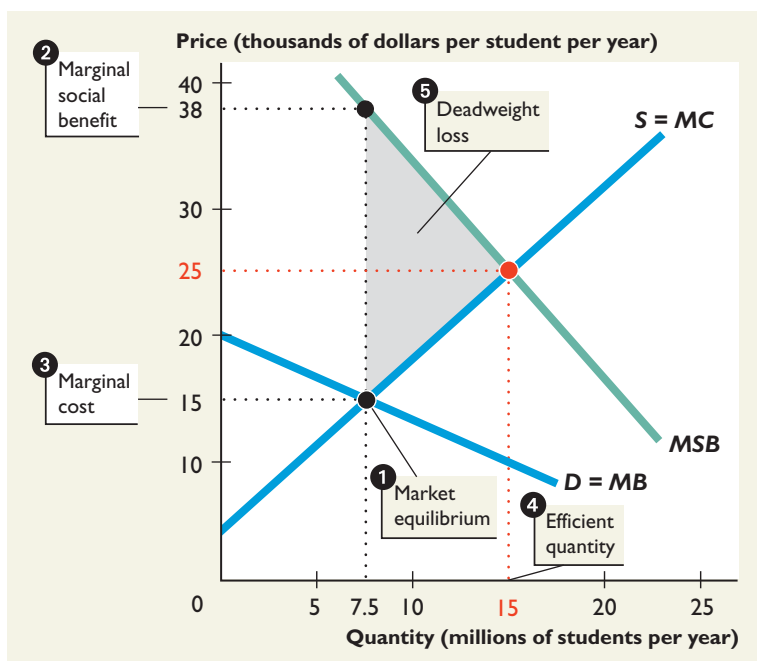
The marginal social benefit curve, MSB , is the sum of marginal private benefit and marginal external benefit. It is steeper than the MB curve because marginal external benefit diminishes for the same reasons that MB diminishes.

When people make decisions about how much schooling to undertake, they consider only its private benefits and if education were provided by private schools that charged full-cost tuition, there would be too few college graduates.

Figure 9.7 shows the underproduction that would occur if all college education were left to the private market. The supply curve is the marginal cost curve of the private schools, $S = MC$. The demand curve is the marginal private benefit curve, $D = MB$. Market equilibrium is at a tuition of \$15,000 per student per year and 7.5 million students per year. At this equilibrium, marginal social benefit is \$38,000 per student, which exceeds marginal cost by \$23,000. Too few students enroll in college. The efficient number is 15 million, where marginal social benefit equals marginal cost. The gray triangle shows the deadweight loss created by the underproduction.

FIGURE 9.7
Underproduction with an External Benefit

MyEconLab Animation



The market demand curve is the marginal private benefit curve, $D = MB$. The supply curve is the marginal cost curve, $S = MC$.

- 1 Market equilibrium is at a tuition of \$15,000 a year and 7.5 million students and is inefficient because
- 2 marginal social benefit exceeds
- 3 marginal cost.
- 4 The marginal social benefit curve is MSB , so the efficient number of students is 15 million a year.
- 5 The gray triangle shows the deadweight loss created because too few students enroll in college.

■ Government Actions in the Face of External Benefits

To get closer to producing the efficient quantity of a good or service that generates an external benefit, we make public choices through governments and modify the market outcome. To achieve a more efficient allocation of resources in the presence of external benefits, such as those that arise from education, governments can use three devices:

- Public provision
- Private subsidies
- Vouchers

Public Provision

Public provision

The production of a good or service by a public authority that receives most of its revenue from the government. Education services produced by the public universities, colleges, and schools are examples of public provision.

Public provision is the production of a good or service by a public authority that receives most of its revenue from the government. Education services produced by the public universities, colleges, and schools are examples of public provision.

Figure 9.8 shows how public provision might overcome the underproduction that arises in Figure 9.7. Public provision cannot lower the cost of production, so marginal cost is the same as before. Marginal private benefit, marginal external benefit, and marginal social benefit are also the same as before.

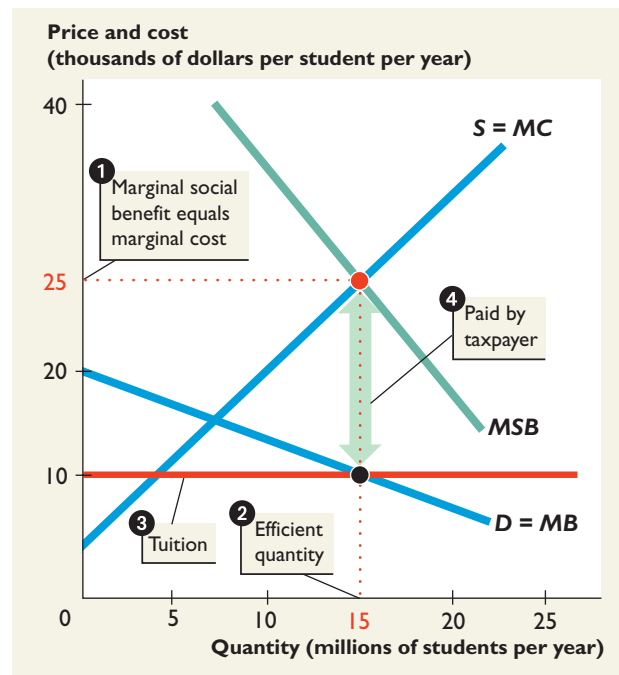
The efficient quantity occurs where marginal social benefit equals marginal cost. In Figure 9.8, this quantity is 15 million students per year. Tuition is set to ensure that the efficient number of students enroll. That is, tuition is set at the level that equals the marginal private benefit at the efficient quantity. In Figure 9.8, tuition is \$10,000 a year. The rest of the cost of the public university is borne by the taxpayers and, in this example, is \$15,000 per student per year.

■ FIGURE 9.8

Public Provision to Achieve an Efficient Outcome

MyEconLab Animation

- 1 Marginal social benefit equals marginal cost with 15 million students enrolled in college, the 2 efficient quantity.
- 2
- 3 Tuition is set at \$10,000 per year, and 4 the taxpayers cover the remaining \$15,000 of marginal cost per student.
- 4



Private Subsidies

A **subsidy** is a payment by the government to a producer to cover part of the costs of production. By giving producers a subsidy, the government can induce private decision makers to consider external benefits when they make their choices.

Figure 9.9 shows how a subsidy to private colleges works. In the absence of a subsidy, the marginal cost curve is the market supply curve of private college education, $S = MC$. The marginal benefit is the demand curve, $D = MB$. In this example, the government provides a subsidy to colleges of \$15,000 per student per year. We must subtract the subsidy from the marginal cost of education to find the colleges' supply curve. That curve is $S = MC - \text{subsidy}$ in the figure. The equilibrium tuition (market price) is \$10,000 a year, and the equilibrium quantity is 15 million students. To educate 15 million students, colleges incur a marginal cost of \$25,000 a year. The marginal social benefit is also \$25,000 a year. So with marginal cost equal to marginal social benefit, the subsidy has achieved an efficient outcome. The tuition and the subsidy just cover the colleges' marginal cost.

Public Provision Versus Private Subsidy In the two methods we've just studied, the same number of students enroll and tuition is the same. So are these two methods of providing education services equally good? This question is difficult to resolve. The bureaucrats that operate public schools don't have as strong an incentive to minimize costs and maximize *quality* as those who run private schools. But for elementary and secondary education, *charter schools* (see p. 241) might be an efficient compromise between traditional public schools and subsidized private schools.

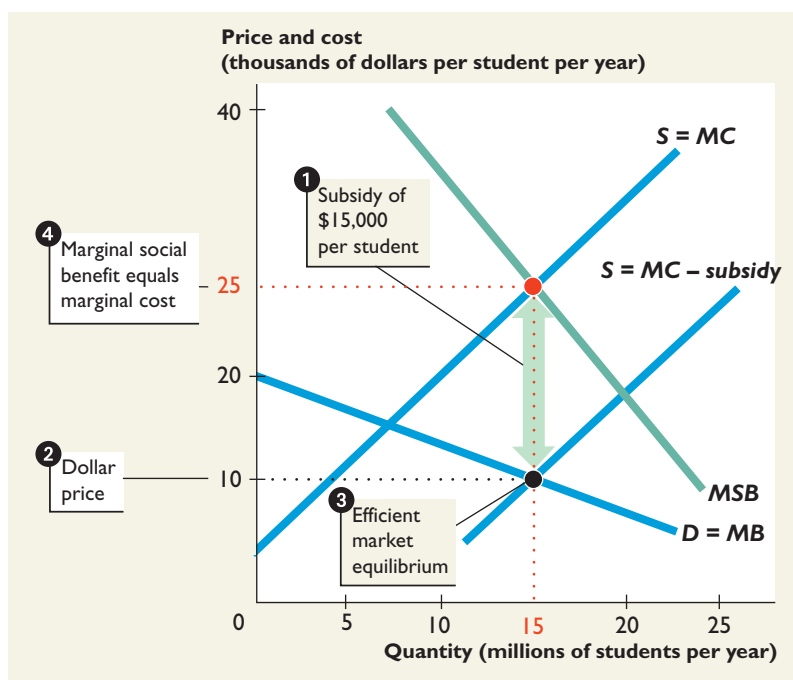
Subsidy

A payment by the government to a producer to cover part of the costs of production.

FIGURE 9.9

Private Subsidy to Achieve an Efficient Outcome

MyEconLab Animation



With a 1 subsidy of \$15,000 per student, the supply curve is $S = MC - \text{subsidy}$.

- The equilibrium price is \$10,000.
- The market equilibrium is efficient with 15 million students enrolled in college because 4 marginal social benefit equals marginal cost.

Voucher

A token that the government provides to households, which they can use to buy specified goods or services.

Vouchers

A **voucher** is a token that the government provides to households, which they can use to buy specified goods or services. Food stamps that the U.S. Department of Agriculture provides under a federal Food Stamp Program are examples of vouchers. Vouchers for college education could be provided to students. Let's see how they would work.

The government would issue each student with a voucher. Students would choose the school to attend and pay the tuition with dollars plus a voucher. Schools would exchange the vouchers they receive for dollars from the government. If the government set the value of a voucher equal to the marginal external benefit of a year of college at the efficient quantity, the outcome would be efficient.

Figure 9.10 illustrates an efficient voucher scheme in action. The government issues vouchers worth \$15,000 per student per year. Each student pays \$10,000 tuition and the government pays \$15,000 per voucher, so the school collects \$25,000 per student. The voucher scheme results in 15 million students attending college, the marginal cost of a student equals the marginal social benefit, and the outcome is efficient.

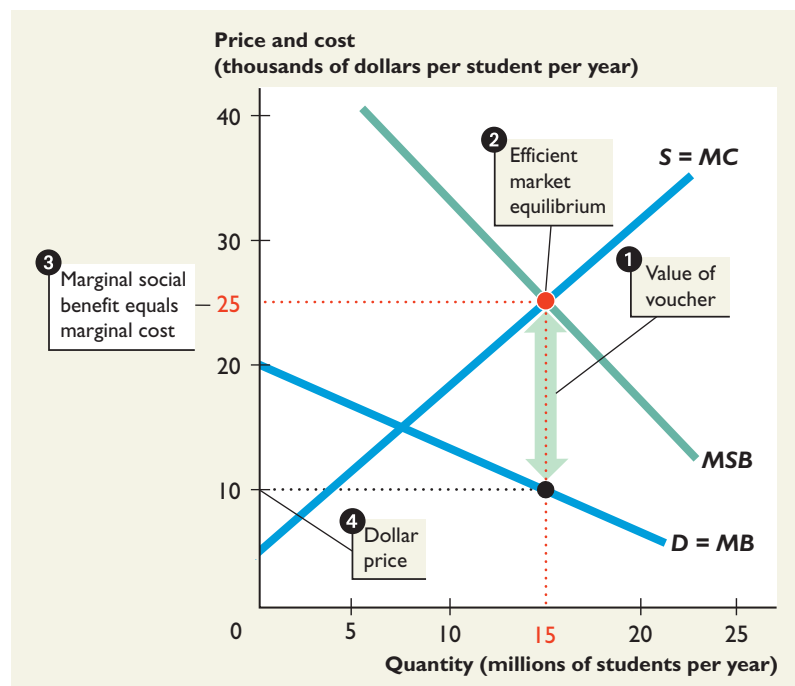
Do Vouchers Beat Public Provision and Subsidy? Vouchers provide public financial resources to the consumer rather than the producer. Economists generally believe that vouchers offer a more efficient outcome than public provision and subsidies because they combine the benefits of competition among private schools with the injection of the public funds needed to achieve an efficient level of output. Also, students and their parents can monitor school performance more effectively than the government can (see *Eye on the U.S. Economy* opposite.)

FIGURE 9.10
Vouchers Achieve an Efficient Outcome

MyEconLab Animation

With vouchers, buyers are willing to pay MB plus the value of the voucher.

- 1 The government issues vouchers to each student valued at \$15,000.
- 2 The market equilibrium is efficient. With 15 million students enrolled in college, 3 marginal social benefit equals marginal cost.
- 4 Each student pays tuition of \$10,000 (the dollar price) and the school collects \$15,000 (the value of the voucher) from the government.





EYE on the U.S. ECONOMY

Education Quality: Charter Schools and Vouchers

The three methods of achieving efficient education have similar effects on the *quantity* of education but different effects on its *quality*. And quality has become a big issue with international league tables showing U.S. students performing worse on standardized math and science tests than those in more than 20 other countries. Here, we look at two ways of trying to improve the quality of U.S. education: charter schools and school vouchers.

Charter Schools

A *charter school* is a public school but one that is free to make its own education policy. Around 4,000 charter schools in 40 states are operating today and they teach more than 1 million students. When the demand for places in a charter school exceeds the supply, students are chosen by lottery.

How efficient are the charter schools?

School efficiency has two dimensions: cost per student and educational standard attained.

Charter schools perform well on both criteria. They cost less than public schools and they achieve more. Cost per student in New York charter schools is 18 percent less than regular public schools. And charter school students perform higher in math and reading than equivalent students who apply to but (randomly) don't get into a charter school.

Vouchers

School vouchers are much less used and more controversial than charter schools. But an increasing number of states, among them Wisconsin, Louisiana, Ohio, the District of Columbia, and New York, operate a



Stanford University professor Caroline Hoxby says: "Tell me your goals and I'll design you a voucher to achieve them."

school voucher program.

Studies of the effects of vouchers have generated more controversies than firm conclusions, but some economists are convinced that they offer the best solution.



EYE on YOUR LIFE

Externalities in Your Life

Think about the externalities, both negative and positive, that play a huge part in *your* life; and think about the incentives that attempt to align your self-interest with the social interest.

You respond to the gasoline tax by buying a little bit less gas than you otherwise would. As you saw in *Eye on Climate Change* (p. 234), this incentive is small compared to that in some other countries. With a bigger gas tax, such

as that in the United Kingdom, for example, you would find ways of getting by with a smaller quantity of gasoline and your actions and those of millions of others would make the traffic on our highways much lighter.

You are responding to the huge incentive of subsidized tuition by being in school. Without subsidized college education, fewer people would attend college and university and with fewer

college graduates, the benefits we all receive from living in a well-educated society would be smaller.

Think about your attitude as a citizen-voter to these two externalities. Should the gas tax be higher to discourage the use of the automobile? Should tuition be even lower to encourage even more people to enroll in school? Or have we got these incentives just right in the social interest?

■ Economic Problems in Health-Care Markets

Health care is two distinct products: health insurance—insurance that pays health-care bills—and health-care services—the services of physicians, specialists, nurses, other health-care professionals, and hospitals. Left to competitive market forces, both health insurance and health care services would be underprovided. So government plays a major role in the health-care markets that we briefly describe in *Eye on Health Care* below.

Reasons for Underprovision in Health-Care Markets

First, positive consumption externalities arise from the provision of public sanitation systems and vaccination programs. People who get a flu shot protect not only themselves but everyone with whom they come into contact. The marginal social benefit of flu shots exceeds the marginal private benefit. The efficient quantity of flu shots exceeds the quantity that an unregulated market would provide.

Public health consumption externalities are one reason, but not the main reason why health-care markets underprovide. The main reason is that health insurance markets suffer from an *asymmetric information* problem. People know more about the risk they pose to an insurance company than the insurer knows and doctors know more about the treatment that should be prescribed and its cost than the insurance company knows. The result is an underprovision of health insurance. The young and healthy don't insure and those who have the highest chance of making claims buy insurance, so insurance premiums are high and the aged and the poor get priced out of the market. Also, people with pre-existing health issues find it difficult or impossible to get insurance.



EYE on HEALTH CARE

Does Health Care Need Fixing?

Health care does need fixing. U.S. health-care spending is 17 percent of income, more than double the average of other rich countries. This already large cost is expected to rise as the population ages and the “baby boom” generation retires

In all other rich countries, governments provide health insurance and everyone is covered. In the United States, 88 million people are covered by government Medicare and Medicaid programs, and 167 million have private health insurance. Encouraged by tax breaks, more than one half of all people with jobs buy health insurance through their employer.

An estimated 46 million have no health-care insurance, and a further 25 million are reckoned to be underinsured—have some insurance but not enough for a big emergency. Some of the uninsured are healthy and choose not to insure. Others can't afford insurance and don't qualify for Medicare or Medicaid.

Figure 1 shows the distribution of the health-care dollar and Figure 2 shows expenditure per person.

With 88 million people covered by Medicare and Medicaid at a total cost of \$831 billion, governments spend \$9,443 per person per year on these two programs. The cost of private insurance per person covered is 50

percent of the cost of the government programs at \$4,690 per person per year. Out-of-pocket expenditure, which includes spending by the uninsured, is \$1,304 per person per year.

Health-care services in the United States are delivered mostly by private doctors and private hospitals. Health Maintenance Organizations deliver about one half of these services.

This situation contrasts with other countries where public hospitals and government-paid doctors deliver most of the health-care services.

Of the reform ideas on the table, only Laurence Kotlikoff's voucher plan (p. 243) combines choice with an effective mechanism for containing costs.

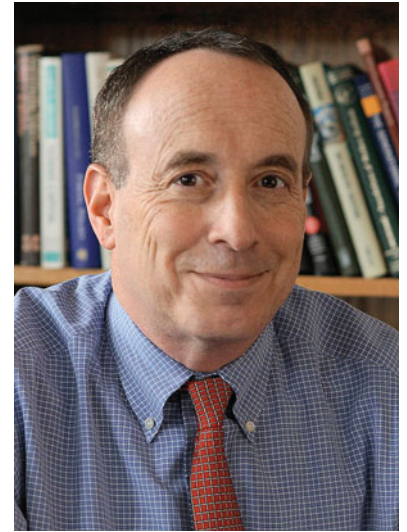
Not only are many people underprovided with health care, but those who do get care get very good and extremely costly care. And the costs keep rising as the population ages and health-care technology advances to keep more and more people living longer (see *Eye on Health Care* below).

A Reform Idea

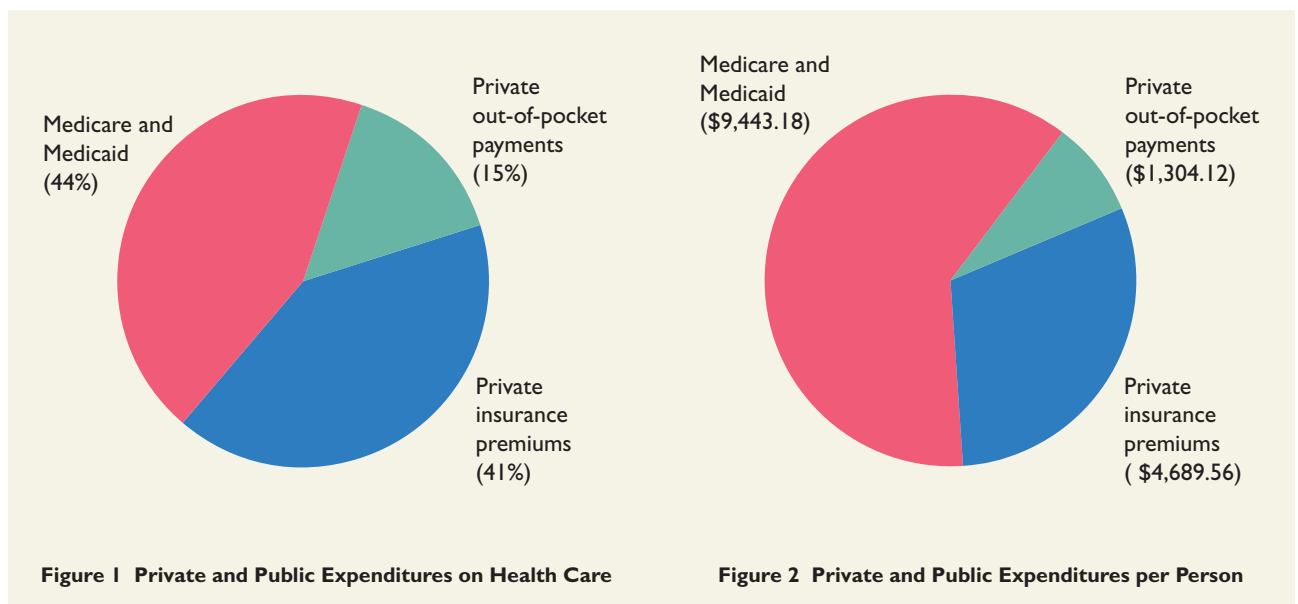
The Medicare and Medicaid programs are an open-ended commitment of public funds to the health care of the aged and those too poor to buy private health care. Health care in the United States faces two problems: Too many people are uninsured and health care costs too much. These problems are going to get worse if nothing major is done to reverse this trend.

The Obama Affordable Care Act addresses the first of these problems by requiring everyone to be insured and by creating a new Pre-Existing Condition Insurance Plan, financed partly by the government. But the Act does little to address the problem of overexpenditure, and this problem is extremely serious. It is so serious that without massive change, the present open-ended health-care programs will bankrupt the United States.

A solution to both the problem of coverage and access and the problem of over-expenditure has been suggested by Laurence Kotlikoff, an economics professor at Boston University. His proposal uses health-care *vouchers* to ensure universal coverage and a cap on total expenditure. Everyone would get a voucher and those with higher expected health-care costs would get a bigger voucher. Health-care vouchers would work like the education vouchers. They would provide the choice that is so important and valued by Americans, combined with a cost discipline similar to that of the health-care systems of Europe and Canada.



Professor Laurence J. Kotlikoff of Boston University; author of *The Healthcare Fix* and creator of Medicare Part C for All.



SOURCE OF DATA: U.S. Bureau of the Census, *Statistical Abstract of the United States*: 2011, Tables 131, 140, 142, and 145.

MyEconLab

You can work these problems in Study Plan 9.2 and get instant feedback.

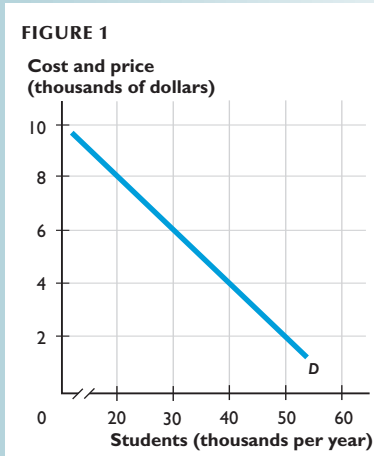
CHECKPOINT 9.2

Explain why positive externalities lead to inefficient underproduction and how public provision, subsidies and vouchers can achieve a more efficient outcome.

Practice Problems

Figure 1 shows the marginal private benefit from college education. The marginal cost of a college education is a constant \$6,000 a year. The marginal external benefit from a college education is a constant \$4,000 per student per year.

1. What is the efficient number of students? If colleges are private (no government involvement), how many people enroll, what is the tuition, and what is the deadweight loss?
2. If the government provides public colleges, what is the tuition that will achieve the efficient number of students? How much must taxpayers pay?
3. If the government subsidizes private colleges, what subsidy will achieve the efficient number of college students?
4. If the government offers students vouchers, what value of the voucher will achieve the efficient number of students?



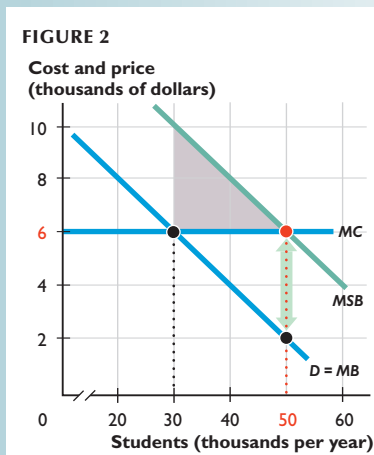
In the News

Tuition hikes should frighten students

Despite the hard times, families will not be deprived of access to federal student loans. The real danger is a hike in tuition. Often in past recessions, states have cut funding for colleges and tuition has skyrocketed. The Cato Institute says a better policy would be for the states to maintain the subsidies to colleges.

Source: Michael Dannenberg, *USA Today*, October 22, 2008

If government cuts the subsidy to colleges, why will tuition rise and the number of students enrolled decrease? Why does the Cato Institute say that it's a better policy for government to maintain the subsidy?



Solutions to Practice Problems

1. In Figure 2, the efficient number of students is 50,000 a year. With no government involvement, enrollment is 30,000 students a year and tuition is \$6,000 a year. The gray triangle shows the deadweight loss.
2. To enroll the efficient 50,000 students, public colleges would charge \$2,000 per student and taxpayers would pay \$4,000 per student (Figure 2).
3. A subsidy of \$4,000 per student (equal to marginal external benefit).
4. The value of the voucher will be \$4,000. Enrollment will be 50,000 if the tuition is \$2,000. The private college tuition is \$6,000, so to get 50,000 students to enroll, the value of the voucher will have to be \$4,000.

Solution to In the News

A cut in the subsidy will increase the college's marginal cost. Tuition will rise and the number of students will decrease—a movement up along the demand curve. The Cato Institute says maintaining the subsidy is a better policy because it avoids the deadweight loss of a cut in the number of students.

CHAPTER SUMMARY

Key Points

- 1 Explain why negative externalities lead to inefficient overproduction and how property rights, pollution charges, and taxes can achieve a more efficient outcome.**
 - External costs are costs of production that fall on people other than the producer of a good or service. Marginal social cost equals marginal private cost plus marginal external cost.
 - Producers take account only of marginal private cost and produce more than the efficient quantity when there is a marginal external cost.
 - Sometimes it is possible to overcome a negative externality by assigning a property right.
 - When property rights cannot be assigned, governments might overcome a negative externality by using pollution limits, pollution charges or taxes, or marketable permits (cap-and-trade).

- 2 Explain why positive externalities lead to inefficient underproduction and how public provision, subsidies, and vouchers can achieve a more efficient outcome.**
 - External benefits are benefits that are received by people other than the consumer of a good or service. Marginal social benefit equals marginal private benefit plus marginal external benefit.
 - External benefits from education arise because better-educated people are better citizens, commit fewer crimes, and support social activities.
 - Public provision, subsidies, and vouchers can achieve a more efficient provision of a good with positive externalities such as education and health care.

Key Terms

| | |
|--------------------------------|---------------------------|
| Coase theorem, 230 | Negative externality, 224 |
| Externality, 224 | Positive externality, 224 |
| Marginal external benefit, 236 | Property rights, 229 |
| Marginal external cost, 226 | Public provision, 238 |
| Marginal private benefit, 236 | Subsidy, 239 |
| Marginal private cost, 226 | Transactions costs, 230 |
| Marginal social benefit, 236 | Voucher, 240 |
| Marginal social cost, 226 | |

MyEconLab

You can work these problems in Chapter 9 Study Plan and get instant feedback.

TABLE 1 DEMAND FOR ELECTRICITY

| Price (cents per kilowatt) | Quantity demanded (kilowatts per day) |
|----------------------------------|---|
| 4 | 500 |
| 8 | 400 |
| 12 | 300 |
| 16 | 200 |
| 20 | 100 |
| 24 | 0 |

TABLE 2 PRIVATE AND EXTERNAL COSTS

| Quantity (kilowatts per day) | Marginal cost (cents per kilowatt) | Marginal external cost |
|------------------------------------|--|------------------------------|
| 0 | 0 | 0 |
| 100 | 2 | 2 |
| 200 | 4 | 4 |
| 300 | 6 | 6 |
| 400 | 8 | 8 |
| 500 | 10 | 10 |

TABLE 3

| Students (millions per year) | Marginal benefit (dollars per student per year) |
|------------------------------------|--|
| 1 | 5,000 |
| 2 | 3,000 |
| 3 | 2,000 |
| 4 | 1,500 |
| 5 | 1,200 |
| 6 | 1,000 |
| 7 | 800 |
| 8 | 500 |

CHAPTER CHECKPOINT

Study Plan Problems and Applications

Table 1 shows the demand schedule for electricity from a coal burning utility. Table 2 shows the utility's cost of producing electricity and the external cost of the pollution created. Use this information to work Problems 1 to 3.

1. With no pollution control, calculate the quantity of electricity produced, the price of electricity, and the marginal external cost of the pollution generated.
2. With no pollution control, calculate the quantity of electricity produced, the marginal social cost of the electricity generated, and the deadweight loss.
3. If the government levies a pollution tax such that the utility generates the efficient quantity of electricity, calculate the quantity of electricity generated, the price of electricity, the size of the pollution tax, and the tax revenue.

Use the following information to work Problems 4 and 5.

Tom and Larry must spend a day working together. Tom likes to smoke cigars and the price of a cigar is \$2. Larry likes a smoke-free environment.

4. If Tom's marginal benefit from a cigar a day is \$20 and Larry's marginal benefit from a smoke-free environment is \$25 a day, what is the outcome if they meet at Tom's home? What is the outcome if they meet at Larry's home?
5. If Tom's marginal benefit from a cigar a day is \$25 and Larry's marginal benefit from a smoke-free environment is \$20 a day, what is the outcome if they meet at Tom's home? What is the outcome if they meet at Larry's home?

Use Table 3 and the following information to work Problems 6 to 8.

The marginal cost of educating a college student is \$5,000 a year. Table 3 shows the marginal benefit schedule from a college education. The marginal external benefit from a college education is a constant \$2,000 per student per year. There are no public colleges.

6. With no government involvement in college education, how many students enroll, what is the tuition, and what is the deadweight loss created?
7. If the government subsidizes colleges and sets the subsidy so that the efficient number of students enroll, what is the subsidy per student, how many students enroll, and what is the cost to taxpayers?
8. If the government offers vouchers to students, what is the value of the voucher that will encourage the efficient number of students to enroll?
9. **Global solutions for local gridlock**

The Toronto Board of Trade has warned that gridlock already costs the region \$6 billion a year, with average commute times of 80 minutes, among the highest in North America. By 2031, that situation is going to get worse, adding an additional 27 minutes to the daily grind. Civic leaders are looking at the options: road tolls, a regional gas tax, and parking levies.

Source: *Toronto Star*, June 24, 2011

With road tolls, a regional gas tax, and parking levies would Toronto streets become less congested? If the new charges cut commute times, would the Toronto road system be more efficient? Explain your answers.

Instructor Assignable Problems and Applications

Your instructor can assign these problems as homework, a quiz, or a test in [MyEconLab](#).

1. The price of gasoline in Europe is about three times that in the United States, mainly because the European gas tax is higher than the U.S. gas tax. In light of the principles you've learned in this chapter, what is the case for increasing the gas tax in the United States to the European level and what is the case against an increase in the gas tax to the European level?

2. Polar ice cap shrinks further and thins

With global warming of the planet, the polar ice cap is shrinking. As the Arctic Sea expands more underwater mineral resources will be accessible. Countries are staking out territorial claims to parts of the polar region.

Source: *The Wall Street Journal*, April 7, 2009

Explain how ownership of these mineral resources will influence the amount of damage done to the Arctic Sea and its wildlife.

Use the following information to work Problems 3 and 4.

Plans to curtail use of plastic bags, but not much action

Plastic bags have been blamed for street litter, ocean pollution, and carbon emissions produced by manufacturing and shipping them. Last summer, Seattle approved a 20-cents charge on plastic shopping bags, which was intended to reduce pollution by encouraging reusable bags.

Source: *The New York Times*, February 23, 2009

3. Explain how Seattle's 20-cents charge will change the use of plastic bags and how the deadweight loss created by plastic bags will change.

4. Explain why a complete ban on plastic bags would be inefficient.

Use the following information to work Problems 5 to 7.

The marginal cost of educating a college student online is \$3,000 a year. Table 1 shows the marginal private benefit schedule from a college education. The marginal external benefit is 50 percent of the marginal private benefit.

5. With no government involvement in college education, how many students enroll and what is the tuition? Calculate the deadweight loss created.

6. If the government subsidizes colleges so that the efficient number of students will enroll, what is the cost to taxpayers?

7. If the government offers vouchers to students and values them so that the efficient number of students will enroll, what is the value of the voucher?

8. U.S. environmentalists back EU emission plan

The European Union has introduced a new law, which requires any airline operating to or from an EU airport after January 1 to participate in the EU cap-and-trade system. Under the EU plan, 15 percent of pollution credits for airlines will be auctioned off and the other 85 percent of credits are being given without charge.

Source: *The Wall Street Journal*, June 30, 2011

Explain the conditions under which a cap-and-trade system would reduce the amount of airline emissions to the efficient quantity.

TABLE 1

| Students (millions per year) | Marginal private benefit (dollars per student per year) |
|------------------------------|---|
| 1 | 6,000 |
| 2 | 5,000 |
| 3 | 4,000 |
| 4 | 3,000 |
| 5 | 2,000 |
| 6 | 1,000 |

MyEconLab

You can work this quiz in
Chapter 9 Study Plan and get
instant feedback.

Multiple Choice Quiz

1. Electricity has a negative production externality because _____.
 - A. its marginal benefit decreases as more of it is consumed
 - B. the marginal private cost of producing it increases as more of it is produced
 - C. the marginal social cost of producing it exceeds the marginal private cost of producing it
 - D. a marginal external cost lowers the marginal benefit from consuming it
2. A steel-making plant pollutes the air and water so _____.
 - A. the marginal social cost of producing steel exceeds the marginal private cost by the amount of the marginal external cost
 - B. the marginal social cost of producing steel is less than the marginal private cost by the amount of the marginal external cost
 - C. the marginal private cost of producing steel equals the marginal external cost plus the marginal social cost
 - D. the marginal private cost of producing steel minus the marginal social cost equals the marginal external cost
3. An unregulated chemical factory that pollutes a river results in _____ and _____.
 - A. overproduction; a price that exceeds the marginal benefit from the good
 - B. underproduction; a price that equals the marginal benefit from the good
 - C. the efficient quantity produced; a marginal benefit equal to the marginal social cost
 - D. an inefficient quantity produced; a marginal benefit below the marginal social cost
4. Steel production creates pollution. If a tax is imposed on steel production equal to the marginal external cost of the pollution it creates, _____.
 - A. steel producers will cut pollution to zero
 - B. the deadweight loss created by steel producers will be cut to zero
 - C. the market price of steel will rise by the amount of the tax
 - D. steel producers will continue to produce the inefficient quantity of steel
5. A good or service with a positive externality is one which _____.
 - A. everyone wants to have access to
 - B. is produced in the social interest
 - C. the marginal social benefit exceeds the marginal private benefit
 - D. the marginal external benefit exceeds the marginal private benefit
6. Because education generates a positive externality, _____.
 - A. everyone who wants a college education should get one
 - B. graduates' marginal benefit exceeds the society's value of the education
 - C. the quantity of education undertaken will achieve the social interest if it is free
 - D. subsidies to colleges or vouchers to students are means of achieving the efficient number of graduates



Which store has the lower costs:
Wal-Mart or 7-Eleven?



CHAPTER CHECKLIST

Production and Cost

When you have completed your study of this chapter, you will be able to

- 1 Explain and distinguish between the economic and accounting measures of a firm's cost of production and profit.
- 2 Explain the relationship between a firm's output and labor employed in the short run.
- 3 Explain the relationship between a firm's output and costs in the short run.
- 4 Derive and explain a firm's long-run average cost curve.

10.1 ECONOMIC COST AND PROFIT

The 20 million firms in the United States differ in size and in what they produce, but they all perform the same basic economic function: They hire factors of production and organize them to produce and sell goods and services. To understand the behavior of a firm, we need to know its goals.

■ The Firm's Goal

If you asked a group of entrepreneurs what they are trying to achieve, you would get many different answers. Some would talk about making a high-quality product, others about business growth, others about market share, and others about job satisfaction of the work force. All of these goals might be pursued, but they are not the fundamental goal. They are a means to a deeper goal.

The firm's goal is to *maximize profit*. A firm that does not seek to maximize profit is either eliminated or bought by firms that *do* seek to achieve that goal. To calculate a firm's profit, we must determine its total revenue and total cost. Economists have a special way of defining and measuring cost and profit, which we'll explain and illustrate by looking at Sam's Smoothies, a firm that is owned and operated by Samantha.

■ Accounting Cost and Profit

In 2011, Sam's Smoothies' total revenue from the sale of smoothies was \$150,000. The firm paid \$20,000 for fruit, yogurt, and honey; \$22,000 in wages for the labor it hired; and \$3,000 in interest to the bank. These expenses totaled \$45,000.

Sam's accountant said that the depreciation of the firm's blenders, refrigerators, and shop during 2011 was \$10,000. Depreciation is the fall in the value of the firm's capital, and accountants calculate it by using the Internal Revenue Service's rules, which are based on standards set by the Financial Accounting Standards Board. So the accountant reported Sam's Smoothies' total cost for 2011 as \$55,000 and the firm's profit as \$95,000—\$150,000 of total revenue minus \$55,000 of total costs.

Sam's accountant measures cost and profit to ensure that the firm pays the correct amount of income tax and to show the bank how Sam's has used its bank loan. Economists have a different purpose: to predict the decisions that a firm makes to maximize its profit. These decisions respond to *opportunity cost* and *economic profit*.

■ Opportunity Cost

To produce its output, a firm employs factors of production: land, labor, capital, and entrepreneurship. Another firm could have used these same resources to produce other goods or services. In Chapter 3 (pp. 66–67), resources can be used to produce either cell phones or DVDs, so the opportunity cost of producing a cell phone is the number of DVDs forgone. Pilots who fly passengers for Southwest Airlines can't at the same time fly freight for FedEx. Construction workers who are building an office high-rise can't simultaneously build apartments. A communications satellite operating at peak capacity can carry television signals or e-mail messages but not both at the same time. A journalist writing for the *New York Times*

can't at the same time create Web news reports for CNN. And Samantha can't simultaneously run her smoothies business and a flower shop.

The highest-valued alternative forgone is the opportunity cost of a firm's production. From the viewpoint of the firm, this opportunity cost is the amount that the firm must pay the owners of the factors of production it employs to attract them from their best alternative use. So a firm's opportunity cost of production is the cost of the factors of production it employs.

To determine these costs, let's return to Sam's and look at the opportunity cost of producing smoothies.

Explicit Costs and Implicit Costs

The amount that a firm pays to attract resources from their best alternative use is either an explicit cost or an implicit cost. A cost paid in money is an **explicit cost**. Because the amount spent could have been spent on something else, an explicit cost is an opportunity cost. The wages that Samantha pays labor, the interest she pays the bank, and her expenditure on fruit, yogurt, and honey are explicit costs.

A firm incurs an **implicit cost** when it uses a factor of production but does not make a direct money payment for its use. The two categories of implicit cost are economic depreciation and the cost of the resources of the firm's owner.

Economic depreciation is the opportunity cost of the firm using capital that it owns. It is measured as the change in the *market value* of capital—the market price of the capital at the beginning of the period minus its market price at the end of the period. Suppose that Samantha could have sold her blenders, refrigerators, and shop on December 31, 2010, for \$250,000. If she can sell the same capital on December 31, 2011, for \$246,000, her economic depreciation during 2011 is \$4,000. This is the opportunity cost of using her capital during 2011, not the \$10,000 depreciation calculated by Sam's accountant.

Interest is another cost of capital. When the firm's owner provides the funds used to buy capital, the opportunity cost of those funds is the interest income forgone by not using them in the best alternative way. If Sam loaned her firm funds that could have earned her \$1,000 in interest, this amount is an implicit cost of producing smoothies.

When a firm's owner supplies labor, the opportunity cost of the owner's time spent working for the firm is the wage income forgone by not working in the best alternative job. For example, instead of working at her next best job that pays \$34,000 a year, Sam supplies labor to her smoothies business. This implicit cost of \$34,000 is part of the opportunity cost of producing smoothies.

Finally, a firm's owner often supplies entrepreneurship, the factor of production that organizes the business and bears the risk of running it. The return to entrepreneurship is **normal profit**. Normal profit is part of a firm's opportunity cost because it is the cost of a forgone alternative—running another firm. Instead of running Sam's Smoothies, Sam could earn \$16,000 a year running a flower shop. This amount is an implicit cost of production at Sam's Smoothies.

■ Economic Profit

A firm's **economic profit** equals total revenue minus total cost. Total revenue is the amount received from the sale of the product. It is the price of the output multiplied by the quantity sold. Total cost is the sum of the explicit costs and implicit costs and is the opportunity cost of production.

Explicit cost

A cost paid in money.

Implicit cost

An opportunity cost incurred by a firm when it uses a factor of production for which it does not make a direct money payment.

Economic depreciation

An opportunity cost of a firm using capital that it owns—measured as the change in the *market value* of capital over a given period.

Normal profit

The return to entrepreneurship. Normal profit is part of a firm's opportunity cost because it is the cost of not running another firm.

Economic profit

A firm's total revenue minus total cost.

TABLE 10.1
Economic Accounting

| Item | | |
|----------------------------------|----------|------------------|
| Total Revenue | | \$150,000 |
| <i>Explicit Costs</i> | | |
| Cost of fruit, yogurt, and honey | \$20,000 | |
| Wages | \$22,000 | |
| Interest | \$3,000 | |
| <i>Implicit Costs</i> | | |
| Samantha's forgone wages | \$34,000 | |
| Samantha's forgone interest | \$1,000 | |
| Economic depreciation | \$4,000 | |
| Normal profit | \$16,000 | |
| Opportunity Cost | | \$100,000 |
| Economic Profit | | \$50,000 |

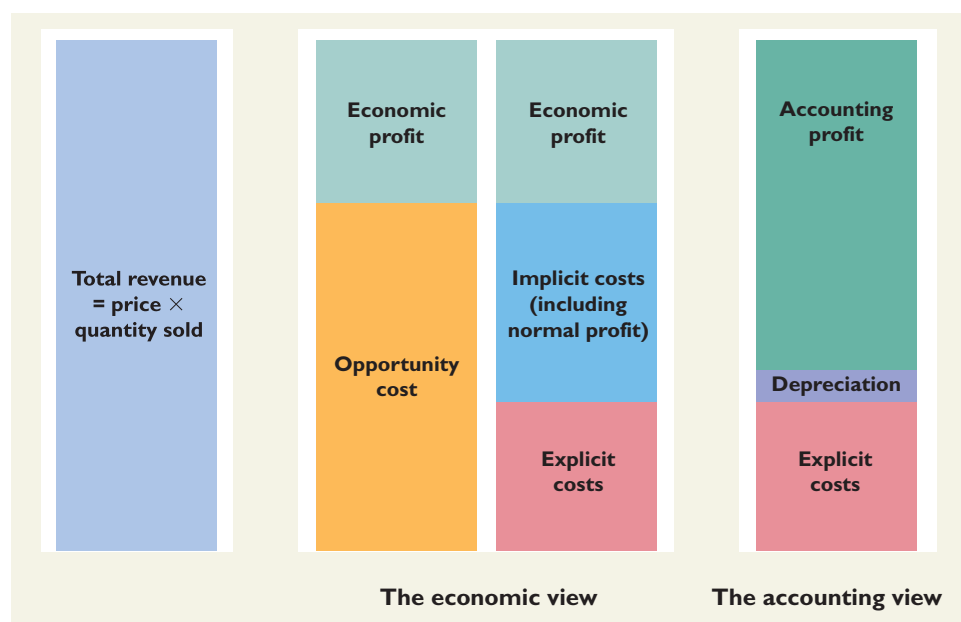
Because one of the firm's implicit costs is *normal profit*, the return to the entrepreneur equals normal profit plus economic profit. If a firm incurs an economic loss, the entrepreneur receives less than normal profit.

Table 10.1 summarizes the economic cost concepts, and Figure 10.1 compares the economic view and the accounting view of cost and profit. Sam's total revenue (price multiplied by quantity sold) is \$150,000; the opportunity cost of the resources that Sam uses is \$100,000; and Sam's economic profit is \$50,000.

FIGURE 10.1
Two Views of Cost and Profit

MyEconLab Animation

Both economists and accountants measure a firm's total revenue the same way. It equals the price multiplied by the quantity sold of each item. Economists measure economic profit as total revenue minus opportunity cost. Opportunity cost includes explicit costs and implicit costs. Normal profit is an implicit cost. Accountants measure profit as total revenue minus explicit costs—costs paid in money—and depreciation.



CHECKPOINT 10.1

Explain and distinguish between the economic and accounting measures of a firm's cost of production and profit.

MyEconLab

You can work these problems in Study Plan 10.1 and get instant feedback.

Practice Problems

Lee, a programmer, earned \$35,000 in 2010, but in 2011, he began to manufacture body boards. After one year, he submitted the following data to his accountant.

- He stopped renting out his cottage for \$3,500 a year and used it as his factory. The market value of the cottage increased from \$70,000 to \$71,000.
 - He spent \$50,000 on materials, phone, utilities, etc.
 - He leased machines for \$10,000 a year.
 - He paid \$15,000 in wages.
 - He used \$10,000 from his savings account, which pays 5 percent a year interest.
 - He borrowed \$40,000 at 10 percent a year from the bank.
 - He sold \$160,000 worth of body boards.
 - Normal profit is \$25,000 a year.
1. Calculate Lee's explicit costs, implicit costs, and economic profit.
 2. Lee's accountant recorded the depreciation on Lee's cottage during 2011 as \$7,000. What did the accountant say Lee's profit or loss was?

In the News

What does it cost to make 100 pairs of running shoes?

An Asian manufacturer of running shoes pays its workers \$275 to make 100 pairs an hour. Workers use company-owned equipment that costs in forgone interest and economic depreciation \$300 an hour. Materials cost \$900.

Source: washpost.com

Which costs are explicit costs? Which are implicit costs? With total revenue from the sale of 100 pairs of shoes of \$1,650, calculate economic profit.

Solutions to Practice Problems

1. Lee's explicit costs are costs paid with money: \$50,000 on materials, phone, utilities, etc; \$10,000 on leased machines; \$15,000 in wages; and \$4,000 in bank interest. These items total \$79,000. Lee's implicit costs are \$35,000 in forgone wages; \$3,500 in forgone rent; \$1,000 increase in the value of his cottage is economic depreciation of -\$1,000; \$500 in forgone interest; and \$25,000 in normal profit. These items total \$63,000. Economic profit equals total revenue (\$160,000) minus total cost (\$79,000 + \$63,000), which equals \$142,000. So economic profit is \$160,000 - \$142,000, or \$18,000.
2. The accountant measures Lee's profit as total revenue minus explicit costs minus depreciation: \$160,000 - \$79,000 - \$7,000, or \$74,000.

Solution to In the News

Explicit costs are wages (\$275) and materials (\$900). Implicit costs are the forgone interest and economic depreciation (\$300). Economic profit equals total revenue (\$1,650) minus total cost (\$1,475), which is \$175.

SHORT RUN AND LONG RUN

The main goal of this chapter is to explore the influences on a firm's costs. The key influence on cost is the quantity of output that the firm produces per period. The greater the output rate, the higher is the total cost of production. But the effect of a change in production on cost depends on how soon the firm wants to act. A firm that plans to change its output rate tomorrow has fewer options than a firm that plans ahead and intends to change its production six months from now.

To study the relationship between a firm's output decision and its costs, we distinguish between two decision time frames:

- The short run
- The long run

The Short Run: Fixed Plant

Short run

The time frame in which the quantities of some resources are fixed. In the short run, a firm can usually change the quantity of labor it uses but not its technology and quantity of capital.

The **short run** is the time frame in which the quantities of some resources are fixed. For most firms, the fixed resources are the firm's technology and capital—its equipment and buildings. The management organization is also fixed in the short run. The fixed resources that a firm uses are its *fixed factors of production* and the resources that it can vary are its *variable factors of production*. The collection of fixed resources is the firm's *plant*. So in the short run, a firm's plant is fixed.

Sam's Smoothies' plant is its blenders, refrigerators, and shop. Sam's cannot change these inputs in the short run. An electric power utility can't change the number of generators it uses in the short run. An airport can't change the number of runways, terminal buildings, and traffic control facilities in the short run.

To increase output in the short run, a firm must increase the quantity of variable factors it uses. Labor is usually the variable factor of production. To produce more smoothies, Sam must hire more labor. Similarly, to increase the production of electricity, a utility must hire more engineers and run its generators for longer hours. To increase the volume of traffic it handles, an airport must hire more check-in clerks, cargo handlers, and air-traffic controllers.

Short-run decisions are easily reversed. A firm can increase or decrease output in the short run by increasing or decreasing the number of labor hours it hires.

The Long Run: Variable Plant

Long run

The time frame in which the quantities of *all* resources can be varied.

The **long run** is the time frame in which the quantities of *all* resources can be varied. That is, the long run is a period in which the firm can change its *plant*.

To increase output in the long run, a firm can increase the size of its plant. Sam's Smoothies can install more blenders and refrigerators and increase the size of its shop. An electric power utility can install more generators. And an airport can build more runways, terminals, and traffic-control facilities.

Long-run decisions are not easily reversed. Once a firm buys a new plant, its resale value is usually much less than the amount the firm paid for it. The fall in value is economic depreciation. It is called a *sunk cost* to emphasize that it is irrelevant to the firm's decisions. Only the short-run cost of changing its labor inputs and the long-run cost of changing its plant size are relevant to a firm's decisions.

We're going to study costs in the short run and the long run. We begin with the short run and describe the limits to the firm's production possibilities.

10.2 SHORT-RUN PRODUCTION

To increase the output of a fixed plant, a firm must increase the quantity of labor it employs. We describe the relationship between output and the quantity of labor employed by using three related concepts:

- Total product
- Marginal product
- Average product

Total Product

Total product (TP) is the total quantity of a good produced in a given period. Total product is an output *rate*—the number of units produced per unit of time (for example, per hour, day, or week). Total product changes as the quantity of labor employed increases and we illustrate this relationship as a total product schedule and total product curve like those in Figure 10.2. The total product schedule (the table below the graph) lists the maximum quantities of smoothies per hour that Sam can produce with her existing plant at each quantity of labor. Points A through H on the TP curve correspond to the columns in the table.

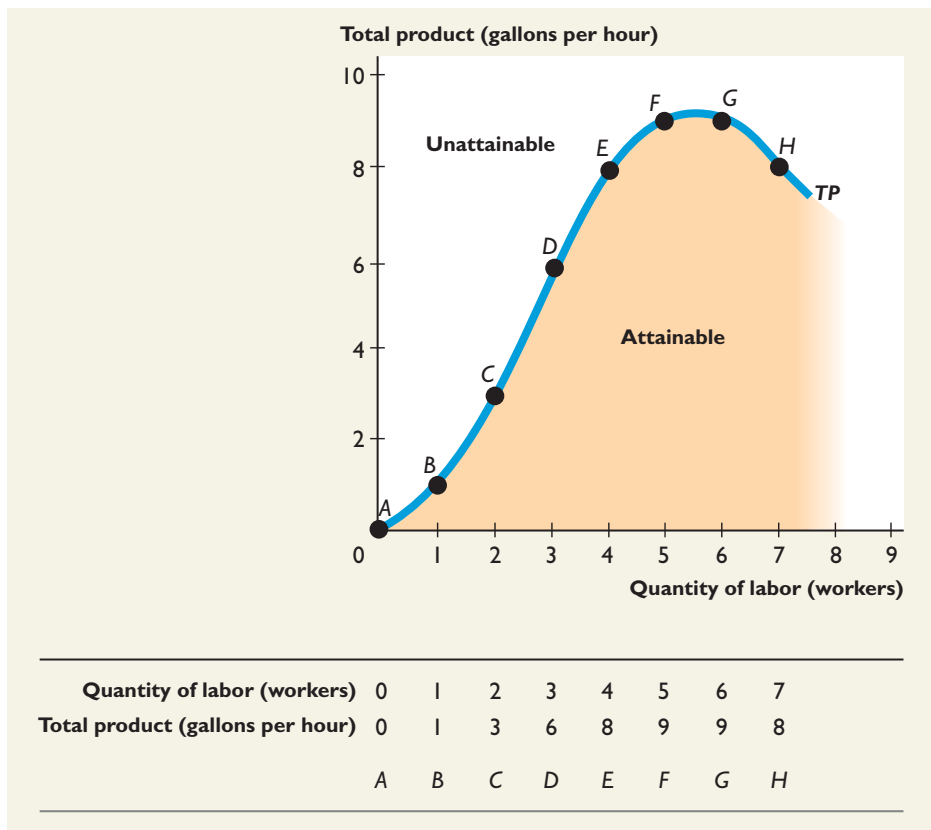
Total product

The total quantity of a good produced in a given period.

FIGURE 10.2

Total Product Schedule and Total Product Curve

MyEconLab Animation



The total product schedule shows how the quantity of smoothies that Sam's can produce changes as the quantity of labor employed changes. In column C, Sam's employs 2 workers and can produce 3 gallons of smoothies an hour.

The total product curve, TP, graphs the data in the table. Points A through H on the curve correspond to the columns of the table. The total product curve separates attainable outputs from unattainable outputs. Points below the TP curve are inefficient. Points on the TP curve are efficient.

Like the *production possibilities frontier* (see Chapter 3, p. 62), the total product curve separates attainable outputs from unattainable outputs. All the points that lie above the curve are unattainable. Points that lie below the curve, in the orange area, are attainable, but they are inefficient: They use more labor than is necessary to produce a given output. Only the points *on* the total product curve are efficient.

■ Marginal Product

Marginal product

The change in total product that results from a one-unit increase in the quantity of labor employed.

Marginal product (MP) is the change in total product that results from a one-unit increase in the quantity of labor employed. It tells us the contribution to total product of adding one additional worker. When the quantity of labor increases by more than one worker, we calculate marginal product as

$$\text{Marginal product} = \text{Change in total product} \div \text{Change in quantity of labor.}$$

Figure 10.3 shows Sam's Smoothies' marginal product curve, *MP*, and its relationship with the total product curve. You can see that as the quantity of labor increases from 1 to 3 workers, marginal product increases. But as more than 3 workers are employed, marginal product decreases. When the seventh worker is employed, marginal product is negative.

Notice that the steeper the slope of the total product curve in part (a), the greater is marginal product in part (b). And when the total product curve turns downward in part (a), marginal product is negative in part (b).

The total product curve and marginal product curve in Figure 10.3 incorporate a feature that is shared by all production processes in firms as different as the Ford Motor Company, Jim's Barber Shop, and Sam's Smoothies:

- Increasing marginal returns initially
- Decreasing marginal returns eventually

Increasing Marginal Returns

Increasing marginal returns

When the marginal product of an additional worker exceeds the marginal product of the previous worker.

Increasing marginal returns occur when the marginal product of an additional worker exceeds the marginal product of the previous worker. The source of increasing marginal returns is increased specialization and greater division of labor in the production process.

For example, if Samantha employs just one worker, that person must learn all the aspects of making smoothies: running the blender, cleaning it, fixing breakdowns, buying and checking the fruit, and serving the customers. That one person must perform all these tasks.

If Samantha hires a second person, the two workers can specialize in different parts of the production process. As a result, two workers can produce more than twice as much as one worker. The marginal product of the second worker is greater than the marginal product of the first worker. Marginal returns are increasing. Most production processes experience increasing marginal returns initially.

Decreasing Marginal Returns

Decreasing marginal returns

When the marginal product of an additional worker is less than the marginal product of the previous worker.

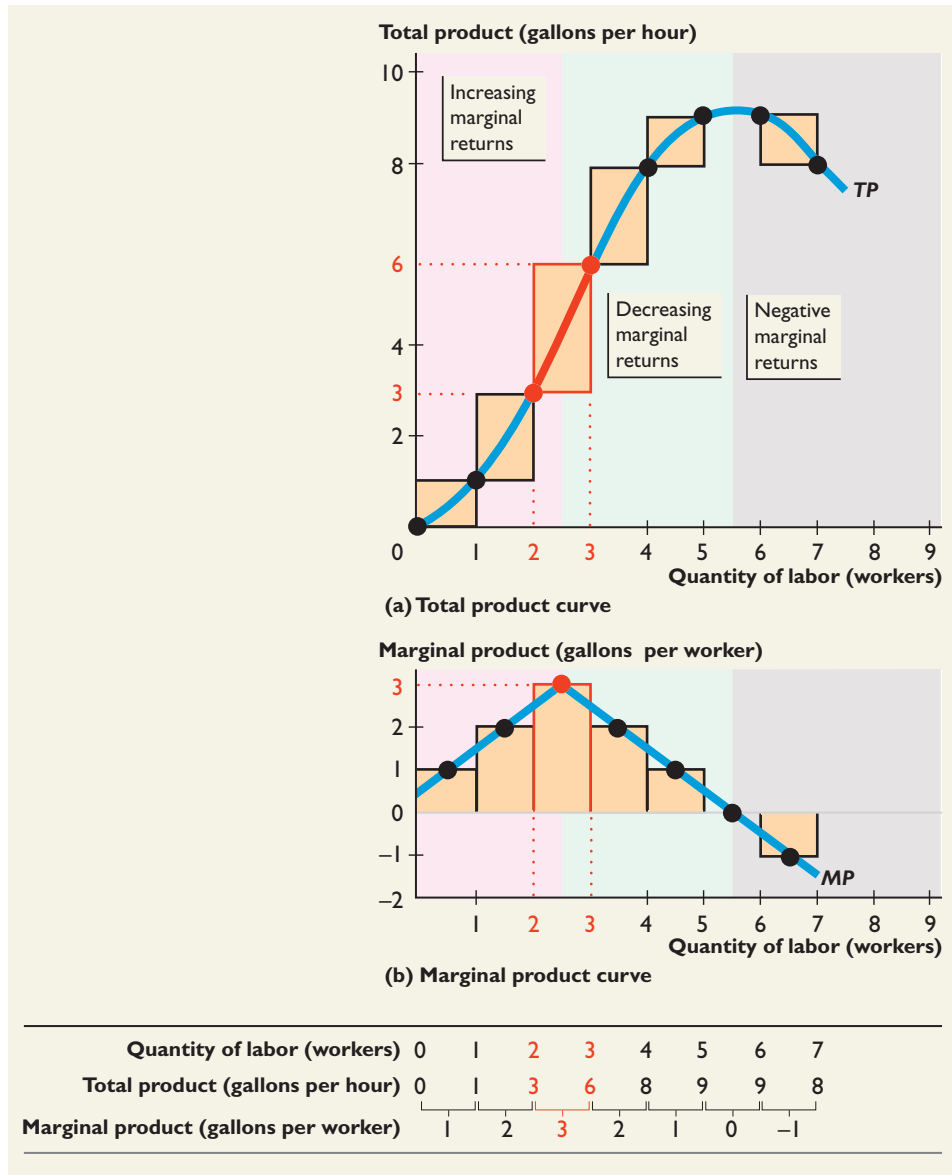
All production processes eventually reach a point of *decreasing* marginal returns. **Decreasing marginal returns** occur when the marginal product of an additional worker is less than the marginal product of the previous worker. Decreasing marginal returns arise from the fact that more and more workers use the same equipment and work space. As more workers are employed, there is less and less that is productive for the additional worker to do. For example, if Samantha hires a

FIGURE 10.3
Total Product and Marginal Product

MyEconLab Animation

The table calculates marginal product, and the orange bars illustrate it. When labor increases from 2 to 3 workers, total product increases from 3 gallons to 6 gallons of smoothies an hour. So marginal product is the orange bar whose height is 3 gallons (in both parts of the figure).

In part (b), marginal product is graphed midway between the labor inputs to emphasize that it is the result of *changing* inputs. Marginal product increases to a maximum (when 3 workers are employed in this example) and then declines—diminishing marginal product.



fourth worker, output increases but not by as much as it did when she hired the third worker. In this case, three workers exhaust all the possible gains from specialization and the division of labor. By hiring a fourth worker, Sam’s produces more smoothies per hour, but the equipment is being operated closer to its limits. Sometimes the fourth worker has nothing to do because the machines are running without the need for further attention.

Hiring yet more workers continues to increase output but by successively smaller amounts until Samantha hires the sixth worker, at which point total product

stops rising. Add a seventh worker, and the workplace is so congested that the workers get in each other's way and total product falls.

Decreasing marginal returns are so pervasive that they qualify for the status of a law: the **law of decreasing returns**, which states that

As a firm uses more of a variable factor of production, with a given quantity of fixed factors of production, the marginal product of the variable factor eventually decreases.

■ Average Product

Average product

Total product divided by the quantity of a factor of production. The average product of labor is total product divided by the quantity of labor employed.

Average product (AP) is the total product per worker employed. It is calculated as

$$\text{Average product} = \text{Total product} \div \text{Quantity of labor.}$$

Another name for average product is *productivity*.

Figure 10.4 shows the average product of labor, AP, and the relationship between average product and marginal product. Average product increases from 1 to 3 workers (its maximum value) but then decreases as yet more workers are employed. Notice also that average product is largest when average product and marginal product are equal. That is, the marginal product curve cuts the average

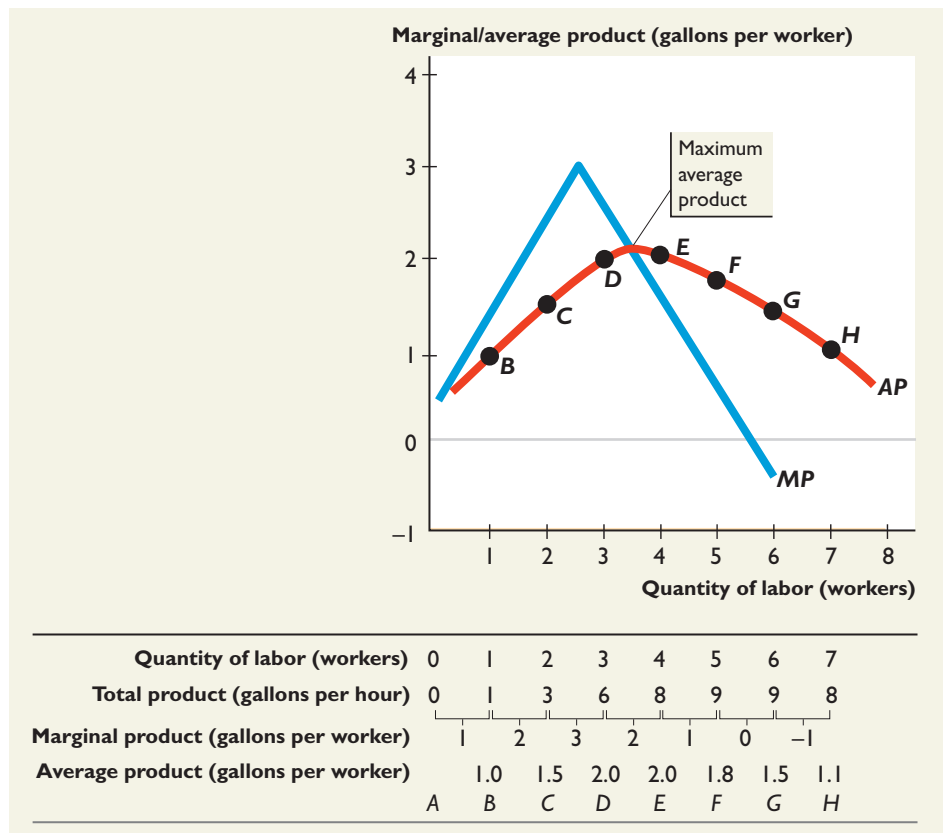
■ **FIGURE 10.4**

Average Product and Marginal Product

MyEconLab Animation

The table calculates average product. For example, when the quantity of labor is 3 workers, total product is 6 gallons an hour, so average product is 6 gallons ÷ 3 workers = 2 gallons a worker.

The average product curve is AP. When marginal product exceeds average product, average product is increasing. When marginal product is less than average product, average product is decreasing.



product curve at the point of maximum average product. For employment levels at which marginal product exceeds average product, the average product curve slopes upward and average product increases as more labor is employed. For employment levels at which marginal product is less than average product, the average product curve slopes downward and average product decreases as more labor is employed.

The relationship between average product and marginal product is a general feature of the relationship between the average value and the marginal value of any variable. *Eye on Your Life* looks at a familiar example.



EYE on YOUR LIFE

Your Average and Marginal Grades

Jen, a part-time student, takes one course each semester over five semesters. In the first semester, she takes calculus and her grade is a C (2). This grade is her marginal grade. It is also her average grade—her GPA.

In the next semester, Jen takes French and gets a B (3)—her new marginal grade. When the marginal value exceeds the average value, the average rises. Because Jen's marginal grade exceeds her average grade, the marginal grade pulls her average up. Her GPA rises to 2.5.

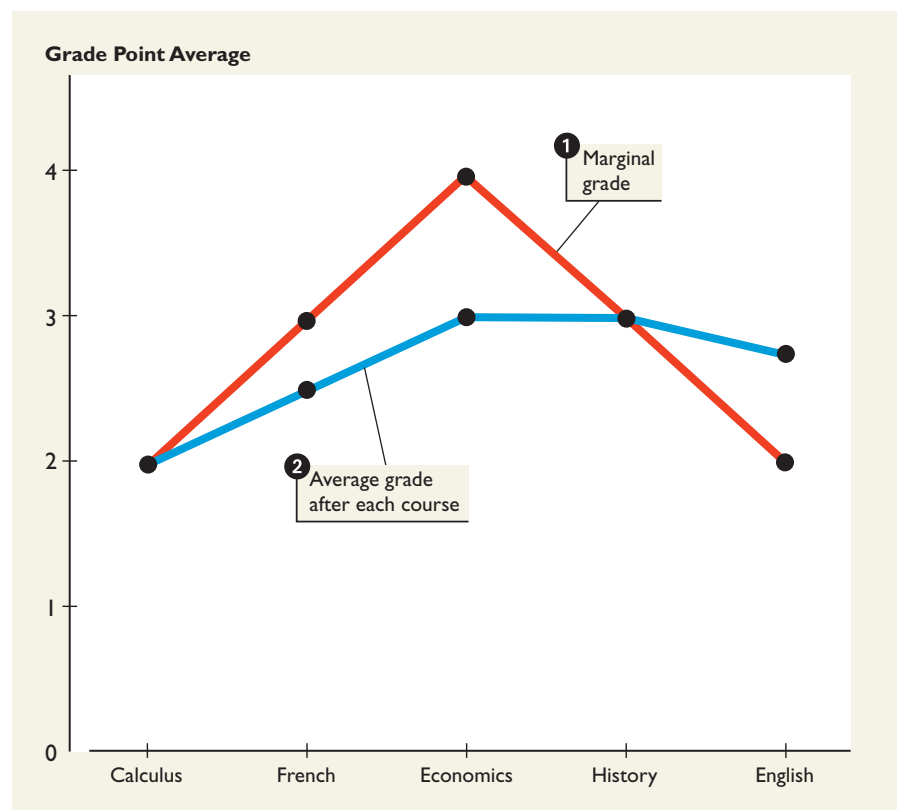
In the third semester, Jen takes economics and gets an A (4). Again her marginal grade exceeds her average, so the marginal grade pulls her average up. Jen's GPA is now 3—the average of 2, 3, and 4.

In the fourth semester, she takes history and gets a B (3). Now her marginal grade equals her average. When the marginal value equals the average value, the average doesn't change. So Jen's average remains at 3.

In the fifth semester, Jen takes English and gets a C (2). When the marginal value is below the average

value, the average falls. Because Jen's marginal grade, 2, is below her average of 3, the marginal grade pulls the average down. Her GPA falls.

This relationship between Jen's ① marginal grade and ② average grade is similar to the relationship between marginal product and average product.



MyEconLab

You can work these problems in Study Plan 10.2 and get instant feedback.

TABLE 1

| Labor (students) | Total product (pineapples per day) |
|------------------|------------------------------------|
| 0 | 0 |
| 1 | 100 |
| 2 | 220 |
| 3 | 300 |
| 4 | 360 |
| 5 | 400 |
| 6 | 420 |
| 7 | 430 |

CHECKPOINT 10.2

Explain the relationship between a firm's output and labor employed in the short run.

Practice Problems

Tom leases a farmer's field and grows pineapples. Tom hires students to pick and pack the pineapples. Table 1 sets out Tom's total product schedule.

1. Calculate the marginal product of the third student and the average product of three students.
2. Over what range of numbers of students does marginal product increase?
3. When marginal product increases, is average product greater than, less than, or equal to marginal product?

In the News

Budget cuts bring layoffs to museums

The Detroit Institute of Arts cut its staff by 56 full-time and 7 part-time employees and canceled some of this year's planned exhibitions.

Source: *The New York Times*, February 25, 2009

As the number of workers decreased and some exhibitions were canceled, how did marginal product and average product of a worker change in the short run?

Solutions to Practice Problems

1. The marginal product of the third student is the change in total product that results from hiring the third student. When Tom hires 2 students, total product is 220 pineapples a day. When Tom hires 3 students, total product is 300 pineapples a day. Marginal product of the third student is the total product of 3 students minus the total product of 2 students, which is 300 pineapples – 220 pineapples or 80 pineapples a day. Average product equals total product divided by the number of students. When Tom hires 3 students, total product is 300 pineapples a day, so average product is 300 pineapples a day ÷ 3 students, which equals 100 pineapples a day.
2. Marginal product of the first student is 100 pineapples a day, of the second student is 120 pineapples a day, and of the third is 80 pineapples a day. So marginal product increases when Tom hires the first and second students.
3. When Tom hires 1 student, marginal product is 100 pineapples and average product is 100 pineapples per student. When Tom hires 2 students, marginal product is 120 pineapples and average product is 110 pineapples per student. When Tom hires the second student, marginal product is increasing and average product is less than marginal product.

Solution to In the News

With a decrease in the number of exhibitions, output (number of visitors to the museum) might fall, but the percentage decrease in output is probably less than the percentage cut in labor services. Marginal product per worker increased and the increase in marginal product brought an increase in the average product.

10.3 SHORT-RUN COST

To produce more output (total product) in the short run, a firm must employ more labor, which means that it must increase its costs. We describe the relationship between output and cost using three cost concepts:

- Total cost
- Marginal cost
- Average cost

■ Total Cost

A firm's **total cost** (TC) is the cost of all the factors of production used by the firm. Total cost divides into two parts: total fixed cost and total variable cost. **Total fixed cost** (TFC) is the cost of a firm's fixed factors of production: land, capital, and entrepreneurship. In the short run, the quantities of these inputs don't change as output changes, so total fixed cost doesn't change as output changes. **Total variable cost** (TVC) is the cost of a firm's variable factor of production—labor. To change its output in the short run, a firm must change the quantity of labor it employs, so total variable cost changes as output changes.

Total cost is the sum of total fixed cost and total variable cost. That is,

$$TC = TFC + TVC.$$

Table 10.2 shows Sam's Smoothies' total costs. Sam's fixed costs are \$10 an hour regardless of whether it operates or not— TFC is \$10 an hour. To produce smoothies, Samantha hires labor, which costs \$6 an hour. TVC , which increases as output increases, equals the number of workers per hour multiplied by \$6. For example, to produce 6 gallons an hour, Samantha hires 3 workers, so TVC is \$18 an hour. TC is the sum of TFC and TVC . So to produce 6 gallons an hour, TC is \$28. Check the calculation in each row and note that to produce some quantities—2 gallons an hour, for example—Sam hires a worker for only part of the hour.

Total cost

The cost of all the factors of production used by a firm.

Total fixed cost

The cost of the firm's fixed factors of production—the cost of land, capital, and entrepreneurship.

Total variable cost

The cost of the firm's variable factor of production—the cost of labor.

■ TABLE 10.2

Sam's Smoothies' Total Costs

| Labor (workers per hour) | Output (gallons per hour) | Total fixed cost | Total variable cost (dollars per hour) | Total cost | Sam's fixed factors of production are land, capital, and entrepreneurship. Total fixed cost is constant regardless of the quantity produced. Sam's variable factor of production is labor. Total variable cost is the cost of labor. Total cost is the sum of total fixed cost and total variable cost. |
|--------------------------------|---------------------------------|---------------------|--|---------------|---|
| 0 | 0 | 10 | 0 | 10.00 | |
| 1.00 | 1 | 10 | 6.00 | 16.00 | |
| 1.60 | 2 | 10 | 9.60 | 19.60 | |
| 2.00 | 3 | 10 | 12.00 | 22.00 | |
| 2.35 | 4 | 10 | 14.10 | 24.10 | |
| 2.65 | 5 | 10 | 15.90 | 25.90 | |
| 3.00 | 6 | 10 | 18.00 | 28.00 | The highlighted row shows that to produce 6 gallons of smoothies, Sam's hires 3 workers. Total fixed cost is \$10 an hour. Total variable cost is the cost of the 3 workers. At \$6 an hour, 3 workers cost \$18. Sam's total cost of producing 6 gallons an hour is \$10 plus \$18, which equals \$28. |
| 3.40 | 7 | 10 | 20.40 | 30.40 | |
| 4.00 | 8 | 10 | 24.00 | 34.00 | |
| 5.00 | 9 | 10 | 30.00 | 40.00 | |

Figure 10.5 illustrates Sam's total cost curves. The green total fixed cost curve (TFC) is horizontal because total fixed cost does not change when output changes. It is a constant at \$10 an hour. The purple total variable cost curve (TVC) and the blue total cost curve (TC) both slope upward because variable cost increases as output increases. The arrows highlight total fixed cost as the vertical distance between the TVC and TC curves.

Let's now look at Sam's Smoothies' marginal cost.

■ Marginal Cost

In Figure 10.5, total variable cost and total cost increase at a decreasing rate at small levels of output and then begin to increase at an increasing rate as output increases. To understand these patterns in the changes in total cost, we need to use the concept of *marginal cost*.

Marginal cost

The change in total cost that results from a one-unit increase in output.

A firm's **marginal cost** is the change in total cost that results from a one-unit increase in output. Table 10.3 calculates the marginal cost for Sam's Smoothies. When, for example, output increases from 5 gallons to 6 gallons an hour, total cost increases from \$25.90 to \$28. So the marginal cost of this gallon of smoothies is \$2.10 ($\$28 - \25.90). Notice that marginal cost is located midway between the total costs to emphasize that it is the result of *changing* outputs

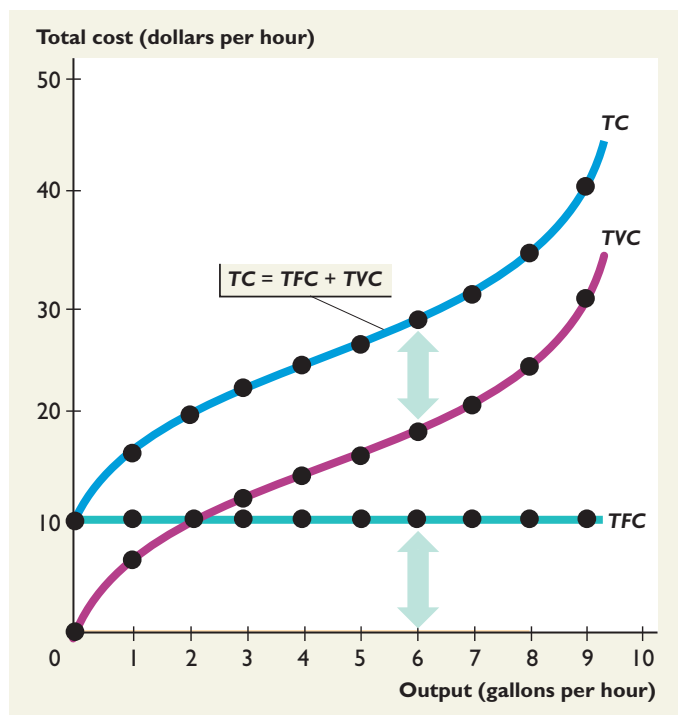
Marginal cost tells us how total cost changes as output changes. The final cost concept tells us what it costs, on average, to produce a unit of output. Let's now look at Sam's average costs.

■ FIGURE 10.5

Total Cost Curves at Sam's Smoothies

MyEconLab Animation

Total fixed cost (TFC) is constant—it graphs as a horizontal line—and total variable cost (TVC) increases as output increases. Total cost (TC) also increases as output increases. The vertical distance between the total cost curve and the total variable cost curve is total fixed cost, as illustrated by the two arrows.



■ Average Cost

There are three average cost concepts:

- Average fixed cost
- Average variable cost
- Average total cost

Average fixed cost (AFC) is total fixed cost per unit of output. **Average variable cost (AVC)** is total variable cost per unit of output. **Average total cost (ATC)** is total cost per unit of output. The average cost concepts are calculated from the total cost concepts as follows:

$$TC = TFC + TVC.$$

Divide each total cost term by the quantity produced, Q , to give

$$\frac{TC}{Q} = \frac{TFC}{Q} + \frac{TVC}{Q}.$$

or

$$ATC = AFC + AVC.$$

Table 10.3 shows these average costs. For example, when output is 6 gallons an hour, average fixed cost is $(\$10 \div 6)$, which equals \$1.67; average variable cost is $(\$18 \div 6)$, which equals \$3.00; and average total cost is $(\$28 \div 6)$, which equals \$4.67. Note that average total cost (\$4.67) equals average fixed cost (\$1.67) plus average variable cost (\$3.00).

Average fixed cost

Total fixed cost per unit of output.

Average variable cost

Total variable cost per unit of output.

Average total cost

Total cost per unit of output, which equals average fixed cost plus average variable cost.

■ **TABLE 10.3**
Sam's Smoothies' Marginal Cost and Average Cost

| Output (gallons per hour) | Total cost (dollars per hour) | Marginal cost (dollars per gallon) | Average fixed cost | Average variable cost | Average total cost | |
|---------------------------------|-------------------------------------|---|--------------------------|-----------------------------|--------------------------|--|
| | | | (dollars per gallon) | | | |
| 0 | 10.00 | | – | – | – | To produce 6 gallons of smoothies an hour, Sam's total cost is \$28. Table 10.2 shows that this total cost is the sum of total fixed cost (\$10) and total variable cost (\$18). Marginal cost is the increase in total cost that results from a one-unit increase in output. When Sam's increases output from 5 gallons to 6 gallons an hour, total cost increases from \$25.90 to \$28.00, an increase of \$2.10 a gallon. The marginal cost of the sixth gallon an hour is \$2.10. Marginal cost is located midway between the total costs to emphasize that it is the result of <i>changing</i> output. When Sam's produces 6 gallons an hour, average fixed cost $(\$10 \div 6$ gallons) is \$1.67 a gallon; average variable cost $(\$18 \div 6$ gallons) is \$3.00 a gallon; average total cost $(\$28 \div 6$ gallons) is \$4.67 a gallon. |
| 1 | 16.00 | 6.00 | 10.00 | 6.00 | 16.00 | |
| 2 | 19.60 | 3.60 | 5.00 | 4.80 | 9.80 | |
| 3 | 22.00 | 2.40 | 3.33 | 4.00 | 7.33 | |
| 4 | 24.10 | 2.10 | 2.50 | 3.53 | 6.03 | |
| 5 | 25.90 | 1.80 | 2.00 | 3.18 | 5.18 | |
| 6 | 28.00 | 2.10 | 1.67 | 3.00 | 4.67 | |
| 7 | 30.40 | 2.40 | 1.43 | 2.91 | 4.34 | |
| 8 | 34.00 | 3.60 | 1.25 | 3.00 | 4.25 | |
| 9 | 40.00 | 6.00 | 1.11 | 3.33 | 4.44 | |

Figure 10.6 graphs the marginal cost and average cost data in Table 10.3. The red marginal cost curve (MC) is U-shaped because of the way in which marginal product changes. Recall that when Samantha hires a second or a third worker, marginal product increases and output increases to 6 gallons an hour (Figure 10.3 on p. xxx). Over this output range, marginal cost decreases as output increases. When Samantha hires a fourth or more workers, marginal product decreases but output increases up to 9 gallons an hour (Figure 10.3). Over this output range, marginal cost increases as output increases.

The green average fixed cost curve (AFC) slopes downward. As output increases, the same constant total fixed cost is spread over a larger output. The blue average total cost curve (ATC) and the purple average variable cost curve (AVC) are U-shaped. The vertical distance between the average total cost and average variable cost curves is equal to average fixed cost—as indicated by the two arrows. That distance shrinks as output increases because average fixed cost decreases with increasing output.

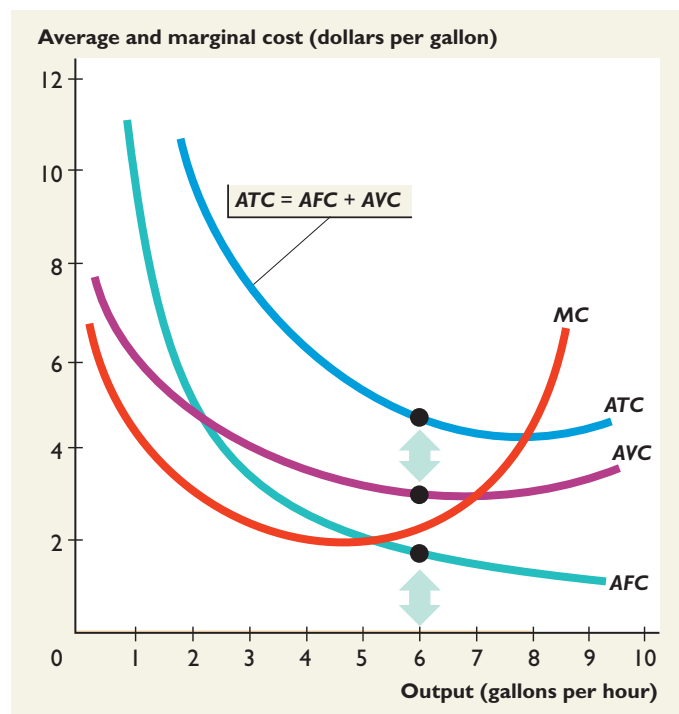
The marginal cost curve intersects the average variable cost curve and the average total cost curve at their minimum points. That is, when marginal cost is less than average cost, average cost is decreasing; and when marginal cost exceeds average cost, average cost is increasing. This relationship holds for both the ATC curve and the AVC curve and is another example of the relationship you saw in Figure 10.4 for average product and marginal product.

FIGURE 10.6
Average Cost Curves and Marginal Cost Curve at Sam's Smoothies

MyEconLab Animation

Average fixed cost decreases as output increases. The average fixed cost curve (AFC) slopes downward. The average total cost curve (ATC) and average variable cost curve (AVC) are U-shaped. The vertical distance between these two curves is equal to average fixed cost, as illustrated by the two arrows.

Marginal cost is the change in total cost when output increases by one unit. The marginal cost curve (MC) is U-shaped and intersects the average variable cost curve and the average total cost curve at their minimum points.



■ Why the Average Total Cost Curve Is U-Shaped

Average total cost, *ATC*, is the sum of average fixed cost, *AFC*, and average variable cost, *AVC*. So the shape of the *ATC* curve combines the shapes of the *AFC* and *AVC* curves. The U-shape of the average total cost curve arises from the influence of two opposing forces:

- Spreading total fixed cost over a larger output
- Decreasing marginal returns

When output increases, the firm spreads its total fixed costs over a larger output and its average fixed cost decreases—its average fixed cost curve slopes downward.

Decreasing marginal returns means that as output increases, ever larger amounts of labor are needed to produce an additional unit of output. So average variable cost eventually increases, and the *AVC* curve eventually slopes upward.

The shape of the average total cost curve combines these two effects. Initially, as output increases, both average fixed cost and average variable cost decrease, so average total cost decreases and the *ATC* curve slopes downward. But as output increases further and decreasing marginal returns set in, average variable cost begins to increase. Eventually, average variable cost increases more quickly than average fixed cost decreases, so average total cost increases and the *ATC* curve slopes upward.

All the short-run cost concepts that you've met are summarized in Table 10.4.

■ **TABLE 10.4**

A Compact Glossary of Costs

| Term | Symbol | Definition | Equation |
|-----------------------|------------|---|----------------------------------|
| Fixed cost | | The cost of a fixed factor of production that is independent of the quantity produced | |
| Variable cost | | The cost of a variable factor of production that varies with the quantity produced | |
| Total fixed cost | <i>TFC</i> | Cost of the fixed factors of production | |
| Total variable cost | <i>TVC</i> | Cost of the variable factor of production | |
| Total cost | <i>TC</i> | Cost of all factors of production | $TC = TFC + TVC$ |
| Marginal cost | <i>MC</i> | Change in total cost resulting from a one-unit increase in output (<i>Q</i>) | $MC = \Delta TC \div \Delta Q^*$ |
| Average fixed cost | <i>AFC</i> | Total fixed cost per unit of output | $AFC = TFC \div Q$ |
| Average variable cost | <i>AVC</i> | Total variable cost per unit of output | $AVC = TVC \div Q$ |
| Average total cost | <i>ATC</i> | Total cost per unit of output | $ATC = AFC + AVC$ |

*In this equation, the Greek letter delta (Δ) stands for "change in."

■ Cost Curves and Product Curves

A firm's cost curves and product curves are linked, and Figure 10.7 shows how. The upper graph shows the average product curve, AP , and the marginal product curve, MP . The lower graph shows the average variable cost curve, AVC , and the marginal cost curve, MC .

As labor increases up to 2.5 workers a day (upper graph), output increases to 4 units a day (lower graph). Marginal product and average product rise and marginal cost and average variable cost fall. At the point of maximum marginal product, marginal cost is at a minimum.

As labor increases to 3.5 workers a day (upper graph), output increases to 7 units a day (lower graph). Marginal product falls and marginal cost rises, but average product continues to rise and average variable cost continues to fall. At the point of maximum average product, average variable cost is at a minimum. As labor increases further, output increases. Average product diminishes and average variable cost increases.

■ Shifts in the Cost Curves

The position of a firm's short-run cost curves, in Figures 10.5 and 10.6, depends on two factors:

- Technology
- Prices of factors of production

Technology

A technological change that increases productivity shifts the total product curve upward. It also shifts the marginal product curve and the average product curve upward. With a better technology that increases productivity, the same factors of production can produce more output, so an advance in technology lowers the average and marginal costs and shifts the short-run cost curves downward.

For example, advances in robotic technology have increased productivity in the automobile industry. As a result, the product curves of Chrysler, Ford, and GM have shifted upward, and their average and marginal cost curves have shifted downward. But the relationships between their product curves and cost curves have not changed. The curves are still linked, as in Figure 10.7.

Often a technological advance results in a firm using more capital, a fixed factor of production, and less labor, a variable factor of production. For example, today telephone companies use computers to connect long-distance calls instead of the human operators they used in the 1980s. When a telephone company makes this change, total variable cost decreases and total cost decreases, but total fixed cost increases. This change in the mix of fixed cost and variable cost means that at small output levels, average total cost might increase, but at large output levels, average total cost decreases.

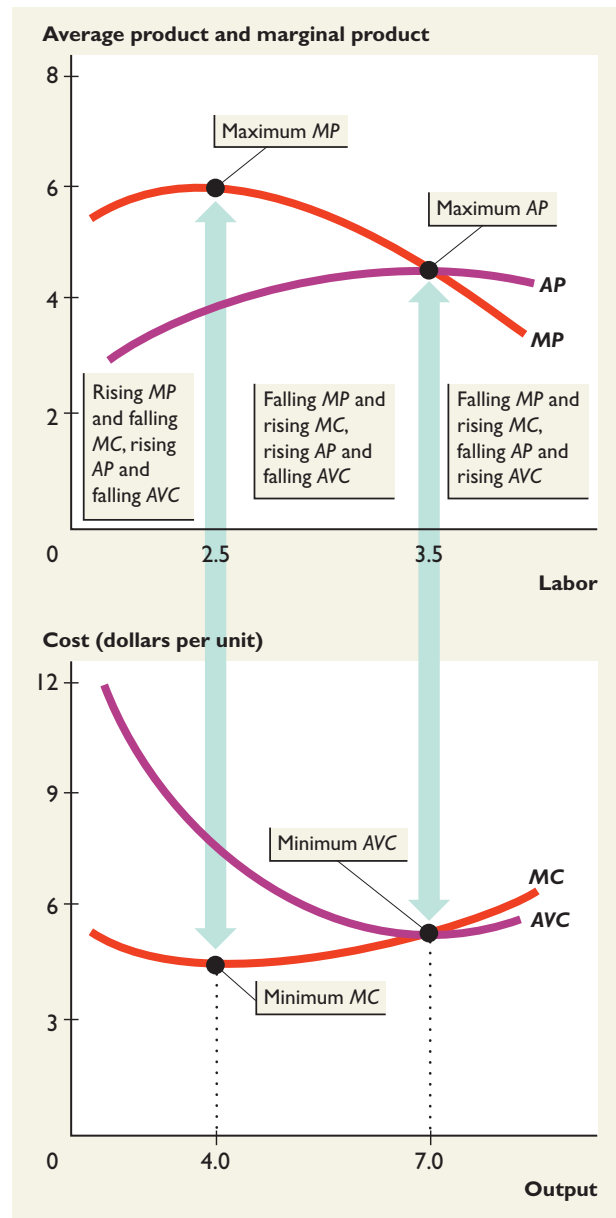
Prices of Factors of Production

An increase in the price of a factor of production increases costs and shifts the cost curves. But how the curves shift depends on which resource price changes. An increase in rent or some other component of *fixed* cost shifts the fixed cost curves (TFC and AFC) upward and shifts the total cost curve (TC) upward but leaves the variable cost curves (AVC and TVC) and the marginal cost curve (MC) unchanged.

■ **FIGURE 10.7**

Product Curves and Cost Curves

MyEconLab Animation



A firm's MC curve is linked to its MP curve. If, as the firm hires more labor up to 2.5 workers a day, the firm's marginal product rises, its marginal cost falls. If marginal product is at a maximum, marginal cost is at a minimum. If, as the firm hires more labor, its marginal product diminishes, its marginal cost rises.

A firm's AVC curve is linked to its AP curve. If, as the firm hires more labor up to 3.5 workers a day, its average product rises, its average variable cost falls. If average product is at a maximum, average variable cost is at a minimum. If as the firm hires more labor its average product diminishes, its average variable cost rises.

An increase in wage rates or some other component of *variable* cost shifts the variable cost curves (*TVC* and *AVC*) and the marginal cost curve (*MC*) upward but leaves the fixed cost curves (*AFC* and *TFC*) unchanged. So, for example, if the interest expense paid by a trucking company increases, the fixed cost of transportation services increases, but if the wage rate paid to truck drivers increases, the variable cost and marginal cost of transportation services increase.

MyEconLab

You can work these problems in Study Plan 10.3 and get instant feedback.

TABLE 1

| Labor (students) | Output (pineapples per day) |
|------------------|-----------------------------|
| 0 | 0 |
| 1 | 100 |
| 2 | 220 |
| 3 | 300 |
| 4 | 360 |
| 5 | 400 |
| 6 | 420 |
| 7 | 430 |

TABLE 2

| Labor | TP | TC | MC | ATC |
|-------|-----|-----|-------|------|
| 0 | 0 | 200 | 1.00 | — |
| 1 | 100 | 300 | 0.83 | 3.00 |
| 2 | 220 | 400 | 1.25 | 1.82 |
| 3 | 300 | 500 | 1.67 | 1.67 |
| 4 | 360 | 600 | 2.50 | 1.67 |
| 5 | 400 | 700 | 5.00 | 1.75 |
| 6 | 420 | 800 | 10.00 | 1.90 |
| 7 | 430 | 900 | | 2.09 |

CHECKPOINT 10.3

Explain the relationship between a firm's output and costs in the short run.

Practice Problems

Tom leases a farmer's field for \$120 a day and grows pineapples. He pays students \$100 a day to pick pineapples and he leases capital at \$80 a day. Table 1 shows Tom's daily output.

1. What is Tom's total cost and average total cost of 300 pineapples a day?
2. What is the marginal cost of picking a pineapple when the quantity increases from 360 to 400 pineapples a day?
3. At what output is Tom's average total cost a minimum?

In the News

Metropolitan Museum completes round of layoffs

The museum cut 74 jobs and 95 other workers retired. The museum also laid off 127 other employees in its retail shops. The cut in labor costs is \$10 million, but the museum expects no change in the number of visitors.

Source: *The New York Times*, June 22, 2009

Explain how the job cuts will change the museum's short-run average cost curves and marginal cost curve.

Solutions to Practice Problems

1. Total cost is the sum of total fixed cost and total variable cost. Tom leases the field for \$120 a day and capital for \$80 a day, so Tom's total fixed cost is \$200 a day. Total variable cost is the wages of the students. To produce 300 pineapples a day, Tom hires 3 students, so total variable cost is \$300 a day and total cost is \$500 a day. Table 2 shows the total cost (TC) schedule. Average total cost is the total cost divided by total product. The total cost of 300 pineapples a day is \$500, so average total cost is \$1.67 a pineapple. Table 2 shows the average total cost schedule.
2. Marginal cost is the increase in total cost that results from picking one additional pineapple a day. When the quantity picked increases from 360 to 400 pineapples a day, total cost (from Table 2) increases from \$600 to \$700. The increase in the number of pineapples is 40, and the increase in total cost is \$100. Marginal cost is the increase in total cost (\$100) divided by the increase in the number of pineapples (40), which is \$2.50 per pineapple. So the marginal cost of a pineapple is \$2.50.
3. At the minimum of average total cost, average total cost equals marginal cost. Minimum average total cost of a pineapple between 300 and 360 pineapples is \$1.67. Table 2 shows that the marginal cost of increasing output from 300 to 360 pineapples a day is \$1.67 a pineapple.

Solution to In the News

A cut in labor but no change in output increases marginal product of labor and decreases marginal cost. The MC, AVC, and ATC curves shift downward.

10.4 LONG-RUN COST

In the long run, a firm can vary both the quantity of labor and the quantity of capital. A small firm, such as Sam's Smoothies, can increase its plant size by moving into a larger building and installing more machines. A big firm such as General Motors can decrease its plant size by closing down some production lines.

We are now going to see how costs vary in the long run when a firm varies its plant—the quantity of capital it uses—along with the quantity of labor it uses.

The first thing that happens is that the distinction between fixed cost and variable cost disappears. All costs are variable in the long run.

■ Plant Size and Cost

When a firm changes its plant size, its cost of producing a given output changes. In Table 10.3 on p. xxx and Figure 10.6 on p. xxx, the lowest average total cost that Samantha can achieve is \$4.25 a gallon, which occurs when she produces 8 gallons of smoothies an hour. Samantha wonders what would happen to her average total cost if she increased the size of her plant by renting a bigger building and installing a larger number of blenders and refrigerators. Will the average total cost of producing a gallon of smoothies fall, rise, or remain the same?

Each of these three outcomes is possible, and they arise because when a firm changes the size of its plant, it might experience

- Economies of scale
- Diseconomies of scale
- Constant returns to scale

Economies of Scale

Economies of scale are features of a firm's technology that make average total cost *fall* as output increases. The main source of economies of scale is greater specialization of both labor and capital.

Specialization of Labor If Ford produced 100 cars a week, each production line worker would have to perform many different tasks. But if Ford produces 10,000 cars a week, each worker can specialize in a small number of tasks and become highly proficient at them. The result is that the average product of labor increases and the average total cost of producing a car falls.

Specialization also occurs off the production line. For example, a small firm usually does not have a specialist sales manager, personnel manager, and production manager. One person covers all these activities. But when a firm is large enough, specialists perform these activities. Average product increases, and the average total cost falls.

Specialization of Capital At a small output rate, firms often must employ general-purpose machines and tools. For example, with an output of a few gallons an hour, Sam's Smoothies uses regular blenders like the one in your kitchen. But if Sam's produces hundreds of gallons an hour, it uses commercial blenders that fill, empty, and clean themselves. The result is that the output rate is larger and the average total cost of producing a gallon of smoothies is lower.

Economies of scale

Features of a firm's technology that make average total cost *fall* as output increases.



Specialization of both labor and capital on an auto-assembly line.

Diseconomies of scale

Features of a firm's technology that make average total cost *rise* as output increases.

Diseconomies of Scale

Diseconomies of scale are features of a firm's technology that make average total cost *rise* as output increases. Diseconomies of scale arise from the difficulty of coordinating and controlling a large enterprise. The larger the firm, the greater is the cost of communicating both up and down the management hierarchy and among managers. Eventually, management complexity brings rising average total cost. Diseconomies of scale occur in all production processes but in some perhaps only at a very large output rate.

Constant returns to scale

Features of a firm's technology that keep average total cost constant as output increases.

Constant Returns to Scale

Constant returns to scale are features of a firm's technology that keep average total cost *constant* as output increases. Constant returns to scale occur when a firm is able to replicate its existing production facility including its management system. For example, Ford might double its production of Fusion cars by doubling its production facility for those cars. It can build an identical production line and hire an identical number of workers. With the two identical production lines, Ford produces exactly twice as many cars. The average total cost of producing a Fusion is identical in the two plants. Ford's average total cost remains constant as it increases production.

Long-run average cost curve

A curve that shows the lowest average total cost at which it is possible to produce each output when the firm has had sufficient time to change both its plant size and labor employed.

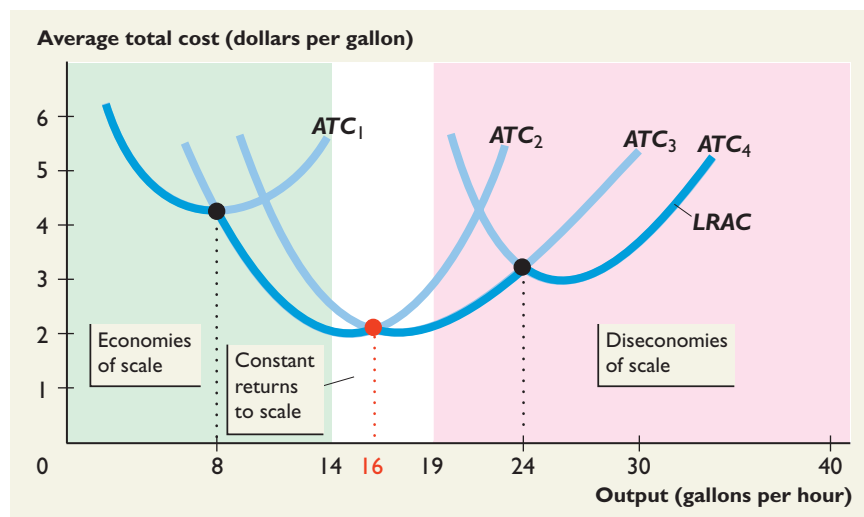
The **long-run average cost curve** shows the lowest average total cost at which it is possible to produce each output when the firm has had sufficient time to change both its plant size and its labor force.

Figure 10.8 shows Sam's Smoothies' long-run average cost curve *LRAC*. This long-run average cost curve is derived from the short-run average total cost curves for different possible plant sizes.

With its current small plant, Sam's Smoothies operates on the average total cost curve ATC_1 in Figure 10.8. The other three average total cost curves are for

FIGURE 10.8
Long-Run Average Cost Curve

MyEconLab Animation



In the long run, Samantha can vary both the plant size and the quantity of labor she employs. The long-run average cost curve traces the lowest attainable average total cost of producing each output. The dark blue curve is the long-run average cost curve *LRAC*.

Sam's experiences economies of scale as output increases up to 14 gallons an hour, constant returns to scale for outputs between 14 gallons and 19 gallons an hour, and diseconomies of scale for outputs that exceed 19 gallons an hour.

successively bigger plants. In this example, for outputs up to 8 gallons an hour, the existing plant with average total cost curve ATC_1 produces smoothies at the lowest attainable average cost. For outputs between 8 and 16 gallons an hour, average total cost is lowest on ATC_2 . For outputs between 16 and 24 gallons an hour, average total cost is lowest on ATC_3 . And for outputs in excess of 24 gallons an hour, average total cost is lowest on ATC_4 .

The segment of each of the four average total cost curves for which that plant has the lowest average total cost is highlighted in dark blue in Figure 10.8. The scallop-shaped curve made up of these four segments is Sam's Smoothies' long-run average cost curve.

Economies and Diseconomies of Scale

When economies of scale are present, the $LRAC$ curve slopes downward. The $LRAC$ curve in Figure 10.8 shows that Sam's Smoothies experiences economies of scale for output rates up to 14 gallons an hour. At output rates between 14 and 19 gallons an hour, the firm experiences constant returns to scale. And at output rates that exceed 19 gallons an hour, the firm experiences diseconomies of scale.



EYE on RETAILERS' COSTS

Which Store Has the Lower Costs: Wal-Mart or 7-Eleven?

Wal-Mart's "small" supercenters measure 99,000 square feet and serve an average of 30,000 customers a week. The average 7-Eleven store, most of which today are attached to gas stations, measures 2,000 square feet and serves 5,000 customers a week.

Which retailing technology has the lower operating cost? The answer depends on the scale of operation.

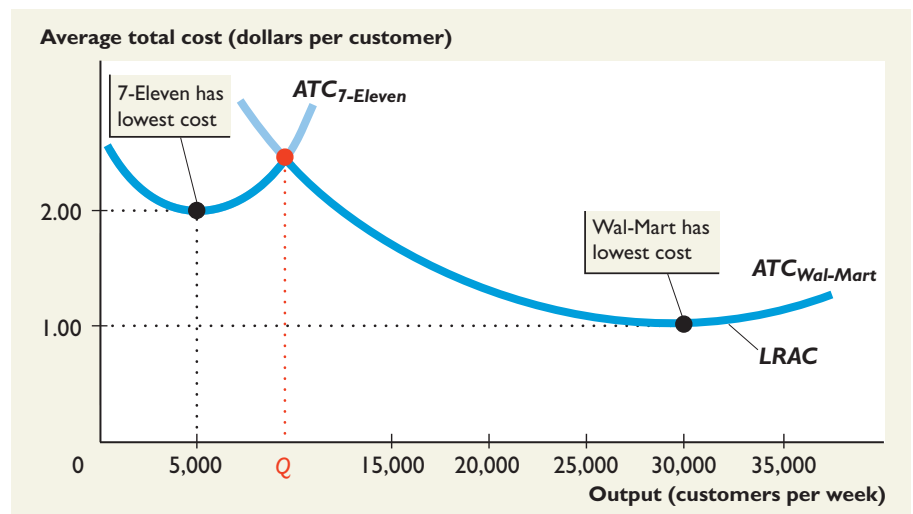
At a small number of customers per week, it costs less per customer to operate a store of 2,000 square feet than one of 99,000 square feet.

In the figure, the average total cost curve of operating a 7-Eleven store of 2,000 square feet is $ATC_{7-Eleven}$ and the average total cost curve of a store of 99,000 square feet is $ATC_{Wal-Mart}$. The dark blue curve is a retailer's long-run

average cost curve $LRAC$.

If the number of customers is Q a week, the average total cost per transaction is the same for both stores. For a store that serves more than Q cus-

tomers a week, the least-cost method is the big store. For fewer than Q customers a week, the least-cost method is the small store. The least-cost store is not always the biggest.



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You can work these problems in Study Plan 10.4 and get instant feedback.

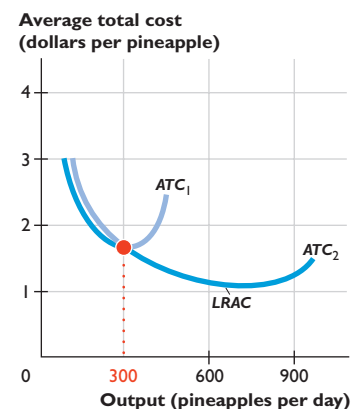
TABLE 1

| Labor (students per day) | Output 1 field (pineapples per day) | Output 2 fields |
|--------------------------|-------------------------------------|-----------------|
| 0 | 0 | 0 |
| 1 | 100 | 220 |
| 2 | 220 | 460 |
| 3 | 300 | 620 |
| 4 | 360 | 740 |
| 5 | 400 | 820 |
| 6 | 420 | 860 |
| 7 | 430 | 880 |

TABLE 2

| TP (1 field) | ATC (1 field) | TP (2 fields) | ATC (2 fields) |
|--------------|---------------|---------------|----------------|
| 100 | 3.00 | 220 | 2.27 |
| 220 | 1.82 | 460 | 1.30 |
| 300 | 1.67 | 620 | 1.13 |
| 360 | 1.67 | 740 | 1.08 |
| 400 | 1.75 | 820 | 1.10 |
| 420 | 1.90 | 860 | 1.16 |
| 430 | 2.09 | 880 | 1.25 |

FIGURE 1



CHECKPOINT 10.4

Derive and explain a firm's long-run average cost curve.

Practice Problems

To grow pineapples, Tom leases 1 field for \$120 a day and capital for \$80 a day and hires students at \$100 a day. Suppose that Tom now leases 2 fields for \$240 a day and twice as much capital for \$160 a day. Table 1 shows his outputs.

1. What is Tom's average total cost when he farms 2 fields and produces 220 pineapples a day?
2. Make a graph of Tom's average total cost curves using 1 field and 2 fields. Show on the graph Tom's long-run average cost curve. Over what output range will Tom use 1 field? 2 fields?
3. Does Tom experience constant returns to scale, economies of scale, or diseconomies of scale?

In the News

GM restructuring plan released

GM's restructuring plan will close 11 plants and reduce output at 3 others.

Source: boston.com, May 31, 2009

Explain the effects of the restructuring plan on GM's total fixed cost, total variable cost, short-run ATC curve, and LRAC curve.

Solutions to Practice Problems

1. Total cost equals fixed cost (\$400 a day) plus \$100 a day for each student. Tom can produce 220 pineapples with 2 fields and 1 student, so total cost is \$500 a day. Average total cost is the total cost divided by output, which at 220 pineapples a day is \$500 divided by 220, or \$2.27. The "ATC (2 fields)" column of Table 2 shows Tom's average total cost schedule for 2 fields.
2. Figure 1 shows Tom's average total cost curve using 1 field as ATC_1 . This curve graphs the data on ATC (1 field) and TP (1 field) in Table 2, which was calculated in Table 2 on p. xxx. Using 2 fields, the average total cost curve is ATC_2 . Tom's long-run average cost curve is the lower segments of the two ATC curves, highlighted in Figure 1. If Tom produces up to 300 pineapples a day, he will use 1 field. If he produces more than 300 pineapples a day, he will use 2 fields.
3. Tom experiences economies of scale up to an output of 740 pineapples a day because as he increases his plant and produces up to 740 pineapples a day, the average total cost of picking a pineapple decreases. (We don't have enough information to know what happens to Tom's average total cost if he uses three fields and three units of capital.)

Solution to In the News

Closing 11 plants will lower GM's total fixed cost; closing 11 plants and decreasing output at 3 plants will lower GM's total variable cost. With a smaller scale, GM will move left along its LRAC curve to the ATC curve associated with its smaller scale. As GM varies its output, it will move along that ATC curve.

CHAPTER SUMMARY

Key Points

- 1 Explain and distinguish between the economic and accounting measures of a firm's cost of production and profit.**
 - Firms seek to maximize economic profit, which is total revenue minus total cost.
 - Total cost equals opportunity cost—the sum of explicit costs and implicit costs, which includes normal profit.
- 2 Explain the relationship between a firm's output and labor employed in the short run.**
 - In the short run, the firm can change the output it produces by changing only the quantity of labor it employs.
 - A total product curve shows the limits to the output that the firm can produce with a given quantity of capital and different quantities of labor.
 - As the quantity of labor increases, the marginal product of labor increases initially but eventually decreases—the law of decreasing returns.
- 3 Explain the relationship between a firm's output and costs in the short run.**
 - As total product increases, total fixed cost is constant, and total variable cost and total cost increase.
 - As total product increases, average fixed cost decreases; average variable cost, average total cost, and marginal cost decrease at small outputs and increase at large outputs so their curves are U-shaped.
- 4 Derive and explain a firm's long-run average cost curve.**
 - In the long run, the firm can change the size of its plant.
 - Long-run cost is the cost of production when all inputs have been adjusted to produce at the lowest attainable cost.
 - The long-run average cost curve traces out the lowest attainable average total cost at each output when both the plant size and labor can be varied.
 - The long-run average cost curve slopes downward with economies of scale and upward with diseconomies of scale.

Key Terms

| | | |
|----------------------------------|----------------------------------|--------------------------|
| Average fixed cost, 263 | Economic profit, 251 | Marginal cost, 262 |
| Average product, 258 | Economies of scale, 269 | Marginal product, 256 |
| Average total cost, 263 | Explicit cost, 251 | Normal profit, 251 |
| Average variable cost, 263 | Implicit cost, 251 | Short run, 254 |
| Constant returns to scale, 270 | Increasing marginal returns, 256 | Total cost, 261 |
| Decreasing marginal returns, 256 | Law of decreasing returns, 258 | Total fixed cost, 261 |
| Diseconomies of scale, 270 | Long run, 254 | Total product, 255 |
| Economic depreciation, 251 | Long-run average cost curve, 270 | Total variable cost, 261 |

MyEconLab

You can work these problems in Chapter 10 Study Plan and get instant feedback.



CHAPTER CHECKPOINT

Study Plan Problems and Applications

1. Joe runs a shoe shine stand at the airport. Joe has no skills, no job experience, and no alternative job. The return to entrepreneurship in the shoe shine business is \$10,000 a year. Joe pays the airport rent of \$2,000 a year, and his total revenue from shining shoes is \$15,000 a year. He spent \$1,000 on a chair, polish, and brushes and paid for these items using a loan that has an interest rate of 20 percent a year. At the end of one year, Joe was offered \$500 for his business and all its equipment. Calculate Joe’s annual explicit costs, implicit costs, and economic profit from his shoe shine business.
2. Len’s body board factory rents equipment for shaping boards and hires students. Table 1 sets out Len’s total product schedule. Construct Len’s marginal product and average product schedules. Over what range of workers do marginal returns increase?

Use the following information to work Problems 3 to 6.

Len’s body board factory pays \$60 a day for equipment and \$200 a day to each student it hires. Table 1 sets out Len’s total product schedule.

3. Construct Len’s total variable cost and total cost schedules. What does the difference between total cost and total variable cost at each output equal?
4. Construct the average fixed cost, average variable cost, and average total cost schedules and the marginal cost schedule.
5. At what output is Len’s average total cost at a minimum? At what output is Len’s average variable cost at a minimum?
6. Explain why the output at which average variable cost is at a minimum is smaller than the output at which average total cost is at a minimum.
7. Table 2 shows the costs incurred at Pete’s peanut farm. Complete the table.

TABLE 1

| Labor (workers per day) | Total product (body boards per day) |
|-------------------------|-------------------------------------|
| 0 | 0 |
| 1 | 20 |
| 2 | 44 |
| 3 | 60 |
| 4 | 72 |

TABLE 2

| L | TP | TVC | TC | AFC | AVC | ATC | MC |
|---|----|-----|-----|-----|-----|-----|----|
| 0 | 0 | 0 | 100 | | | | |
| 1 | 10 | 35 | | | | | |
| 2 | 24 | 70 | | | | | |
| 3 | 38 | 105 | | | | | |
| 4 | 44 | 140 | | | | | |

8. Gap will focus on smaller scale stores

Gap has too many 12,500 square feet stores. The target store size is 6,000 to 10,000 square feet, so Gap plans to combine previously separate stores. Some Gap Body, Gap Adult, and Gap Kids stores will be combined in one store.

Source: CNN, June 10, 2008

Thinking of a Gap store as a production plant, explain why Gap is reducing the size of its stores. Is Gap making a long-run decision or a short-run decision? Is Gap taking advantage of economies of scale?

Instructor Assignable Problems and Applications

Your instructor can assign these problems as homework, a quiz, or a test in [MyEconLab](#).

1. If the *ATC* curves of a Wal-Mart store and a 7-Eleven store are like those in *Eye on Retailers' Costs* on p. xxx, and if each type of store operates at its minimum *ATC*, which store has the lower total cost? How can you be sure? Which has the lower marginal cost? How can you be sure? Sketch each firm's marginal cost curve.
2. Sonya used to earn \$25,000 a year selling real estate, but she now sells greeting cards. The return to entrepreneurship in the greeting cards industry is \$14,000 a year. Over the year, Sonya bought \$10,000 worth of cards from manufacturers and sold them for \$58,000. Sonya rents a shop for \$5,000 a year and spends \$1,000 on utilities and office expenses. Sonya owns a cash register, which she bought for \$2,000 with funds from her savings account. Her bank pays 3 percent a year on savings accounts. At the end of the year, Sonya was offered \$1,600 for her cash register. Calculate Sonya's explicit costs, implicit costs, and economic profit.

Use the following information to work Problems 3 to 5.

Yolanda runs a bullfrog farm. When she employs 1 person, she produces 1,000 bullfrogs a week. When she hires a second worker, her total product doubles. Her total product doubles again when she hires a third worker. When she hires a fourth worker, her total product increases but by only 1,000 bullfrogs. Yolanda pays \$1,000 a week for equipment and \$500 a week to each worker she hires.

3. Construct Yolanda's marginal product and average product schedules. Over what range of workers does marginal returns increase?
4. Construct Yolanda's total variable cost and total cost schedules. What is Yolanda's total fixed cost?
5. At what output is Yolanda's average total cost at a minimum?
6. Table 1 shows some of the costs incurred at Bill's Bakery. Calculate the values of *A*, *B*, *C*, *D*, and *E*. Show your work.

TABLE 1

| <i>L</i> | <i>TP</i> | <i>TVC</i> | <i>TC</i> | <i>AFC</i> | <i>AVC</i> | <i>ATC</i> | <i>MC</i> |
|----------|-----------|------------|-----------|------------|------------|------------|-----------|
| 1 | 100 | 350 | 850 | C | 3.50 | D | 2.50 |
| 2 | 240 | 700 | B | 2.08 | 2.92 | 5.00 | |
| 3 | 380 | A | 1,550 | 1.32 | 2.76 | 4.08 | 5.83 |
| 4 | 440 | 1,400 | 1,900 | 1.14 | 3.18 | 4.32 | |
| 5 | 470 | 1,750 | 2,250 | 1.06 | 3.72 | 4.79 | 11.67 |

7. Grain prices go the way of the oil price

Rising crop prices have started to impact the price of breakfast for millions of Americans—cereal prices are rising.

Source: *The Economist*, July 21, 2007

Explain how the rising price of grain affects the average total cost and marginal cost of producing breakfast cereals.

MyEconLab

You can work this quiz in Chapter 10 Study Plan and get instant feedback.

Multiple Choice Quiz

1. A firm's cost of production equals _____.
 - A. all the costs paid with money, called explicit costs
 - B. the implicit costs of using all the firm's own resources
 - C. all explicit costs and implicit costs, excluding normal profit
 - D. the costs of all resources used by the firm whether bought in the market-place or owned by the firm
2. The average product of labor increases as output increases if _____.
 - A. marginal product exceeds average product
 - B. average product exceeds marginal product
 - C. total product increases
 - D. marginal product increases
3. Marginal returns start to decrease when more and more workers _____.
 - A. have to share the same equipment and workspace
 - B. produce less and less total output
 - C. require jobs to be too specialized
 - D. produce less and less average product
4. Average variable cost is at a minimum when _____.
 - A. marginal cost equals average variable cost
 - B. average total cost is at a minimum
 - C. marginal cost exceeds average fixed cost
 - D. average total cost exceeds average variable cost
5. An increase in the rent that a firm pays for its factory does not increase _____.
 - A. total cost
 - B. fixed cost
 - C. marginal cost
 - D. average fixed cost
6. An increase in the wage rate _____.
 - A. shifts the average total cost curve and the marginal cost curve upward
 - B. shifts the average fixed cost and average variable cost curve upward
 - C. increases average variable cost but does not change marginal cost
 - D. does not change average variable cost but increases average total cost
7. When average variable cost is at its minimum level, marginal product _____.
 - A. equals average product
 - B. exceeds average product
 - C. is less than average product
 - D. is at its maximum level
8. In the long run, with an increase in the plant size, _____.
 - A. the short-run average total cost curve shifts downward
 - B. the long-run average cost curve slopes downward
 - C. the short-run average total cost curve shifts downward if economies of scale exist
 - D. the average total cost of production rises



Why did GM fail?

Perfect Competition

When you have completed your study of this chapter, you will be able to

- 1 Explain a perfectly competitive firm's profit-maximizing choices and derive its supply curve.
- 2 Explain how output, price, and profit are determined in the short run.
- 3 Explain how output, price, and profit are determined in the long run and explain why perfect competition is efficient.



CHAPTER CHECKLIST

MARKET TYPES

The four market types are

- Perfect competition
- Monopoly
- Monopolistic competition
- Oligopoly

■ Perfect Competition

Perfect competition exists when

- Many firms sell an identical product to many buyers.
- There are no barriers to entry into (or exit from) the market.
- Established firms have no advantage over new firms.
- Sellers and buyers are well informed about prices.

These conditions that define perfect competition arise when the market demand for the product is large relative to the output of a single producer. This situation arises when economies of scale are absent so the efficient scale of each firm is small. But a large market and the absence of economies of scale are not sufficient to create perfect competition. In addition, each firm must produce a good or service that has no characteristics that are unique to that firm so that consumers don't care from which firm they buy. Firms in perfect competition all look the same to the buyer.

Wheat farming, fishing, wood pulping and paper milling, the manufacture of paper cups and plastic shopping bags, lawn service, dry cleaning, and the provision of laundry services are all examples of highly competitive industries.

■ Other Market Types

Monopoly arises when one firm sells a good or service that has no close substitutes and a barrier blocks the entry of new firms. In some places, the phone, gas, electricity, and water suppliers are local monopolies—monopolies that are restricted to a given location. For many years, a global firm called DeBeers had a near international monopoly in diamonds. Microsoft has a near monopoly in producing the operating system for a personal computer.

Monopolistic competition arises when a large number of firms compete by making similar but slightly different products. Each firm is the sole producer of the particular version of the good in question. For example, in the market for running shoes, Nike, Reebok, Fila, Asics, New Balance, and many others make their own versions of the perfect shoe. The term “monopolistic competition” reminds us that each firm has a monopoly on a particular brand of shoe but the firms compete with each other.

Oligopoly arises when a small number of *interdependent* firms compete. Airplane manufacture is an example of oligopoly. Oligopolies might produce almost identical products, such as Duracell and Energizer batteries; or they might produce differentiated products, such as the colas produced by Coke and Pepsi.

We study perfect competition in this chapter, monopoly in Chapter 12, and monopolistic competition and oligopoly in Chapter 13.

Perfect competition

A market in which there are many firms, each selling an identical product; many buyers; no barriers to the entry of new firms into the industry; no advantage to established firms; and buyers and sellers are well informed about prices.

Monopoly

A market in which one firm sells a good or service that has no close substitutes and a barrier blocks the entry of new firms.

Monopolistic competition

A market in which a large number of firms compete by making similar but slightly different products.

Oligopoly

A market in which a small number of interdependent firms compete.

11.1 A FIRM'S PROFIT-MAXIMIZING CHOICES

A firm's objective is to maximize *economic profit*, which is equal to *total revenue* minus the *total cost* of production. *Normal profit*, the return that the firm's entrepreneur can obtain on average, is part of the firm's cost.

In the short run, a firm achieves its objective by deciding the quantity to produce. This quantity influences the firm's total revenue, total cost, and economic profit. In the long run, a firm achieves its objective by deciding whether to enter or exit a market.

These are the key decisions that a firm in perfect competition makes. Such a firm does *not* choose the price at which to sell its output. The firm in perfect competition is a **price taker**—it cannot influence the price of its product.

■ Price Taker

To see why a firm in perfect competition is a price taker, imagine that you are a wheat farmer in Kansas. You have a thousand acres under cultivation—which sounds like a lot. But then you go on a drive through Colorado, Oklahoma, Texas, and back up to Nebraska and the Dakotas. You find unbroken stretches of wheat covering millions of acres. And you know that there are similar vistas in Canada, Argentina, Australia, and Ukraine. Your thousand acres are a drop in the ocean. Nothing makes your wheat any better than any other farmer's, and all the buyers of wheat know the price they must pay. If the going price of wheat is \$4 a bushel, you are stuck with that price. You can't get a higher price than \$4, and you have no incentive to offer it for less than \$4 because you can sell your entire output at that price.

The producers of most agricultural products are price takers. We'll illustrate perfect competition with another agriculture example: the market for maple syrup. The next time you pour syrup on your pancakes, think about the competitive market that gets this product from the sap of the maple tree to your table!

Dave's Maple Syrup is one of more than 11,000 similar firms in the maple syrup market of North America. Dave is a price taker. Like the Kansas wheat farmer, he can sell any quantity he chooses at the going price but none above that price. Dave faces a *perfectly elastic* demand. The demand for Dave's syrup is perfectly elastic because syrup from Don Harlow, Casper Sugar Shack, and all the other maple farms in North America are *perfect substitutes* for Dave's syrup.

We'll explore Dave's decisions and their implications for the way a competitive market works. We begin by defining some revenue concepts.

■ Revenue Concepts

In perfect competition, market demand and market supply determine the price. A firm's *total revenue* equals this given price multiplied by the quantity sold. A firm's **marginal revenue** is the change in total revenue that results from a one-unit increase in the quantity sold.

In perfect competition, marginal revenue equals price.

The reason is that the firm can sell any quantity it chooses at the going market price. So if the firm sells one more unit, it sells it for the market price and total revenue increases by that amount. This increase in total revenue is marginal revenue.

The table in Figure 11.1 illustrates the equality of marginal revenue and price. The price of syrup is \$8 a can. Total revenue is equal to the price multiplied by the

Price taker

A firm that cannot influence the price of the good or service that it produces.



Wheat farmers and maple syrup farmers are price takers.

Marginal revenue

The change in total revenue that results from a one-unit increase in the quantity sold.

quantity sold. So if Dave sells 10 cans, his total revenue is $10 \times \$8 = \80 . If the quantity sold increases from 10 cans to 11 cans, total revenue increases from \$80 to \$88, so marginal revenue is \$8 a can, the same as the price.

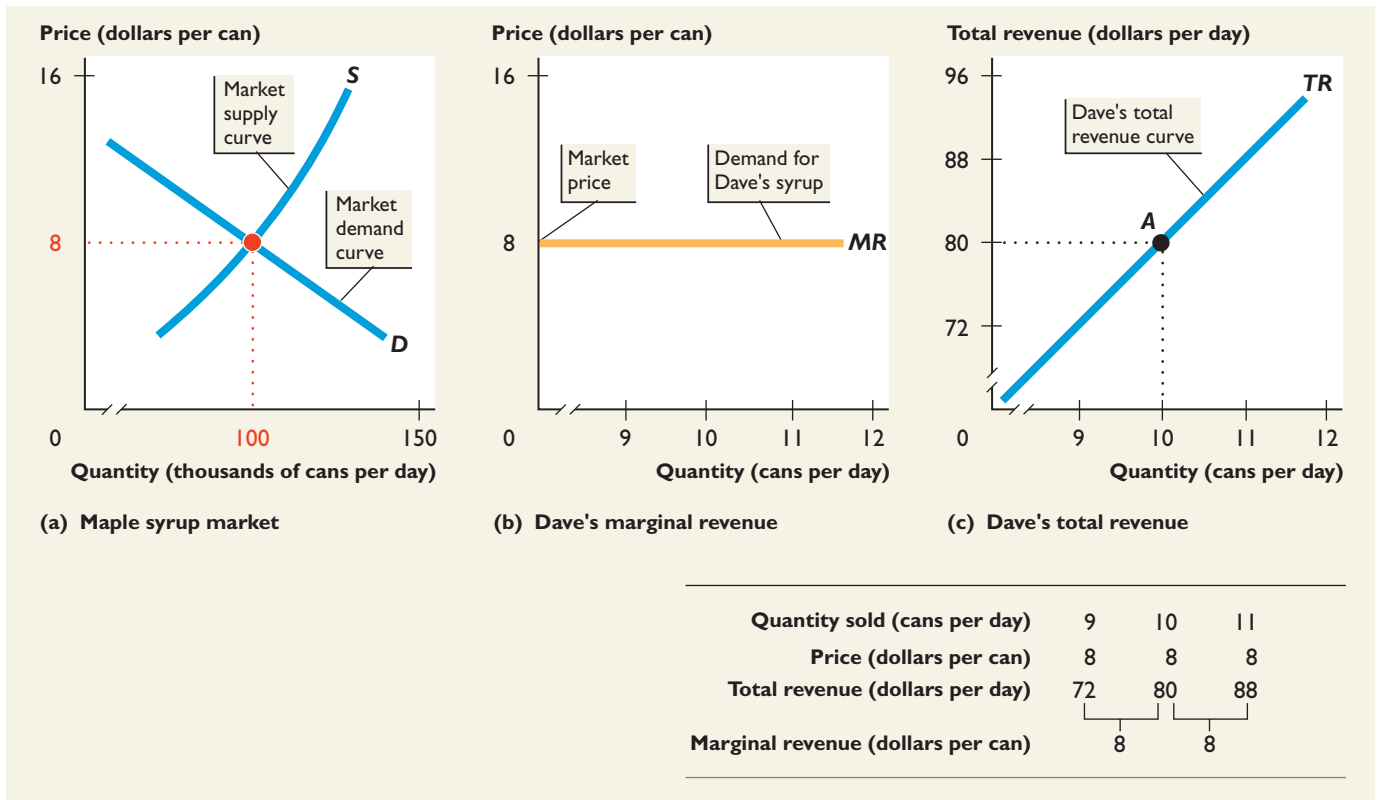
Figure 11.1 illustrates price determination and revenue in the perfectly competitive market. Market demand and market supply in part (a) determine the market price. Dave is a price taker, so he sells his syrup for the market price. The demand curve for Dave's syrup is the horizontal line at the market price in part (b). Because price equals marginal revenue, the demand curve for Dave's syrup is Dave's marginal revenue curve (*MR*). The total revenue curve (*TR*), in part (c), shows the total revenue at each quantity sold. Because he sells each can for the market price, the total revenue curve is an upward-sloping straight line.

■ Profit-Maximizing Output

As output increases, total revenue increases, but total cost also increases. Because of *decreasing marginal returns* (see Chapter 10, pp. xxx–xxx), total cost eventually increases faster than total revenue. There is one output level that maximizes economic profit, and a perfectly competitive firm chooses this output level.

FIGURE 11.1
Demand, Price, and Revenue in Perfect Competition

MyEconLab Animation



Part (a) shows the market for maple syrup. The market price is \$8 a can. The table calculates total revenue and marginal revenue.

Part (b) shows the demand curve for Dave's syrup, which is Dave's marginal revenue curve (*MR*).

Part (c) shows Dave's total revenue curve (*TR*). Point A corresponds to the second column of the table.

One way to find the profit-maximizing output is to use a firm's total revenue and total cost curves. Profit is maximized at the output level at which total revenue exceeds total cost by the largest amount. Figure 11.2 shows how to do this for Dave's Maple Syrup.

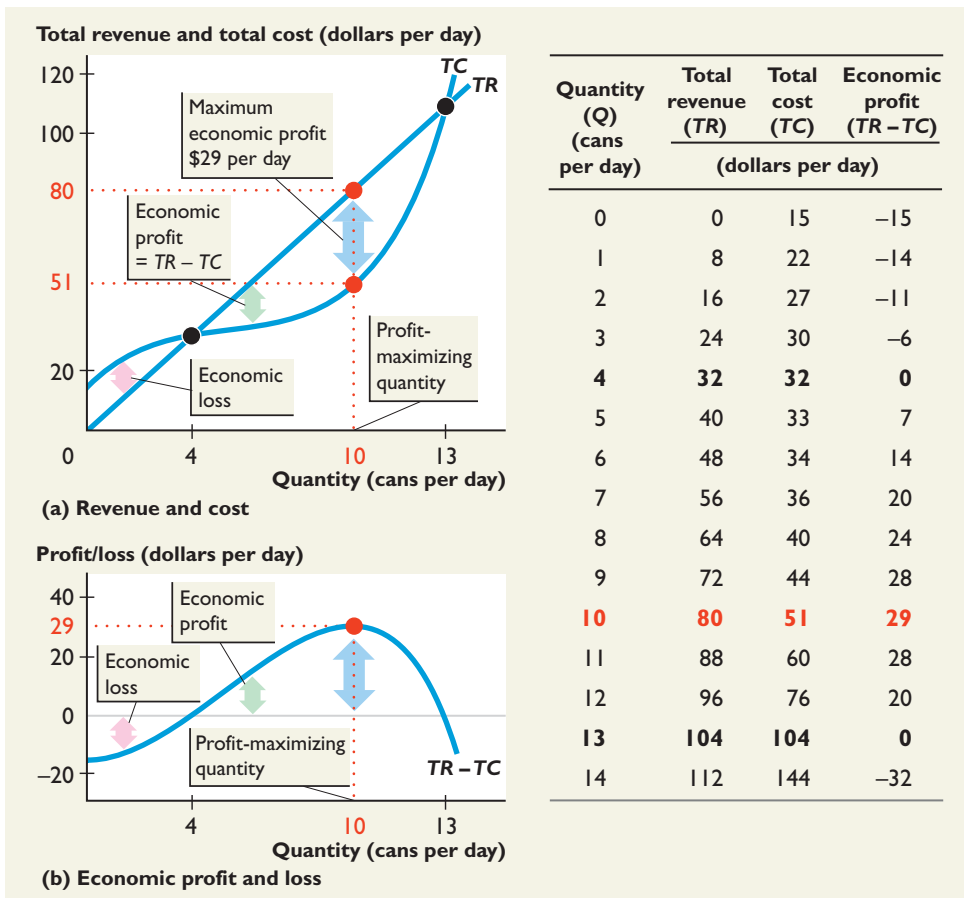
The table lists Dave's total revenue, total cost, and economic profit at different output levels. Figure 11.2 (a) shows the total revenue and total cost curves. These curves are graphs of the numbers shown in the first three columns of the table. The total revenue curve (*TR*) is the same as that in Figure 11.1(c). The total cost curve (*TC*) is similar to the one that you met in Chapter 10 (p. xxx). Figure 11.2(b) is an economic profit curve.

Dave makes an economic profit on outputs between 4 and 13 cans a day. At outputs of fewer than 4 cans a day and more than 13 cans a day, he incurs an economic loss. Outputs of 4 cans and 13 cans are *break-even points*—points at which total cost equals total revenue and economic profit is zero.

The profit curve is at its highest when the vertical distance between the *TR* and *TC* curves is greatest. In this example, profit maximization occurs at an output of 10 cans a day. At this output, Dave's economic profit is \$29 a day.

FIGURE 11.2
Total Revenue, Total Cost, and Economic Profit

MyEconLab Animation



In part (a), economic profit is the vertical distance between the total cost and total revenue curves. Dave's maximum economic profit is \$29 a day (\$80 - \$51) when output is 10 cans a day.

In part (b), economic profit is the height of the profit curve.

■ Marginal Analysis and the Supply Decision

Another way to find the profit-maximizing output is to use *marginal analysis*, which compares marginal revenue, MR , with marginal cost, MC . As output increases, marginal revenue is constant but marginal cost eventually increases.

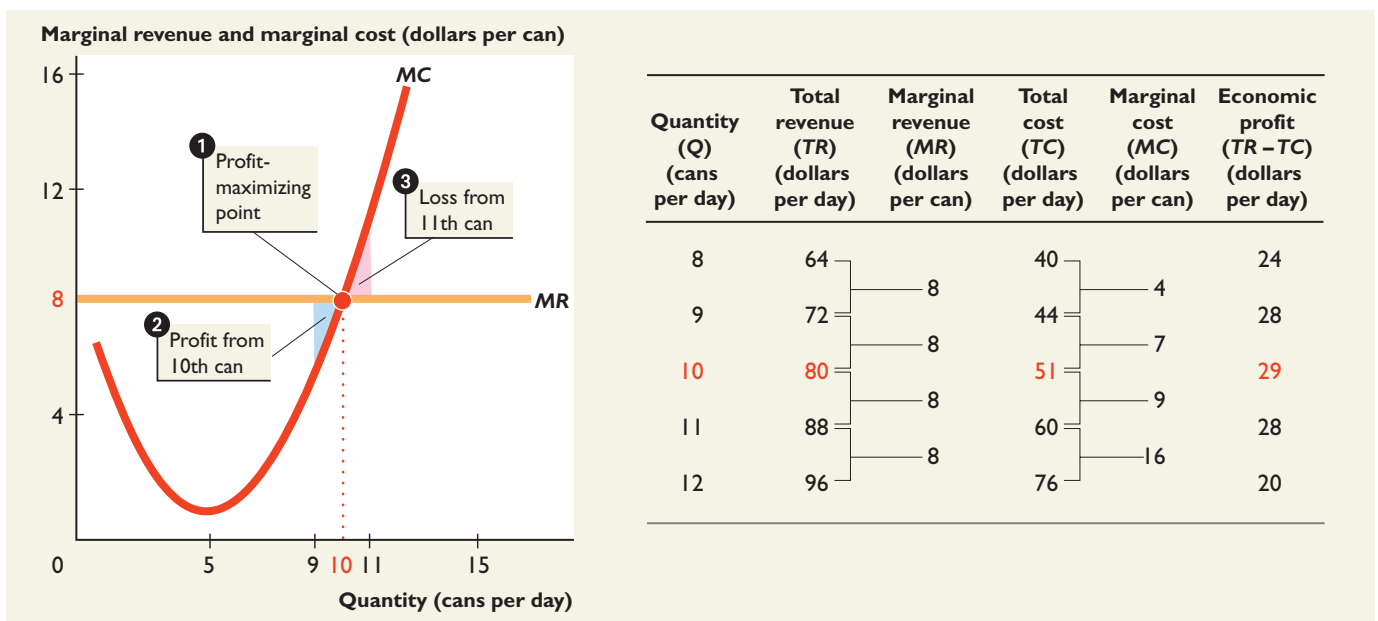
If marginal revenue exceeds marginal cost ($MR > MC$), then the revenue from selling one more unit exceeds the cost of producing that unit and an *increase* in output increases economic profit. If marginal revenue is less than marginal cost ($MR < MC$), then the revenue from selling one more unit is less than the cost of producing that unit and a *decrease* in output increases economic profit. If marginal revenue equals marginal cost ($MR = MC$), then the revenue from selling one more unit equals the cost incurred to produce that unit. Economic profit is maximized and either an increase or a decrease in output *decreases* economic profit. The rule $MR = MC$ is a prime example of marginal analysis.

Figure 11.3 illustrates these propositions. If Dave increases output from 9 cans to 10 cans a day, marginal revenue (\$8) exceeds marginal cost (\$7), so by producing the 10th can economic profit increases. The last column of the table shows that economic profit increases from \$28 to \$29. The blue area in the figure shows the increase in economic profit when production increases from 9 to 10 cans per day.

If Dave increases output from 10 cans to 11 cans a day, marginal revenue (\$8) is less than marginal cost (\$9), so by producing the 11th can, economic profit decreases. The last column of the table shows that economic profit decreases from \$29 to \$28. The red area in the figure shows the economic loss that arises from increasing production from 10 to 11 cans per day.

FIGURE 11.3
Profit-Maximizing Output

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① Profit is maximized when marginal revenue equals marginal cost at 10 cans a day. ② If output increases from 9 to 10 cans a day, marginal cost is \$7, which is less than the marginal revenue of \$8,

and profit increases. ③ If output increases from 10 to 11 cans a day, marginal cost is \$9, which exceeds the marginal revenue of \$8, and profit decreases.

Dave maximizes economic profit by producing 10 cans a day, the quantity at which marginal revenue equals marginal cost.

A firm's profit-maximizing output is its *quantity supplied*. Dave's *quantity supplied* at a price of \$8 a can is 10 cans a day. If the price were higher than \$8 a can, he would increase production. If the price were lower than \$8 a can, he would decrease production. These profit-maximizing responses to different prices are the foundation of the law of supply:

Other things remaining the same, the higher the price of a good, the greater is the quantity supplied of that good.

■ Temporary Shutdown Decision

Sometimes, the price falls so low that a firm cannot cover its costs. What does the firm do in such a situation? The answer depends on whether the firm expects the low price to be permanent or temporary.

If a firm incurs an economic loss that it believes is permanent and sees no prospect of ending, the firm exits the market. We'll study this action later in this chapter when we look at the firm's decisions in the long run (pp. xxx–xxx).

If a firm incurs an economic loss that it believes is temporary, it remains in the market, but it might temporarily shut down. To decide whether to produce or to shut down, the firm compares the loss it would incur in the two situations.

Loss When Shut Down

If the firm shuts down temporarily, it receives no revenue and incurs no variable costs. The firm still incurs fixed costs. So, if a firm shuts down, it incurs an economic loss equal to total fixed cost. This loss is the largest that a firm need incur.

Loss When Producing

A firm that produces an output receives revenue and incurs both fixed costs and variable costs. The firm incurs an economic loss equal to total fixed cost *plus* total variable cost *minus* total revenue. If total revenue exceeds total variable cost, the firm's economic loss is less than total fixed cost. But if total revenue is less than total variable cost, the firm's economic loss will exceed total fixed cost.

The Shutdown Point

If total revenue is less than total variable cost, a firm shuts down temporarily and limits its loss to an amount equal to total fixed cost. If total revenue just equals total variable cost, a firm is indifferent between producing and shutting down. This situation arises when price equals minimum average variable cost and the firm produces the quantity at which average variable cost is a minimum—called the **shutdown point**.

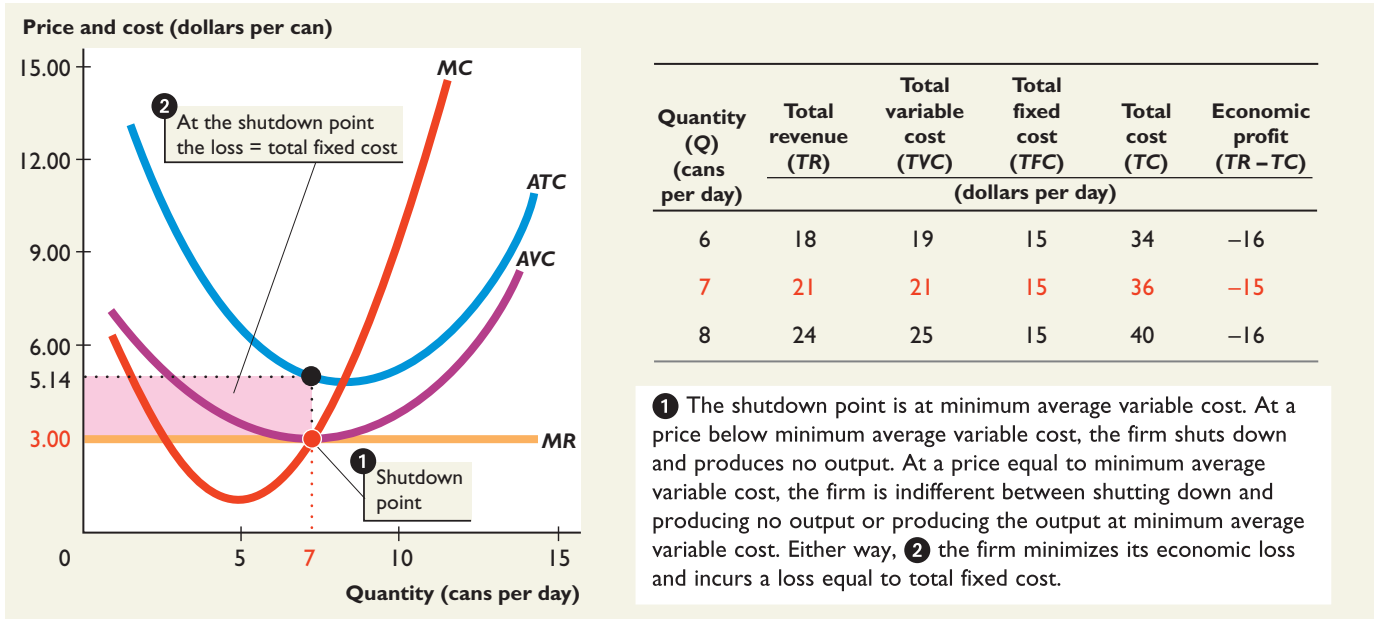
Figure 11.4 illustrates the firm's shutdown decision and the shutdown point that we've just described for Dave's maple syrup farm. Dave's average variable cost curve is *AVC* and his marginal cost curve is *MC*. Average variable cost has a minimum of \$3 a can when output is 7 cans a day. The *MC* curve intersects the *AVC* curve at its minimum. (We explained this relationship between the marginal and average values of a variable in Chapter 10; see pp. xxx–xxx and pp. xxx–xxx.) The figure shows the marginal revenue curve *MR* when the price is \$3 a can, a *price equal to minimum average variable cost*.

Shutdown point

The point at which price equals minimum average variable cost and the quantity produced is that at which average variable cost is at its minimum.

FIGURE 11.4
The Shutdown Decision

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If Dave produces at the shutdown point, he produces 7 cans a day and sells them for \$3 a can. He incurs an economic loss equal to \$2.14 a can and a total economic loss of \$15 a day, which equals his total fixed cost. If Dave shuts down, he also incurs an economic loss equal to total fixed cost.

The table lists Dave’s total revenue, total variable cost, total fixed cost, total cost, and economic profit at three output levels. The middle output, 7 cans a day, is that at which Dave’s average variable cost is at its minimum—\$3 a can. By examining the numbers in the table, you can see that when the price is \$3 a can, Dave incurs a loss equal to total fixed cost by producing 7 cans a day.

■ The Firm’s Short-Run Supply Curve

A perfectly competitive firm’s short-run supply curve shows how the firm’s profit-maximizing output varies as the price varies, other things remaining the same. This supply curve is based on the marginal analysis and shutdown decision that we’ve just explored.

Figure 11.5 derives Dave’s supply curve. Part (a) shows the marginal cost and average variable cost curves, and part (b) shows the supply curve. There is a direct link between the marginal cost and average variable cost curves and the firm’s supply curve. Let’s see what that link is.

In Figure 11.5(a), if the price is above minimum average variable cost, Dave maximizes profit by producing the output at which marginal cost equals marginal revenue, which also equals price. We determine the quantity produced at each price from the marginal cost curve. At a price of \$8 a can, the marginal revenue curve is MR_1 and Dave maximizes profit by producing 10 cans a day. If the price

rises to \$12 a can, the marginal revenue curve is MR_2 and Dave increases production to 11 cans a day.

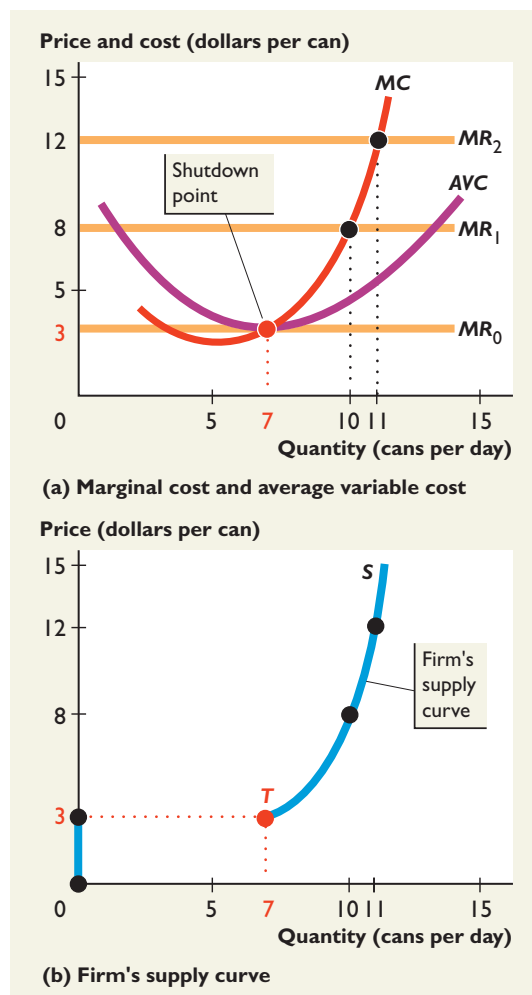
If price equals minimum average variable cost, Dave maximizes profit (minimizes loss) by either producing the quantity at the shutdown point or shutting down and producing no output. But if the price is below minimum average variable cost, Dave shuts down and produces no output.

Figure 11.5(b) shows Dave's short-run supply curve. At prices that exceed minimum average variable cost, the supply curve is the same as the marginal cost curve. At prices below minimum average variable cost, Dave shuts down and produces nothing. His supply curve runs along the vertical axis. At a price of \$3 a can, Dave is indifferent between shutting down and producing 7 cans a day at the shutdown point (T). Either way, he incurs a loss equal to total fixed cost.

So far, we have studied one firm in isolation. We have seen that the firm's profit-maximizing actions depend on the price, which the firm takes as given. In the next section, you'll learn how market supply is determined.

FIGURE 11.5
A Perfectly Competitive Firm's Supply Curve

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Part (a) shows that at \$12 a can, Dave produces 11 cans a day; at \$8 a can, he produces 10 cans a day; and at \$3 a can, he produces either 7 cans a day or nothing. At any price below \$3 a can, Dave produces nothing. The minimum average variable cost is the shutdown point.

Part (b) shows Dave's supply curve. At \$3 a can, Dave is indifferent between producing the quantity at the shutdown point T and not producing. At all prices above \$3 a can, Dave's supply curve is made up of the marginal cost curve, in part (a), above minimum average variable cost. At all prices below \$3 a can, Dave produces nothing and his supply curve runs along the vertical axis.

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You can work these problems in Study Plan 11.1 and get instant feedback.

CHECKPOINT 11.1

Explain a perfectly competitive firm's profit-maximizing choices and derive its supply curve.

Practice Problems

1. Sarah's Salmon Farm produced 1,000 fish last week. The marginal cost was \$30 a fish, average variable cost was \$20 a fish, and the market price was \$25 a fish. Did Sarah maximize profit? If Sarah did not maximize profit and if nothing has changed will she increase or decrease the number of fish she produces to maximize her profit this week?

Use the following information to work Problems 2 to 4.

Trout farming is a perfectly competitive industry and all trout farms have the same cost curves. When the market price is \$25 a fish, farms maximize profit by producing 200 fish a week. At this output, average total cost is \$20 a fish, and average variable cost is \$15 a fish. Minimum average variable cost is \$12 a fish.

2. If the price falls to \$20 a fish, will a farm produce 200 fish a week?
3. If the price falls to \$12 a fish, what will the trout farmer do?
4. What are two points on a trout farm's supply curve?

In the News

BHP Billiton to axe 6,000 jobs

The price of coal has fallen to \$125 a ton from \$300 a ton. BHP Billiton will cut production, lay off 6,000 workers, and close some mines for six months.

Source: FT.com, January 21, 2009

As BHP responded to the fall in price, how did its marginal cost change? What is minimum average variable cost in the mines that closed?

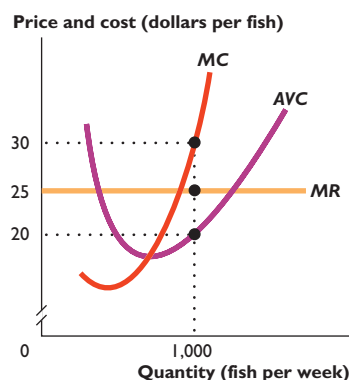
Solutions to Practice Problems

1. Profit is maximized when marginal cost equals marginal revenue. In perfect competition, marginal revenue equals the market price and is \$25 a fish. Because marginal cost exceeded marginal revenue, Sarah did not maximize profit. To maximize profit, Sarah will decrease her output until marginal cost falls to \$25 a fish (Figure 1).
2. The farm will produce fewer than 200 fish a week. The marginal cost curve slopes upward, so to lower marginal cost to \$20, the farm cuts production.
3. If the price falls to \$12 a fish, farms cut output until marginal cost equals \$12. Because \$12 a fish is also minimum average variable cost, farms are at the shutdown point—some farms produce the profit-maximizing output and others produce nothing.
4. One point on a farmer's supply curve is 200 fish at \$25 a fish. Another point is the shutdown point (solution 3) or zero at a price below \$12 a fish.

Solution to In the News

Marginal cost decreased from \$300 a ton to \$125 a ton. The mines that closed temporarily were at the shutdown point. The price of \$125 a ton is equal to or below the firm's minimum average variable cost.

FIGURE 1



11.2 OUTPUT, PRICE, AND PROFIT IN THE SHORT RUN

Demand and supply determine the price and quantity in a perfectly competitive market. We first study short-run supply when the number of firms is fixed.

Market Supply in the Short Run

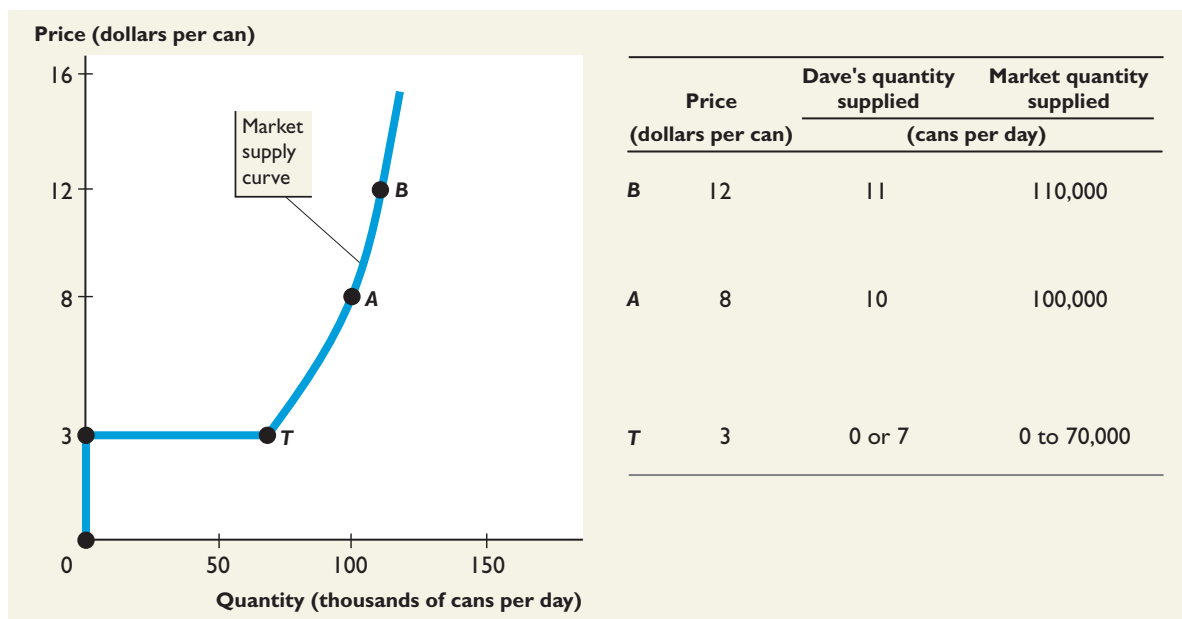
The market supply curve in the short run shows the quantity supplied at each price by a fixed number of firms. The quantity supplied at a given price is the sum of the quantities supplied by all firms at that price.

Figure 11.6 shows the supply curve for the competitive syrup market. In this example, the market consists of 10,000 firms exactly like Dave's Maple Syrup. The table shows how the market supply schedule is constructed. The shutdown point occurs at a price of \$3 a can. At prices below \$3 a can, every firm in the market shuts down; the quantity supplied is zero. At a price of \$3 a can, each firm is indifferent between shutting down and producing nothing or operating and producing 7 cans a day. The quantity supplied by each firm is *either* 0 or 7 cans, and the quantity supplied in the market is *between* 0 (all firms shut down) and 70,000 (all firms produce 7 cans a day each). At prices above \$3 a can, we sum the quantities supplied by the 10,000 firms, so the quantity supplied in the market is 10,000 times the quantity supplied by one firm.

At prices below \$3 a can, the market supply curve runs along the price axis. Supply is perfectly inelastic. At \$3 a can, the market supply curve is horizontal. Supply is perfectly elastic. Above \$3 a can, the supply curve is upward sloping.

FIGURE 11.6
The Market Supply Curve

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A market with 10,000 identical firms has a supply schedule like that of an individual firm, but the quantity sup-

plied is 10,000 times greater. Market supply is perfectly elastic at the price at which the shutdown point occurs.

■ Short-Run Equilibrium in Normal Times

Market demand and market supply determine the price and quantity bought and sold. Figure 11.7(a) shows a short-run equilibrium in the syrup market. The market supply curve S is the same as that in Figure 11.6.

If the demand curve D_1 shows market demand, the equilibrium price is \$5 a can. Although market demand and market supply determine this price, each firm takes the price as given and produces its profit-maximizing output, which is 9 cans a day. Because the market has 10,000 firms, market output is 90,000 cans a day.

Figure 11.7(b) shows the situation that Dave faces. The price is \$5 a can, so Dave's marginal revenue is constant at \$5 a can. Dave maximizes profit by producing 9 cans a day.

Figure 11.7(b) also shows Dave's average total cost curve (ATC). Recall that average total cost is the cost per unit produced. It equals total cost divided by the quantity of output produced.

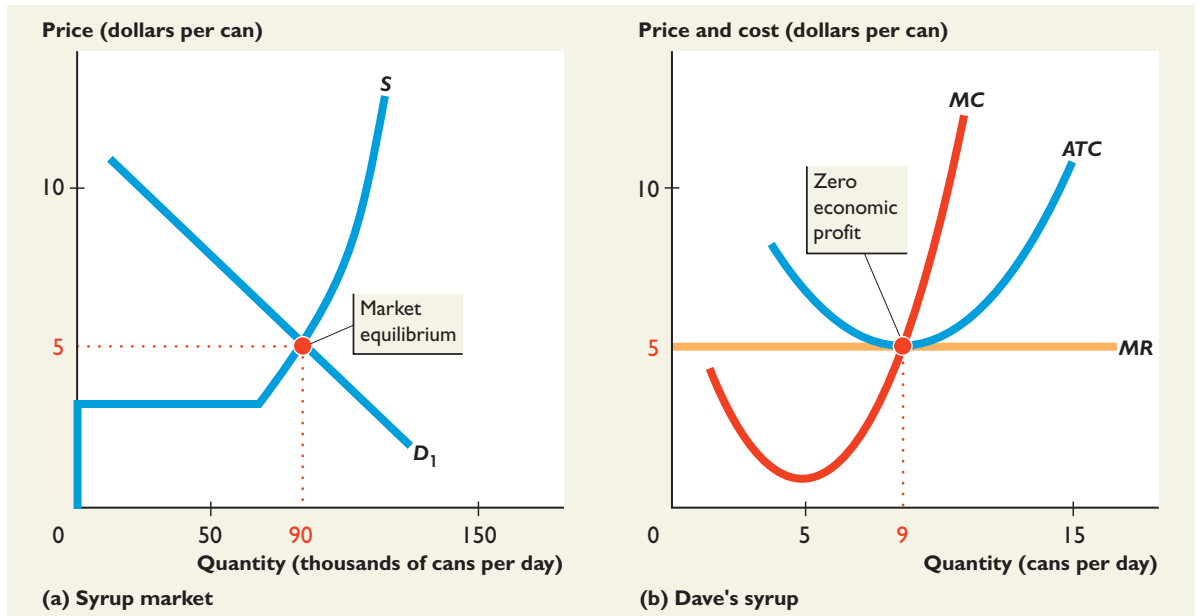
Here, when Dave produces 9 cans a day, his average total cost is \$5 a can, exactly the same as the market price. So Dave sells syrup for exactly the same price as his average cost of production and economic profit is zero.

Making zero economic profit means that Dave earns normal profit from running his business.

The short-run equilibrium in which a firm makes zero economic profit is just one of three possible situations. A competitive market might also deliver a positive economic profit or an economic loss. Let's look at these other two cases.

■ **FIGURE 11.7**
Zero Economic Profit in the Short Run

MyEconLab Animation



In part (a), with market demand curve D_1 and market supply curve S , the equilibrium market price is \$5 a can.

In part (b), Dave's marginal revenue is \$5 a can, so he produces 9 cans a day. At this quantity, price (\$5) equals average total cost, so Dave makes zero economic profit.

Short-Run Equilibrium in Good Times

Market demand might be greater or less than D_1 in Figure 11.7 and the price might be higher or lower than \$5 a can. Figure 11.8(a) shows another short-run equilibrium in the syrup market. The supply curve S is the same as that in Figure 11.6.

If the demand curve D_2 shows market demand, the equilibrium price is \$8 a can. Although market demand and market supply determine this price, each firm takes the price as given and produces its profit-maximizing output, which is 10 cans a day. Because the market has 10,000 firms, market output is 100,000 cans a day.

Figure 11.8(b) shows the situation that Dave faces. The price is \$8 a can, so Dave's marginal revenue is constant at \$8 a can. Dave maximizes profit by producing 10 cans a day.

Figure 11.8(b) also shows Dave's average total cost curve (ATC). Recall that average total cost is the cost per unit produced. It equals total cost divided by the quantity of output produced. Here, when Dave produces 10 cans a day, his average total cost is \$5.10 a can. So the price of \$8 a can exceeds average total cost by \$2.90 a can. This amount is Dave's economic profit per can.

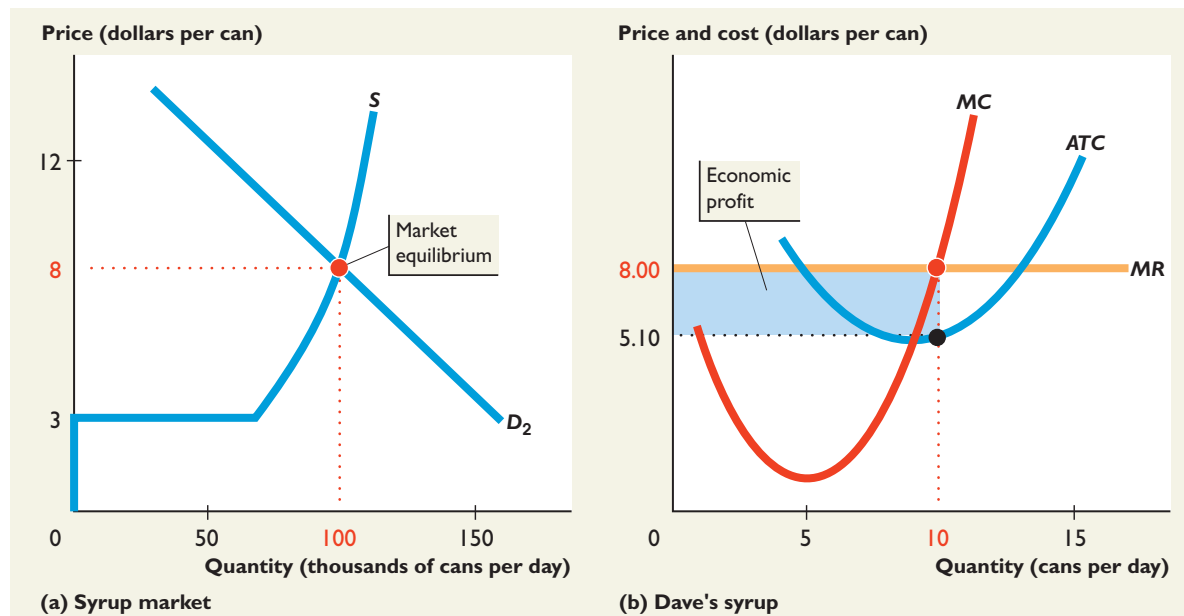
If we multiply the economic profit per can of \$2.90 by the number of cans, 10 a day, we arrive at Dave's economic profit, which is \$29 a day.

The blue rectangle shows this economic profit. The height of that rectangle is the profit per can, \$2.90, and the length is the quantity of cans, 10 a day, so the area of the rectangle (height \times length) measures Dave's economic profit of \$29 a day.

FIGURE 11.8

Positive Economic Profit in the Short Run

MyEconLab Animation



In part (a), with market demand curve D_2 and market supply curve S , the equilibrium market price is \$8 a can.

In part (b), marginal revenue is \$8 a can. Dave produces 10 cans a day. Because price (\$8) exceeds average total cost (\$5.10), the firm makes a positive economic profit.

■ Short-Run Equilibrium in Bad Times

Figure 11.9 shows the syrup market in a loss-incurring situation. The market demand curve is now D_3 . The market still has 10,000 firms and their costs are the same as before, so the market supply curve, S , is also the same as before.

With the demand and supply curves shown in Figure 11.9(a), the equilibrium price of syrup is \$3 a can and the equilibrium quantity is 70,000 cans a day.

Figure 11.9(b) shows the situation that Dave faces. The price is \$3 a can, so Dave's marginal revenue is constant at \$3 a can. Dave maximizes profit by producing 7 cans a day.

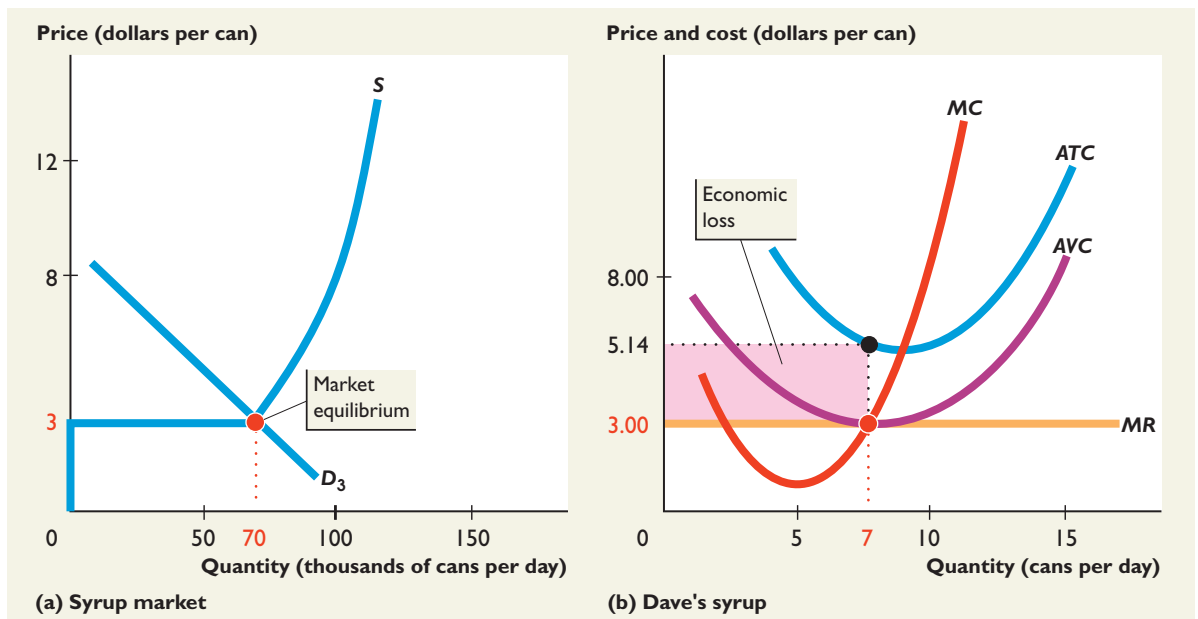
Figure 11.9(b) also shows Dave's average total cost curve (ATC), and you can see that when Dave produces 7 cans a day, his average total cost is \$5.14 a can. Now the price of \$3 a can is less than average total cost by \$2.14 a can. This amount is Dave's economic loss per can. If we multiply the economic loss per can of \$2.14 by the number of cans, 7 a day, we arrive at Dave's economic loss, which is shown by the red rectangle.

Figure 11.9(b) also shows Dave's average variable cost (AVC) curve. Notice that Dave is operating at the shutdown point. Dave might equally well produce no output. Either way, his economic loss would be equal to his total fixed cost. If the price were a bit higher than \$3, Dave would still incur an economic loss, but a smaller one. And if the price were lower than \$3, Dave would shut down and incur an economic loss equal to total fixed cost.

■ FIGURE 11.9

Economic Loss in the Short Run

MyEconLab Animation



In part (a), with market demand curve D_3 and market supply curve S , the equilibrium market price is \$3 a can.

In part (b), Dave's marginal revenue is \$3 a can, so he produces 7 cans a day. At this quantity, price (\$3) is less than average total cost (\$5.14), so Dave incurs an economic loss shown by the red rectangle.

CHECKPOINT 11.2

Explain how output, price, and profit are determined in the short run.

Practice Problems

Tulip growing is perfectly competitive and all growers have the same costs. The market price is \$25 a bunch, and each grower maximizes profit by producing 2,000 bunches a week. Average total cost is \$20 a bunch, and average variable cost is \$15 a bunch. Minimum average variable cost is \$12 a bunch.

1. What is the economic profit that each grower is making in the short run?
2. What is the price at the grower's shutdown point?
3. What is each grower's economic profit at the shutdown point?

In the News

Corn hits record high price

Corn prices have surged 80 percent in the past year, driven up by a global rush for grains to feed people and livestock and to make biofuel.

Source: *USA Today*, June 26, 2008

Explain why the price of corn surged. Explain how marginal revenue, the marginal cost of producing corn, and the farm's economic profit changed.

Solutions to Practice Problems

1. The market price (\$25) exceeds the average total cost (\$20), so growers make an economic profit of \$5 a bunch. Each grower produces 2,000 bunches a week, so a grower's economic profit is \$10,000 a week. Figure 1 illustrates the situation. The grower's marginal revenue equals the market price (\$25). The grower maximizes profit by producing 2,000 bunches, so at 2,000 bunches the marginal cost curve (*MC*) cuts the marginal revenue curve (*MR*). The average total cost of producing 2,000 bunches is \$20, so the *ATC* curve passes through this point. Economic profit equals the area of the blue rectangle.
2. The price at which a grower will shut down temporarily is equal to minimum average variable cost—\$12 a bunch (Figure 1).
3. At the shutdown point, the grower incurs an economic loss equal to total fixed cost. Figure 2 shows the data to calculate *TFC*. When 2,000 bunches a week are grown, *ATC* is \$20 a bunch and *AVC* is \$15 a bunch. $ATC = AFC + AVC$, so *AFC* is \$5 a bunch. Total fixed cost equals \$10,000 a week— $FTC = AFC \times Q$, \$5 a bunch \times 2,000 bunches a week. At the shutdown point, the grower incurs an economic loss of \$10,000 a week.

Solution to In the News

An increase in the market demand for corn increased the market price. The market is competitive, so the farm's marginal revenue (equal to market price) increased. To maximize profit (produce the quantity at which marginal revenue equals marginal cost), the farm increases the quantity produced and moves up along its *MC* curve. In the short run, economic profit increases.

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You can work these problems in Study Plan 11.2 and get instant feedback.

FIGURE 1

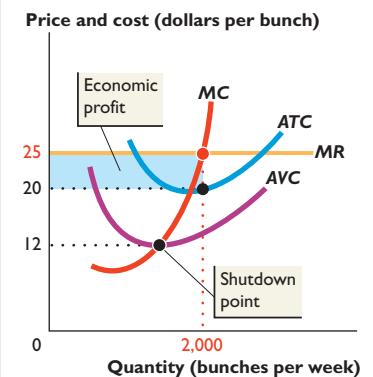
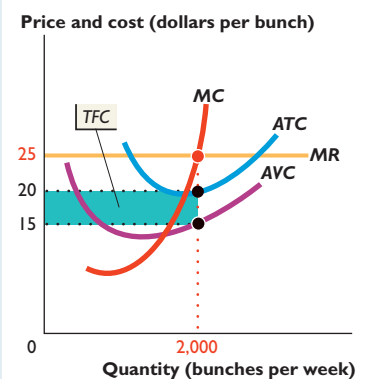


FIGURE 2



11.3 OUTPUT, PRICE, AND PROFIT IN THE LONG RUN

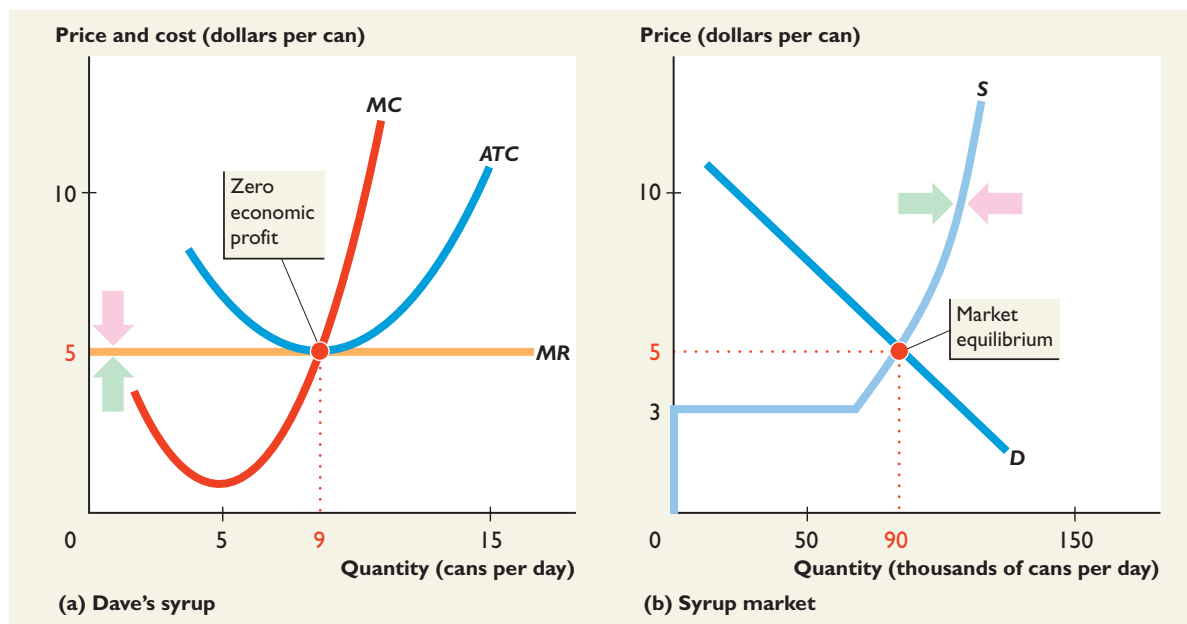
Competitive markets are in a constant state of change. Price, quantity, and economic profit fluctuate as demand and supply change. None of the three situations that we described on the previous pages—normal times, good times, or bad times—last forever in perfect competition. Market forces operate to compete away economic profits and eliminate economic losses to move the price toward the lowest possible price. That price equals minimum average total cost. In the long run, a firm in perfect competition produces at minimum average total cost and makes zero economic profit. (The firm's entrepreneur earns normal profit—part of the firm's total costs.)

Figure 11.10 illustrates a perfectly competitive market in long-run equilibrium and highlights the forces that bring the market to this situation. In Figure 11.10(a), the firm's average total cost curve is ATC , and the firm produces at the point of minimum average total cost—9 cans a day at an average total cost of \$5 a can. If the price rises above or falls below \$5 a can, market forces operate to move the price back toward \$5 a can. The arrows pointing toward \$5 represent these forces.

In Figure 11.10(b) the market demand curve is D . With this market demand, the price equals minimum average total cost only if the market supply curve is S . If supply is less than S (the supply curve is to the left of S), the price is above \$5 a can; if supply exceeds S (the supply curve is to the right of S), the price is below \$5 a can. Market forces operate to shift the supply curve back to S , and the arrows pointing toward S represent these forces.

FIGURE 11.10
Long-Run Equilibrium

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In part (a), minimum average total cost is \$5 a can. In long-run equilibrium, the price and marginal revenue are pulled to this level. The firm makes zero economic profit.

In part (b), if the price is above \$5 a can, above minimum ATC in part (a), supply increases and the price falls. If the price is below \$5, supply decreases and the price rises.

■ Entry and Exit

Entry and exit are the market forces that shift the supply curve and move the price to minimum average total cost in the long run. In the short run, firms might make a positive economic profit (as in Figure 11.8) or incur an economic loss (as in Figure 11.9). But in the long run, firms make zero economic profit.

In the long run, firms respond to economic profit and economic loss by either entering or exiting a market. New firms enter a market in which the existing firms are making economic profits, and some existing firms exit a market in which firms are incurring economic losses. Temporary economic profit or temporary economic loss, like a win or loss at a casino, does not trigger entry and exit. But the prospect of persistent economic profit or economic loss does.

Entry and exit influence the market price, the quantity produced, and economic profit. The immediate effect of the decision to enter or exit a market is to shift the market supply curve. If more firms enter a market, supply increases and the market supply curve shifts rightward. If some firms exit a market, supply decreases and the market supply curve shifts leftward.

Let's see what happens when new firms enter a market.

The Effects of Entry

Figure 11.11 shows the effects of entry. Initially, the market is in long-run equilibrium. Demand is D_0 , supply is S_0 , the price is \$5 a can, and the quantity is 90,000 cans a day. A surge in the popularity of syrup increases demand, and the demand curve shifts to D_1 . The price rises to \$8 a can, and firms in the syrup market increase output to 100,000 cans a day and make an economic profit.

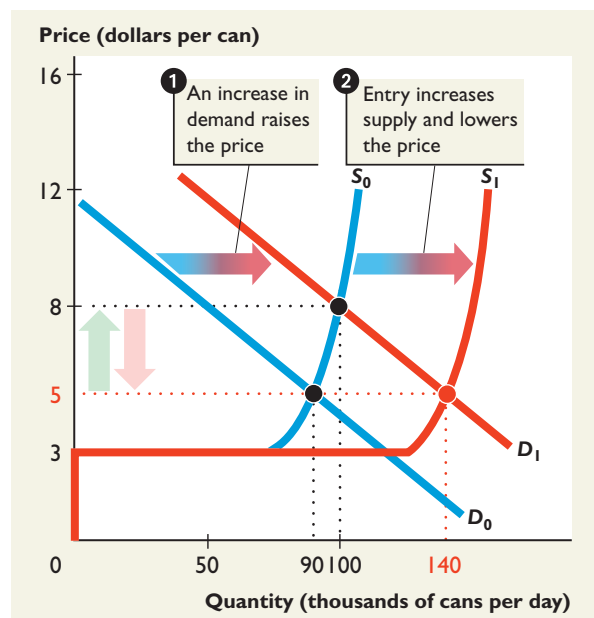
Times are good for syrup producers like Dave, so other potential syrup producers want some of the action. New firms begin to enter the market. As they do



With the prospect of economic profit, a new business opens.

■ FIGURE 11.11

The Effects of Entry



Starting in long-run equilibrium, ① demand increases and the market demand curve shifts from D_0 to D_1 . The price rises from \$5 to \$8 a can.

Economic profit brings entry. ② As firms enter the market, the market supply curve shifts rightward, from S_0 to S_1 . The equilibrium price falls from \$8 to \$5 a can, and the quantity produced increases from 100,000 to 140,000 cans a day.

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so, supply increases and the market supply curve shifts rightward to S_1 . With the greater market supply and unchanged market demand, the market price falls from \$8 to \$5 a can and the equilibrium quantity increases to 140,000 cans a day.

Market output increases, but because the price falls, Dave and the other producers decrease output. As the price falls, each firm's output gradually returns to its original level. Because the number of firms in the market increases, the market as a whole produces more.

As the price falls, each firm's economic profit decreases. When the price falls to \$5 a can, economic profit disappears and each firm makes zero economic profit. The entry process stops, and the market is again in long-run equilibrium.

You have just discovered a key proposition:

Economic profit is an incentive for new firms to enter a market, but as they do so, the price falls and the economic profit of each existing firm decreases.

■ The Effects of Exit

Figure 11.12 shows the effects of exit. Again we begin on demand curve D_0 and supply curve S_0 in long-run equilibrium. Now suppose that the development of a new high-nutrition, low-fat breakfast food decreases the demand for pancakes, and as a result, the demand for maple syrup decreases. The demand curve shifts from D_0 to D_2 . Firms' costs are the same as before, so the market supply curve is S_0 .

With demand at D_2 and supply at S_0 , the price falls to \$3 a can and 70,000 cans a day are produced. The firms in the syrup market incur economic losses.

Times are tough for syrup producers, and Dave must seriously think about leaving his dream business and finding some other way of making a living. But other producers are in the same situation as Dave, and some start to exit the market while Dave is still thinking through his options.



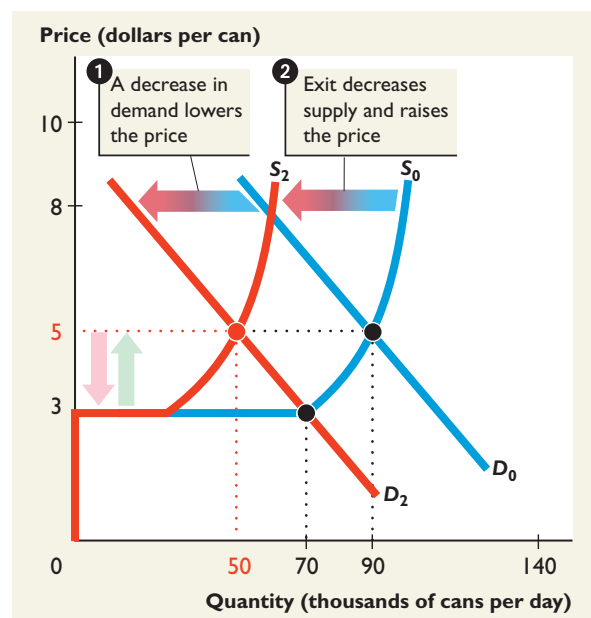
Economic loss brings exit.

FIGURE 11.12
The Effects of Exit

MyEconLab Animation

Starting in long-run equilibrium, **1** demand decreases and the market demand curve shifts from D_0 to D_2 . The price falls from \$5 to \$3 a can.

Economic loss brings exit. **2** As firms exit the market, the market supply curve shifts leftward, from S_0 to S_2 . The equilibrium price rises from \$3 to \$5 a can, and the quantity produced decreases from 70,000 to 50,000 cans a day.



As firms exit, the market supply curve shifts leftward to S_2 . With the decrease in market supply, output decreases from 70,000 to 50,000 cans and the market price rises from \$3 to \$5 a can.

As the price rises, Dave and each other firm that remains in the market move up along their supply curves and increase output. That is, for each firm that remains in the market, the profit-maximizing output *increases*. As the price rises and each firm sells more, economic loss decreases. When the price rises to \$5 a can, each firm makes a zero economic profit. Dave earns normal profit (part of the firm's total cost) and he is happy that he can still make a living producing syrup.

You have just discovered a second key proposition:

Economic loss is an incentive for firms to exit a market, but as they do so, the price rises and the economic loss of each remaining firm decreases.

■ Change in Demand

Initially, a competitive market is in long-run equilibrium and the firms are making zero economic profit (and entrepreneurs are earning normal profit). Now market demand increases. The market price rises, firms increase production to keep marginal cost equal to price, and firms make an economic profit. The market is now in short-run equilibrium but not in long-run equilibrium.

Economic profit is an incentive for new firms to enter the market. As firms enter, market supply increases and the market price falls. With a lower price, firms decrease output to keep marginal cost equal to price.

Notice that as firms enter the market, market output increases, but each firm's output decreases. Eventually, enough firms enter to eliminate economic profit and the market returns to long-run equilibrium.

The key difference between the initial long-run equilibrium and the new long-run equilibrium is the number of firms. A permanent increase in demand increases the number of firms. Each firm produces the same output in the new long-run equilibrium as initially and makes zero economic profit. In the process of moving from the initial equilibrium to the new one, firms make economic profits.

The demand for airline travel in the world economy increased during the 1990s, and the deregulation of the airlines freed up firms to seek profit opportunities in this market. The result was a massive rate of entry of new airlines. The process of competition and change in the airline market were similar to what we have just studied.

A decrease in demand triggers a similar response, except in the opposite direction. The decrease in demand brings a lower price, economic loss, and exit. Exit decreases market supply, raises the price, and eliminates the economic loss.

■ Technological Change

Firms are constantly discovering lower-cost techniques of production. For example, the cost of producing a personal computer has fallen. So has the cost of producing an MP3 player and other electronic products. Most cost-saving production techniques can be implemented only by investing in a new plant. Consequently, it takes time for a technological advance to spread through an industry. Firms whose plants are on the verge of being replaced are quick to adopt the new technology, while firms whose plants have recently been replaced continue to operate with old

technology until they can no longer cover their average variable cost. Once average variable cost cannot be covered, a firm scraps even a relatively new plant (embodying an old technology) in favor of a plant with a new technology.

New technology lowers cost, so as firms adopt a new technology, their cost curves shift downward. With lower costs, firms are willing to supply a given quantity at a lower price, or, equivalently, they are willing to supply a larger quantity at a given price. In other words, market supply increases, and the market supply curve shifts rightward. With a given demand, the quantity produced increases and the price falls.

Firms that adopt the new technology make an economic profit, so new-technology firms enter. Firms that stick with the old technology incur economic losses, so they either exit or switch to the new technology. As new-technology firms enter and old-technology firms exit, the price falls and the quantity produced increases. Eventually, the market arrives at a long-run equilibrium in



EYE on the AUTO INDUSTRY

Why Did GM Fail?

On June 1, 2009, General Motors filed for bankruptcy protection.

Old GM

GM Chief Executive Officer Fritz Henderson blames GM's failure on the expansion of global competitors who produce at lower costs.

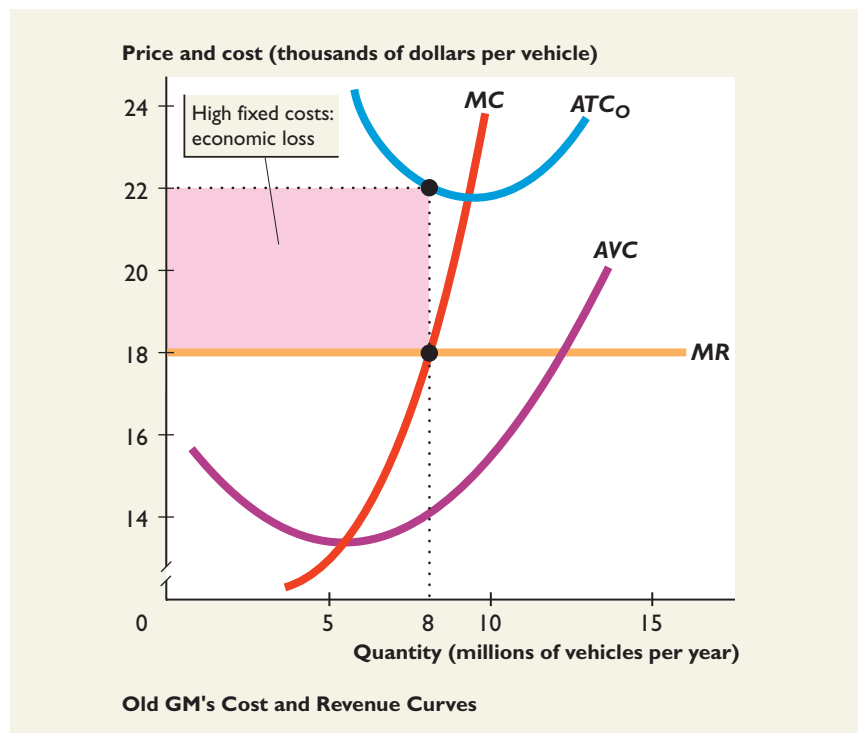
GM's operating costs are both fixed plant costs and variable labor costs. The firm also has "legacy" costs: fixed costs of honoring its pension obligations to its retirees and its debt obligations to its bond holders.

In 2008, (in round numbers) GM produced 8 million vehicles, received a total revenue of \$144 billion, had a total cost of \$176 billion, and incurred an economic loss of \$32 billion. To remain in business, the firm obtained loans from the U.S. and Canadian governments.

The figure shows the situation that old GM faced in 2008. The average price at which it could sell a vehicle

was \$18,000. To maximize profit (minimize loss), GM sold 8 million vehicles. Average total cost at 8 million vehicles was \$22,000, so the economic loss

was \$4,000 per vehicle. With no prospect of turning this loss around, old GM had no alternative but to exit the industry.



which all the firms use the new technology and each firm makes zero economic profit.

Because competition eliminates economic profit in the long run, technological change brings only temporary gains to firms. But the lower prices and better products that technological advances bring are permanent gains for consumers.

The process that we've just described is one in which some firms experience economic profits and others experience economic losses—a period of dynamic change for a market. Some firms do well, and others do badly. Often, the process has a geographical dimension—the expanding new-technology firms bring prosperity to what was once the boondocks, and with old-technology firms going out of business, traditional industrial regions decline. Sometimes, the new-technology firms are in a foreign country, while the old-technology firms are in the domestic economy. The information revolution of the 1990s produced many examples of changes like these. Commercial banking (a competitive but less than perfectly

New GM

On the day old GM filed for bankruptcy, its executives started to talk about the new GM. The firm's "restructuring" Web site reported plans for cost savings and investment in new green technology vehicles.

Creating a new profitable GM is a complex and detailed task that will require creative thinking and action by its management team. But one feature of the restructuring is crucial: cutting the fixed legacy costs.

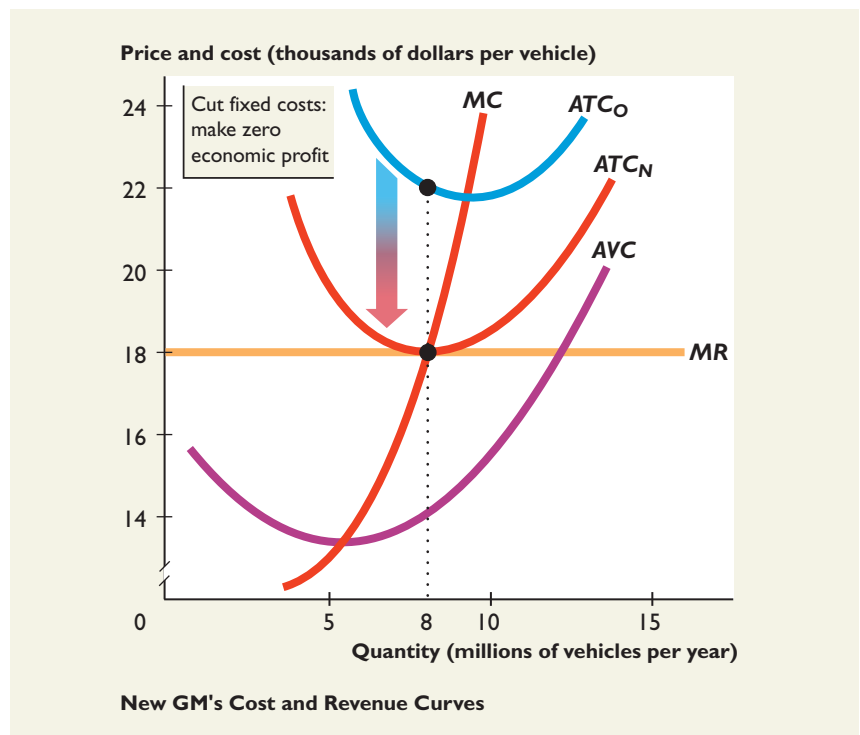
Restructuring GM won't change the market price of vehicles—the global market determines that price. Nor is the restructuring likely to have much effect on the marginal cost of producing a vehicle—technology and factor prices determine marginal cost.

Cutting fixed cost is the only point at which the new GM can have a major impact on its profitability.

The figure (right) shows the minimum that the new GM must do: It must cut fixed cost to shift its ATC curve downward from ATC_O to ATC_N .

GM can then maximize profit at the same quantity, 8 million vehicles a year, but operate with an average total cost equal to the price of a vehicle and so make zero economic profit.

A bigger cut in fixed cost would enable the new GM to make a positive economic profit. But in the long run as new firms enter the global market, economic profit will likely fall to zero.



competitive industry), was traditionally concentrated in New York, San Francisco, and other large cities, but now flourishes in Charlotte, North Carolina, which has become the nation's number three commercial banking city. Television shows and movies, traditionally made in Los Angeles and New York, are now made in large numbers in Orlando and Toronto.

Technological advances are not confined to the information and entertainment markets. Food production has seen major technological change, and today, genetic engineering is fueling that change.

■ Is Perfect Competition Efficient?

Perfect competition is efficient. To see why, first recall the conditions for an efficient allocation of resources. Resources are used efficiently when it is not possible to get more of one good without giving up something that is valued more highly. To achieve this outcome, marginal benefit must equal marginal cost. That is the outcome that perfect competition achieves.

We derive a firm's supply curve in perfect competition from its marginal cost curve. The supply curve is the marginal cost curve at all points above the minimum of average variable cost (the shutdown price). Because the market supply curve is found by summing the quantities supplied by all the firms at each price, the market supply curve is the entire market's marginal cost curve.

The demand curve is the marginal benefit curve. Because the supply curve and demand curve intersect at the equilibrium price, that price equals both marginal cost and marginal benefit.

Figure 11.13 illustrates the efficiency of perfect competition. We've labeled the demand curve $D = MB$ and the supply curve $S = MC$ to remind you that these curves are also the marginal benefit (MB) and marginal cost (MC) curves.

FIGURE 11.13
The Efficiency of Perfect Competition

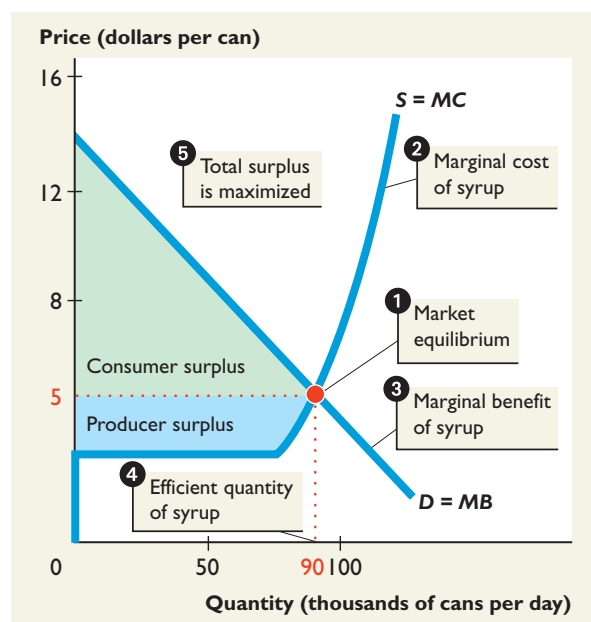
MyEconLab Animation

1 Market equilibrium occurs at a price of \$5 a can and a quantity of 90,000 cans a day.

2 The supply curve is also the marginal cost curve.

3 The demand curve is also the marginal benefit curve.

Because at the market equilibrium, marginal benefit equals marginal cost, the 4 efficient quantity of syrup is produced. 5 Total surplus (consumer surplus plus producer surplus) is maximized.



These curves intersect at the equilibrium price and quantity. The price equals marginal benefit and marginal cost, and the equilibrium quantity is efficient. The total surplus, which is the sum of consumer surplus and producer surplus, is maximized. Any departure from this outcome is inferior to it and brings an avoidable deadweight loss.

■ Is Perfect Competition Fair?

You studied the fairness of markets in Chapter 6 (pp. 159–161) and saw that there are two views of fairness: fair rules and fair results. The outcome is fair in the rules view if property rights are enforced and people acquire resources, goods, and services through voluntary exchange. The outcome is fair in the results view if the poorest aren't too poor and the richest aren't too rich, but there is no unique criterion for determining what is too poor or too rich.

In the short run, if a temporary shortage occurs in a competitive market, perhaps caused by bad weather or natural disaster, the price shoots upward. In such situations, some people might make large windfall gains and others, possibly a majority, might be confronted with high prices for essential items. In the fair results view, such a situation might be considered unfair.

But perfect competition in the long run seems to be fair on both views of fairness. It places no restrictions on anyone's actions, all trade is voluntary, consumers pay the lowest possible prices, and entrepreneurs earn only normal profit.



EYE on YOUR LIFE

The Perfect Competition that You Encounter

Many of the markets that you encounter every day are highly competitive and almost perfectly competitive. And while you don't run into perfect competition on a daily basis, you do have dealings in some perfectly competitive markets. Two of those markets are the Internet auctions organized by eBay and one of its subsidiaries, StubHub.

If you have a ticket for a game between the Giants and the Braves but can't use it, you can sell it on StubHub for the going market price (minus a commission). And if you're desperate to see the game but missed out on getting a ticket, you can buy

one for the going price (plus a commission) on the same Web site.

StubHub takes a commission and makes a profit. But competition between StubHub, TicketMaster, and other ticket brokers ensure that profits are competed away in the long run, with entrepreneurs earning normal profit.

Just about every good or service that you buy and take for granted, no matter where you buy it, is available because of the forces of competition. Your home, your food, your clothing, your books, your DVDs, your MP3 files, your computer, your bike, your car, . . . ; the list is endless. No one organizes all the magic that enables

you to buy this vast array of products. Competitive markets and entrepreneurs striving to make the largest possible profit make it happen.

When either demand or technology changes and makes the current allocation of resources the wrong one, the market swiftly and silently acts. It sends signals to entrepreneurs that bring entry and exit and a new and efficient use of scarce resources.

It is no exaggeration or hype to say that your entire life is influenced by and benefits immeasurably from the forces of competition. Adam Smith's invisible hand might be hidden from view, but it is enormously powerful.

MyEconLab

You can work these problems in Study Plan 11.3 and get instant feedback.

CHECKPOINT 11.3

Explain how output, price, and profit are determined in the long run and explain why perfect competition is efficient.

Practice Problems

Tulip growing is a perfectly competitive industry, and all tulip growers have the same cost curves. The market price of tulips is \$15 a bunch, and each grower maximizes profit by producing 1,500 bunches a week. The average total cost of producing tulips is \$21 a bunch. Minimum average variable cost is \$12 a bunch, and the minimum average total cost is \$18 a bunch.

1. What is a tulip grower's economic profit in the short run and how does the number of tulip growers change in the long run?
2. In the long run, what is the price and the tulip grower's economic profit?

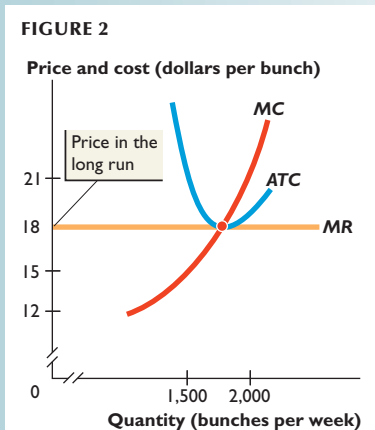
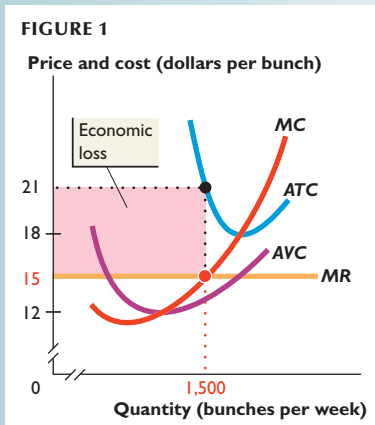
In the News

Cotton farmers face a formidable foe

The growing season has just begun and pigweed is spreading quickly, towering above the plants, and crowding out sunlight. This new breed of pigweed is resistant to herbicides. Scientists estimate that thousands of acres have already been plowed back, and that it could cost \$20 an acre to fend off the weed.

Source: *USA Today*, July 18, 2008

How will the cost of growing cotton change? What effect will this weed have on the cotton market in the short run? How will the cotton market change in the long run?



Solutions to Practice Problems

1. The price is less than average total cost, so the tulip grower is incurring an economic loss in the short run. Because the price exceeds minimum average variable cost, the tulip grower continues to produce. The economic loss equals the loss per bunch (\$21 minus \$15) multiplied by the number of bunches (1,500), which equals \$9,000 (Figure 1). Because tulip growers are incurring economic losses, some growers will exit in the long run. The number of tulip growers will decrease.
2. In the long run, the price will be such that economic profit is zero. That is, as growers exit, the price will rise until it equals minimum average total cost. The long-run price will be \$18 a bunch (Figure 2). A tulip grower's economic profit in the long run will be zero because average total cost equals price (Figure 2).

Solution to In the News

To produce any cotton, farms will have to incur a cost of \$20 an acre. This cost is a fixed cost, so the farm's marginal cost does not change. With acres of cotton already plowed back, the market supply of cotton will decrease in the short run and the market price will rise. To maximize profit, farms produce the quantity at which marginal revenue equals marginal cost. With a higher price and no change in marginal cost, farms with a crop will make positive economic profit. In the long run, farms will grow more cotton and the market price will fall until all farms are making zero economic profit.

CHAPTER SUMMARY

Key Points

1 Explain a perfectly competitive firm's profit-maximizing choices and derive its supply curve.

- A perfectly competitive firm is a price taker.
- Marginal revenue equals price.
- The firm produces the output at which price equals marginal cost.
- If price is less than minimum average variable cost, the firm temporarily shuts down.
- A firm's supply curve is the upward-sloping part of its marginal cost curve at all prices at or above minimum average variable cost (the shut-down point) and the vertical axis at all prices below minimum average variable cost.

2 Explain how output, price, and profit are determined in the short run.

- Market demand and market supply determine price.
- Firms choose the quantity to produce that maximizes profit, which is the quantity at which marginal cost equals price.
- In short-run equilibrium, a firm can make a positive economic profit, make zero economic profit, or incur an economic loss.

3 Explain how output, price, and profit are determined in the long run and explain why perfect competition is efficient.

- Economic profit induces entry, which increases market supply and lowers price and profit. Economic loss induces exit, which decreases market supply, raises price, and lowers the losses.
- In the long run, economic profit is zero and there is no entry or exit.
- An increase in demand increases the number of firms and increases the equilibrium quantity.
- An advance in technology that lowers the cost of producing a good increases market supply, lowers the price, and increases the quantity.
- Perfect competition is efficient because it makes marginal benefit equal marginal cost, and it is fair because trade is voluntary, consumers pay the lowest possible prices, and entrepreneurs earn normal profit.

Key Terms

Marginal revenue, 279

Monopolistic competition, 278

Monopoly, 278

Oligopoly, 278

Perfect competition, 278

Price taker, 279

Shutdown point, 279

MyEconLab

You can work these problems in Chapter 11 Study Plan and get instant feedback.

CHAPTER CHECKPOINT

Study Plan Problems and Applications

- In what type of market is each good or service in the following list sold? Explain your answers.
 - Wheat
 - Jeans
 - Printer cartridges
 - Toothpaste
 - Gym membership in a town with one gym
- Explain why in a perfectly competitive market, the firm is a price taker. Why can't the firm choose the price at which it sells its good?
- Table 1 shows the demand schedule for Lin's Fortune Cookies. Calculate Lin's marginal revenue for each quantity demanded. Compare Lin's marginal revenue and price. In what type of market does Lin's Fortune Cookies operate?

TABLE 1

| Price (dollars per batch) | Quantity demanded (batches per day) |
|---------------------------------|---|
| 50 | 0 |
| 50 | 1 |
| 50 | 2 |
| 50 | 3 |
| 50 | 4 |
| 50 | 5 |
| 50 | 6 |

TABLE 2

| Quantity (batches per day) | AFC | AVC | ATC | MC |
|----------------------------------|---------------------|------|-----|----|
| | (dollars per batch) | | | |
| 1 | 84.0 | 51.0 | 135 | 37 |
| 2 | 42.0 | 44.0 | 86 | 29 |
| 3 | 28.0 | 39.0 | 67 | 27 |
| 4 | 21.0 | 36.0 | 57 | 32 |
| 5 | 16.8 | 35.2 | 52 | 40 |
| 6 | 14.0 | 36.0 | 50 | 57 |
| 7 | 12.0 | 39.0 | 51 | 83 |
| 8 | 10.5 | 44.5 | 55 | |

Table 1 shows the demand schedule for Lin's Fortune Cookies. Table 2 shows some cost data for Lin's. Use this information to work Problems 4 to 7. (Hint: Make a sketch of Lin's short-run cost curves.)

- At a market price of \$50 a batch, what quantity does Lin's produce and what is the firm's economic profit in the short run?
- At a market price of \$35.20 a batch, what quantity does Lin's produce and what is the firm's economic profit in the short run?
- Create Lin's short-run supply schedule and make a graph of Lin's short-run supply curve. Explain why only part of Lin's short-run supply curve is the same as its marginal cost curve.
- At a market price of \$83 a batch, what quantity does Lin's produce and what is the firm's economic profit in the short run? Do firms enter or exit the market and what is Lin's economic profit in the long run?

Use the following information to work Problems 8 to 10.

Maple-syrup makers strike gold

Sugaring season in Vermont is going full blast. Vermont, the biggest U.S. syrup producer, produces about 500,000 gallons a year. In 2007, maple syrup cost an average of \$35 a gallon; this year, the price is \$45 a gallon. Canada is usually a huge producer, but with a poor season it has seen a 30 percent drop in production. As consumers turn to natural and organic products and buy locally made food, demand for maple syrup has rocketed.

Source: *USA Today*, March 30, 2009

- Draw a graph to describe the maple syrup market and the cost and revenue of one firm in 2007, assuming that all firms are making zero economic profit.
- Starting with the industry in long-run equilibrium, explain how the drop in the Canadian supply, other things remaining the same, affects the maple syrup market and an individual producer in the short run.
- Starting with the industry in long-run equilibrium, explain how the increase in the demand for maple syrup, other things remaining the same, affects the maple syrup market and an individual producer in the short run.

Instructor Assignable Problems and Applications

- Why did old GM file for bankruptcy?
- How will the new GM overcome the problems of the old GM?
- In what type of market is each of the following goods and services sold? Explain your answers.
 - Breakfast cereals
 - Cell phones
 - The only restaurant in a small town
 - Oranges
 - Cable TV in a town with one cable company
- Suppose that the restaurant industry is perfectly competitive. Joe's Diner is always packed in the evening but rarely has a customer at lunchtime. Why doesn't Joe's Diner close—temporarily shut down—at lunchtime?

Use the following information to work Problems 5 to 7.

Figure 1 shows the short-run cost curves of a toy producer. The market has 1,000 identical producers and Table 1 shows the market demand schedule for toys.

- At a market price of \$21 a toy, what quantity does the firm produce in the short run and does the firm make a positive economic profit, a zero economic profit, or an economic loss?
- At a market price of \$12 a toy, how many toys does the firm produce and what is its economic profit in the short run? How will the number of firms in the market change in the long run?
- At what market prices would the firm shut down temporarily? What is the market price of a toy in long-run equilibrium? How many firms will be in the toy market in the long run? Explain your answer.

Use the following information to work Problems 8 and 9.

California plans to crack down on the use of fumigants by growers of strawberries. The biggest burden will fall on Ventura County's growers, who produce about 90 percent of the nation's crop.

- Draw graphs of the U.S. strawberry market in long-run equilibrium before the pollution crackdown: one of the U.S. market and one of a California grower. Now show the short-run effects of the pollution crackdown.
- On the graph, show the long-run effects of the pollution crackdown.

Use the following information to work Problems 10 and 11.

Big drops in prices for crops make it tough down on the farm

Corn, soybean, and wheat prices have fallen roughly 50 percent from the historic highs of earlier this year. With better-than expected crop yields, world grain production will rise nearly 5 percent this year. Grain prices have also become more closely tied to oil prices because of the growing corn-based ethanol industry.

Source: *USA Today*, October 23, 2008

- Why did grain prices fall in 2008? Draw a graph to show that short-run effect on an individual farmer's economic profit.
- Explain the effect of the falling oil price on the market for ethanol. If the price of oil remains low for some years, what will be the long-run effects on the market for ethanol and the number of ethanol producers?

Your instructor can assign these problems as homework, a quiz, or a test in [MyEconLab](#).

FIGURE 1

Price and cost (dollars per toy)

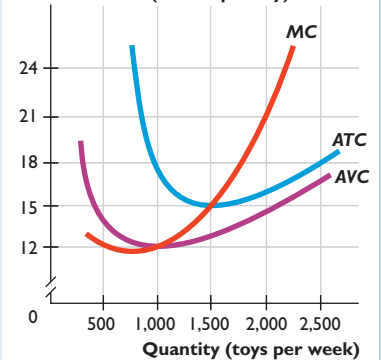


TABLE 1

| Price (dollars per toy) | Quantity demanded (thousands of toys per week) |
|-------------------------|--|
| 24 | 1,000 |
| 21 | 1,500 |
| 18 | 2,000 |
| 15 | 2,500 |
| 12 | 3,000 |

MyEconLab

You can work this quiz in Chapter 11 Study Plan and get instant feedback.

Multiple Choice Quiz

1. In perfect competition, all the following situations arise *except* _____.
 - A. firms produce an identical good or service
 - B. each firm chooses the price at which to sell the good it produces
 - C. firms can sell any quantity they choose to produce at the market price
 - D. buyers know each seller's price
2. A firm that is producing the quantity at which marginal cost exceeds both average total cost and the market price will increase its economic profit by _____.
 - A. producing a larger quantity
 - B. raising the price to equal marginal cost
 - C. producing a smaller quantity
 - D. producing the quantity that minimizes average total cost
3. A firm will shut down in the short run if at the profit-maximizing quantity, _____.
 - A. total revenue is less than total cost
 - B. marginal revenue is less than average fixed cost
 - C. average total cost exceeds the market price
 - D. marginal revenue is less than average variable cost
4. In the short run, the profit-maximizing firm will _____.
 - A. break even if marginal revenue equals marginal cost
 - B. make an economic profit if marginal cost is less than average total cost
 - C. incur an economic loss if average fixed cost exceeds marginal revenue
 - D. incur an economic loss if average total cost exceeds marginal revenue
5. A firm's short-run supply curve is the same as _____ if it produces the good.
 - A. its marginal revenue curve
 - B. the upward-sloping part of its marginal cost curve
 - C. its marginal cost curve above minimum average variable cost
 - D. its marginal cost curve above minimum average total cost
6. A permanent increase in demand _____ economic profit in the short run and some firms will _____ in the long run.
 - A. does not change; exit the market
 - B. increases; enter the market
 - C. increases; raise their price
 - D. does not change; advertise their good
7. Perfect competition is efficient because all the following conditions hold *except* _____.
 - A. total product is maximized
 - B. firms maximize profit and produce on their supply curves
 - C. consumers get a real bargain and pay a price below the value of the good
 - D. firms minimize their average total cost of producing the good



Are Microsoft's prices too high?

Monopoly

When you have completed your study of this chapter, you will be able to

- 1 Explain how monopoly arises and distinguish between single-price monopoly and price-discriminating monopoly.
- 2 Explain how a single-price monopoly determines its output and price.
- 3 Compare the performance of a single-price monopoly with that of perfect competition.
- 4 Explain how price discrimination increases profit.
- 5 Explain why natural monopoly is regulated and the effects of regulation.

12

CHAPTER CHECKLIST

12.1 MONOPOLY AND HOW IT ARISES

Monopoly

A market in which one firm sells a good or service that has no close substitutes and a barrier blocks the entry of new firms.



The market for diamonds is close to being a monopoly.

Barrier to entry

Any constraint that protects a firm from competitors.

Natural monopoly

A monopoly that arises because one firm can meet the entire market demand at a lower average total cost than two or more firms could.

A **monopoly** is a market in which one firm sells a good or service that has no close substitutes and in which a barrier to entry prevents competition from new firms.

Markets for local telephone service, gas, electricity, and water are examples of local monopoly. GlaxoSmithKline has a monopoly on AZT, a drug that is used to treat AIDS. DeBeers, a South African firm, controls 80 percent of the world's production of raw diamonds—close to being a monopoly but not quite one.

How Monopoly Arises

Monopoly arises when there are

- No close substitutes
- A barrier to entry

No Close Substitutes

If a good has a close substitute, even though only one firm produces it, that firm effectively faces competition from the producers of substitutes. Water supplied by a local public utility is an example of a good that does not have close substitutes. While it does have a close substitute for drinking—bottled spring water—it has no effective substitutes for doing the laundry, taking a shower, or washing a car.

The availability of close substitutes isn't static. Technological change can create substitutes and weaken a monopoly. For example, the creation of courier services such as UPS and the development of the fax machine and e-mail provide close substitutes for the mail-carrying services provided by the U.S. Postal Service and have weakened its monopoly. Broadband fiber-optic phone lines and satellite dishes have weakened the monopoly of cable television companies.

The arrival of a new product can also create a monopoly. For example, the technologies of the information age have provided opportunities for Google and Microsoft to become near monopolies in their markets.

A Barrier to Entry

Any constraint that protects a firm from the arrival of new competitors is a **barrier to entry**. There are three types of barrier to entry:

- Natural
- Ownership
- Legal

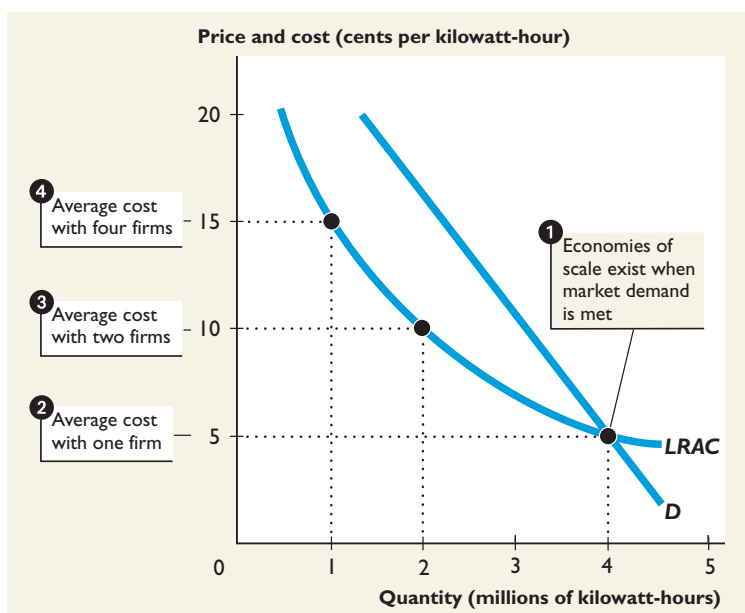
Natural Barrier to Entry A **natural monopoly** exists when the technology for producing a good or service enables one firm to meet the entire market demand at a lower average total cost than two or more firms could. One electric power distributor can meet the market demand for electricity at a lower cost than two or more firms could. Imagine two or more sets of wires running to your home so that you could choose your electric power supplier.

Figure 12.1 illustrates a natural monopoly in the distribution of electric power. Here, the demand curve for electric power is D , and the long-run average cost curve is $LRAC$. Economies of scale prevail over the entire length of this $LRAC$ curve, indicated by the fact that the curve slopes downward. One firm can produce 4 million kilowatt-hours at 5¢ a kilowatt-hour. At this price, the quantity

FIGURE 12.1

Natural Monopoly

MyEconLab Animation



The demand curve for electric power is D , and the long-run average cost curve is $LRAC$.

1 Economies of scale exist over the entire $LRAC$ curve.

One firm can distribute 4 million kilowatt-hours at a 2 cost of 5¢ a kilowatt-hour.

Two firms can distribute this same total output at a 3 cost of 10¢ a kilowatt-hour.

Four firms can distribute this same total output at a 4 cost of 15¢ a kilowatt-hour.

One firm can meet the market demand at a lower cost than two or more firms can, and the market is a natural monopoly.

demanded is 4 million kilowatt-hours. So if the price was 5¢ a kilowatt-hour, one firm could supply the entire market. If two or more firms shared the market, average total cost would be higher.

To see why the situation shown in Figure 12.1 creates a barrier to entry, think about what would happen if a second firm tried to enter the market. Such a firm would find it impossible to make a profit. If it produced less than the original firm, it would have to charge a higher price and it would have no customers. If it produced the same quantity as the original firm, the price would fall below average total cost for both firms and one of them would be forced out of business. There is room for only one firm in this market.

Ownership Barrier to Entry A monopoly can arise in a market in which competition and entry are restricted by the concentration of ownership of a natural resource. If DeBeers controlled 100 percent of the world's production of raw diamonds, it would be an example of this type of monopoly. There is no natural barrier to entry in diamonds. Even though the diamond is a relatively rare mineral, its sources of supply could have many owners who compete in a global competitive auction market. Only by buying control over all the world's diamonds would DeBeers be able to prevent entry and competition.

Legal Barrier to Entry A legal barrier to entry creates a legal monopoly. A **legal monopoly** is a market in which competition and entry are restricted by the granting of a public franchise, government license, patent, or copyright.

A *public franchise* is an exclusive right granted to a firm to supply a good or service, an example of which is the U.S. Postal Service's exclusive right to deliver

Legal monopoly

A market in which competition and entry are restricted by the granting of a public franchise, government license, patent, or copyright.

first-class mail. A *government license* controls entry into particular occupations, professions, and industries. An example is Michael's Texaco in Charleston, Rhode Island, which is the only firm in the area licensed to test for vehicle emissions.

A *patent* is an exclusive right granted to the inventor of a product or service. A *copyright* is an exclusive right granted to the author or composer of a literary, musical, dramatic, or artistic work. Patents and copyrights are valid for a limited time period that varies from country to country. In the United States, a patent is valid for 20 years. Patents are designed to encourage the *invention* of new products and production methods. They also stimulate *innovation*—the use of new inventions—by encouraging inventors to publicize their discoveries and offer them for use under license. Patents have stimulated innovations in areas as diverse as soybean seeds, pharmaceuticals, memory chips, and video games.

Most monopolies are regulated by government agencies. To understand why governments regulate monopolies and what effects regulations have, we need to know how an unregulated monopoly behaves. So we'll first study an unregulated monopoly and then look at monopoly regulation at the end of this chapter.

A monopoly sets its own price, but in doing so, it faces a market constraint. Let's see how the market limits a monopoly's pricing choices.

■ Monopoly Price-Setting Strategies

A monopoly faces a tradeoff between price and the quantity sold. To sell a larger quantity, the monopoly must set a lower price. But there are two price-setting possibilities that create different tradeoffs:

- Single price
- Price discrimination

Single Price

A **single-price monopoly** is a firm that must sell each unit of its output for the same price to all its customers. DeBeers sells diamonds (of a given size and quality) for the same price to all its customers. DeBeers is a *single-price* monopoly because if it tried to sell at a higher price to some customers than to others, only the low-price customers would buy from DeBeers. The others would buy from DeBeers's low-price customers.

Price Discrimination

A **price-discriminating monopoly** is a firm that sells different units for different prices not related to cost differences. Many firms price discriminate. Airlines offer a dizzying array of different prices for the same trip. Pizza producers charge one price for a single pizza and almost give away a second one. Different customers might pay different prices (like airfares), or one customer might pay different prices for different quantities bought (like the bargain price for a second pizza).

When a firm price discriminates, it appears to be doing its customers a favor. In fact, it is charging each group of customers the highest price it can get them to pay and is increasing its profit.

Not all monopolies can price discriminate. The main obstacle to the practice of price discrimination is resale by the customers who buy for a low price. Because of resale possibilities, price discrimination is limited to monopolies that sell goods and services that cannot be resold.

Single-price monopoly

A monopoly that must sell each unit of its output for the same price to all its customers.

Price-discriminating monopoly

A monopoly that sells different units of a good or service for different prices not related to cost differences.

CHECKPOINT 12.1

Explain how monopoly arises and distinguish between single-price monopoly and price-discriminating monopoly.

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You can work these problems in Study Plan 12.1 and get instant feedback.

Practice Problems

Use the information about the firms listed below to work Problems 1 and 2.

- a Coca-Cola cuts its price below that of Pepsi-Cola to increase profit.
 - b A single firm, protected by a barrier to entry, produces a personal service that has no close substitutes.
 - c A barrier to entry exists, but the good has some close substitutes.
 - d A museum offers discounts to students and seniors.
 - e A firm can sell any quantity it chooses at the going price.
 - f A firm experiences economies of scale even when it produces the quantity that meets the entire market demand.
1. Which of the six cases are monopolies or might give rise to monopoly?
 2. Which are legal monopolies and which are natural monopolies? Can any of them price discriminate? If so, why?

In the News

Deal raises monopoly concerns

A deal between United Continental and Air Canada looks like an “effective merger” of all of their Canadian and U.S. operations. The deal would create a monopoly on 10 major high-demand, transborder routes and substantially reduce competition on nine others. Prices would be higher and choice restricted.

Source: CBC News, June 27, 2011

What type of monopoly would be created on the 10 major high-demand routes? With higher prices and restricted choice, what would be the barrier to entry?

Solutions to Practice Problems

1. Monopoly arises when a single firm produces a good or service that has no close substitutes and a barrier to entry exists. Monopoly arises in **b** and **f**. In **a**, there is more than one firm. In **c**, the good has close substitutes. In **d**, a monopoly might be able to price discriminate, but other types of firms (for example, pizza producers) price discriminate and they are not monopolies. In **e**, the demand for the firm’s output is perfectly elastic and there is no limit to what it can sell. This firm operates in a perfectly competitive market.
2. Natural monopoly exists when one firm can meet the entire market demand at a lower price than two or more firms could: **f** is a natural monopoly, but **b** could be. Legal monopoly exists when the granting of a right creates a barrier to entry: **b** might be a legal monopoly. Because a personal service cannot be resold, **b** could price discriminate.

Solution to In the News

This deal would create a legal monopoly on 10 major high-demand, transborder routes. With higher prices, the monopoly might make positive economic profits, which would be an incentive for other airlines to offer service on these routes. The barrier would be the granting of landing slots and boarding gates.

12.2 SINGLE-PRICE MONOPOLY

To understand how a single-price monopoly makes its output and price decisions, we must first study the link between price and marginal revenue.

■ Price and Marginal Revenue

Because in a monopoly there is only one firm, the demand for the firm’s output is the market demand. Let’s look at Bobbie’s Barbershop, the sole supplier of haircuts in Cairo, Nebraska. The table in Figure 12.2 shows the demand schedule for Bobbie’s haircuts. For example, at \$12, consumers demand 4 haircuts an hour (row E).

Total revenue is the price multiplied by the quantity sold. For example, in row D, Bobbie sells 3 haircuts at \$14 each, so total revenue is \$42. *Marginal revenue* is the change in total revenue resulting from a one-unit increase in the quantity sold. For example, if the price falls from \$16 (row C) to \$14 (row D), the quantity sold increases from 2 to 3 haircuts. Total revenue rises from \$32 to \$42, so the change in total revenue is \$10. Because the quantity sold increases by 1 haircut, marginal revenue equals the change in total revenue and is \$10. Marginal revenue is placed between the two rows to emphasize that marginal revenue relates to the *change* in the quantity sold.

Figure 12.2 shows the market demand curve and Bobbie’s marginal revenue curve (*MR*) and also illustrates the calculation that we’ve just made. At each output, marginal revenue is less than price—the marginal revenue curve lies below the demand curve because a lower price is received on *all* units sold, not just on the marginal unit. For example, at a price of \$16, Bobbie sells 2 haircuts (point C). If she lowers the price to \$14 a haircut, she sells 3 haircuts and has a revenue gain

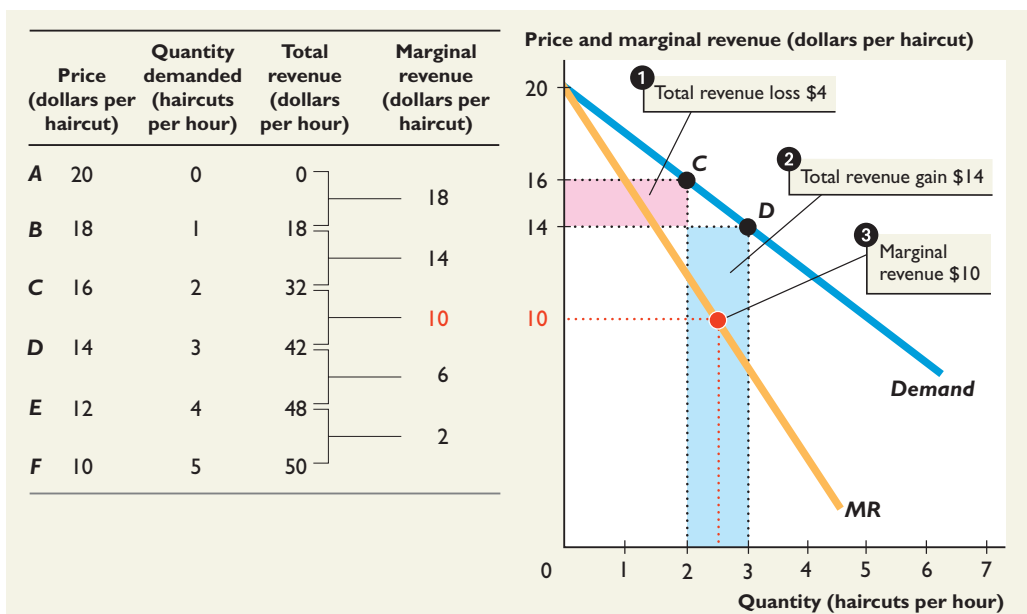
FIGURE 12.2
Demand and Marginal Revenue

MyEconLab Animation

The table shows the market demand schedule and Bobbie’s total revenue and marginal revenue schedules.

If the price falls from \$16 to \$14, the quantity sold increases from 2 to 3 haircuts.

- ① Total revenue lost on 2 haircuts is \$4;
- ② total revenue gained on 1 haircut is \$14;
- and ③ marginal revenue is \$10.



of \$14 on the third haircut. But she now receives only \$14 a haircut on the first two—\$2 a haircut less than before. So she loses \$4 of revenue on the first 2 haircuts. To calculate marginal revenue, she must deduct this amount from the revenue gain of \$14. So her marginal revenue is \$10, which is less than the price.

Notice that the marginal revenue curve has *twice the slope* of the demand curve. When the price falls from \$20 to \$10, the quantity demanded increases from zero to 5 but the quantity on the MR curve increases from zero to 2.5.

■ Marginal Revenue and Elasticity

In Chapter 5 (pp. 120–121), you learned about the *total revenue test* for the price elasticity of demand. If a *fall* in price *increases* total revenue, demand is elastic; and if a *fall* in price *decreases* total revenue, demand is inelastic.

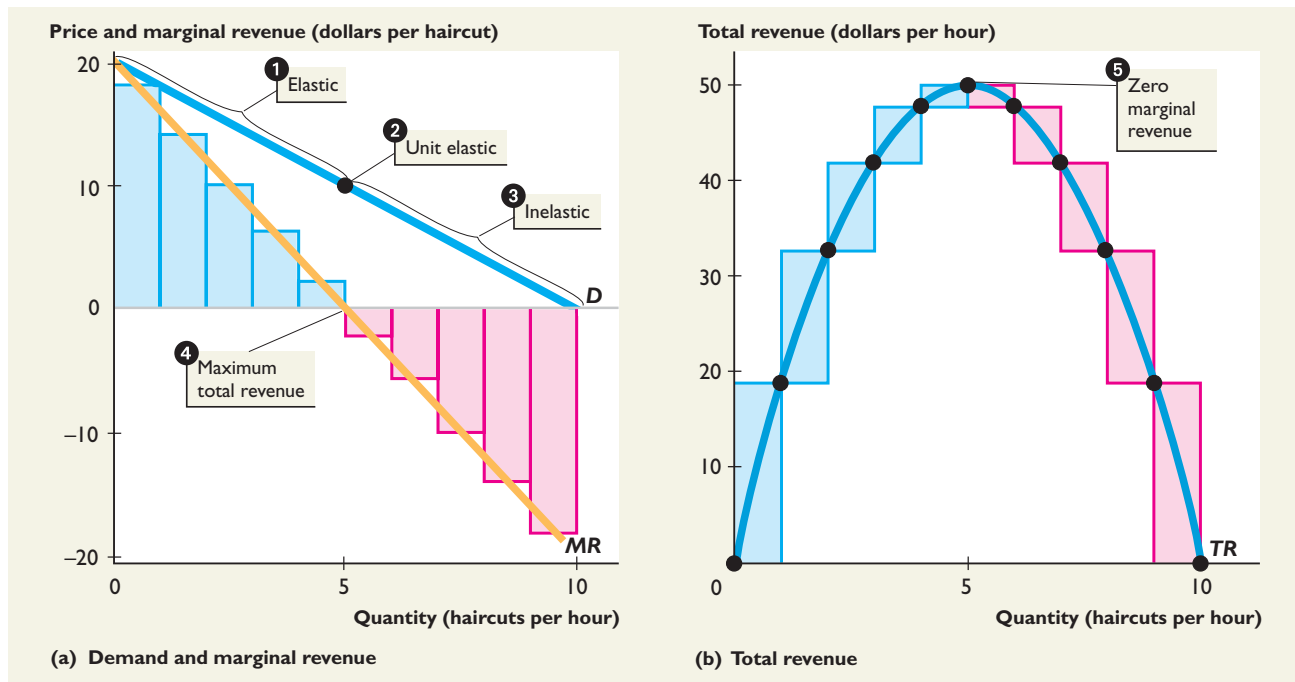
The total revenue test implies that when demand is elastic, marginal revenue is positive and when demand is inelastic, marginal revenue is negative. Figure 12.3 illustrates this relationship between elasticity and marginal revenue.

In part (a) as the price *falls* from \$20 to \$10, marginal revenue (shown by the blue bars) is *positive* and in part (b) total revenue *increases*, so demand is elastic. In part (a) as the price *falls* from \$10 to zero, marginal revenue (the red bars) is *negative* and in part (b), total revenue *decreases*, so demand is *inelastic*. At a price of \$10, total revenue is at a maximum, demand is unit elastic, and marginal revenue is zero.

■ FIGURE 12.3

Marginal Revenue and Elasticity

MyEconLab Animation



As the price falls, if marginal revenue is positive (the blue bars), ① demand is elastic; if marginal revenue is zero, ② demand is unit elastic; if marginal revenue is negative (the red bars), ③ demand is

inelastic. At zero marginal revenue in part (a), ④ total revenue is maximized. And at maximum total revenue in part (b), ⑤ marginal revenue is zero.

The relationship between marginal revenue and elasticity implies that a monopoly never profitably produces along the inelastic range of its demand curve. If a monopoly did produce along the inelastic range of its demand curve, it could increase total revenue by raising its price and selling a smaller quantity. But by producing less, the firm's total cost would fall and the firm's profit would increase. Let's look at a monopoly's output and price decision.

■ Output and Price Decision

To determine the output level and price that maximize a monopoly's profit, we study the behavior of both revenue and costs as output varies.

Table 12.1 summarizes the information we need about Bobbie's revenue, costs, and economic profit. Economic profit, which equals total revenue minus total cost, is maximized at \$12 an hour when Bobbie sells 3 haircuts an hour for \$14 each. If she sold 2 haircuts for \$16 each, her economic profit would be only \$9. And if she sold 4 haircuts for \$12 each, her economic profit would be only \$8.

You can see why 3 haircuts is Bobbie's profit-maximizing output by looking at the marginal revenue and marginal cost. When Bobbie increases output from 2 to 3 haircuts, her marginal revenue is \$10 and her marginal cost is \$7. Profit increases by the difference, \$3 an hour. If Bobbie increases output yet further, from 3 to 4 haircuts, her marginal revenue is \$6 and her marginal cost is \$10. In this case, marginal cost exceeds marginal revenue by \$4, so profit decreases by \$4 an hour.

Figure 12.4 illustrates the information contained in Table 12.1. Part (a) shows Bobbie's total revenue curve (*TR*) and her total cost curve (*TC*). It also shows Bobbie's economic profit as the vertical distance between the *TR* and *TC* curves. Bobbie maximizes her profit at 3 haircuts an hour and earns an economic profit of \$12 an hour (\$42 of total revenue minus \$30 of total cost).

Figure 12.4 (b) shows the market demand curve (*D*) and Bobbie's marginal revenue curve (*MR*) along with her marginal cost curve (*MC*) and average total cost curve (*ATC*). Bobbie maximizes profit by producing the output at which marginal cost equals marginal revenue—3 haircuts an hour. But what price does she charge for a haircut? To set the price, the monopoly uses the demand curve and finds the highest price at which it can sell the profit-maximizing output. In Bobbie's case, the highest price at which she can sell 3 haircuts an hour is \$14 a haircut.

■ Table 12.1

A Monopoly's Output and Price Decision

| | Price (dollars per haircut) | Quantity demanded (haircuts per hour) | Total revenue (dollars per hour) | Marginal revenue (dollars per haircut) | Total cost (dollars per hour) | Marginal cost (dollars per haircut) | Profit (dollars per hour) |
|----------|-----------------------------------|--|---|---|--|--|---------------------------------|
| A | 20 | 0 | 0 | 18 | 12 | 5 | -12 |
| B | 18 | 1 | 18 | 14 | 17 | 6 | 1 |
| C | 16 | 2 | 32 | 10 | 23 | 7 | 9 |
| D | 14 | 3 | 42 | 6 | 30 | 10 | 12 |
| E | 12 | 4 | 48 | 2 | 40 | 15 | 8 |
| F | 10 | 5 | 50 | | 55 | | -5 |

When Bobbie produces 3 haircuts an hour, her average total cost is \$10 (read from the *ATC* curve at the quantity 3 haircuts) and her price is \$14 (read from the *D* curve). Her profit per haircut is \$4 (\$14 minus \$10). Bobbie's economic profit is shown by the blue rectangle, which equals the profit per haircut (\$4) multiplied by the number of haircuts (3 an hour), for a total of \$12 an hour.

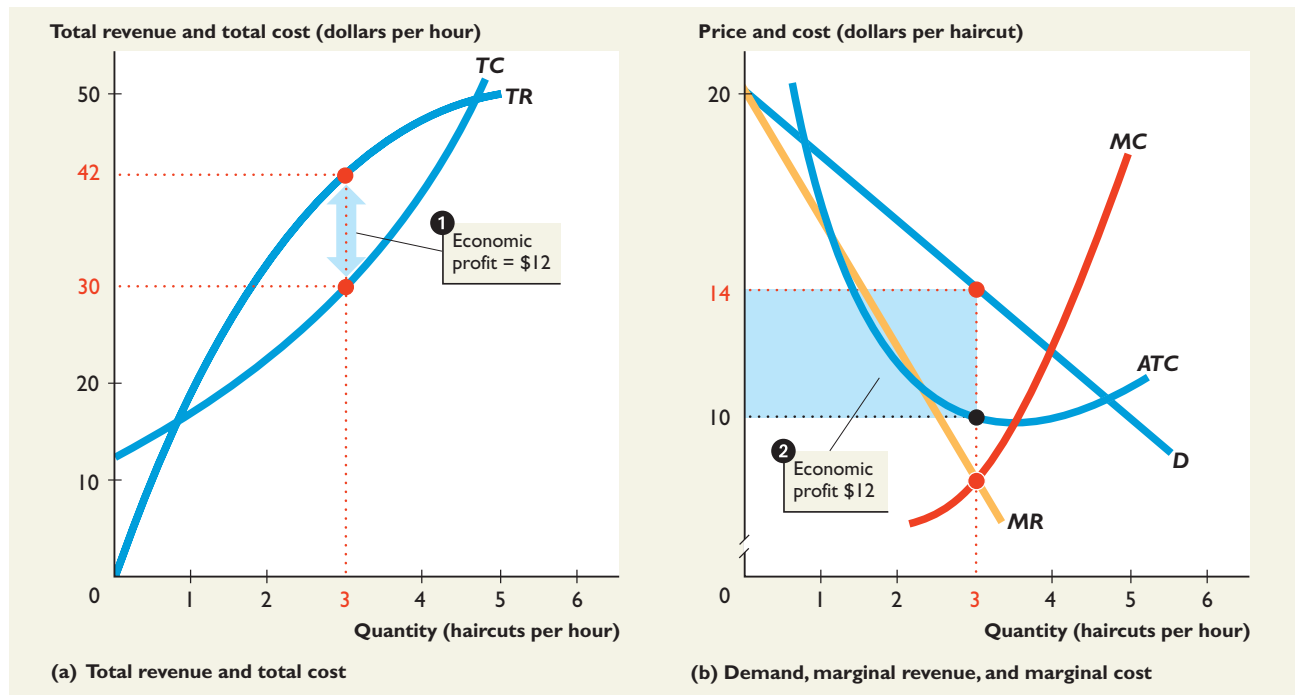
A positive economic profit is an incentive for firms to enter a market. But barriers to entry prevent that from happening in a monopoly. So in a monopoly, the firm can make a positive economic profit and continue to do so indefinitely.

A monopoly charges a price that exceeds marginal cost, but does it always make an economic profit? The answer is no. Bobbie makes a positive economic profit in Figure 12.4. But suppose that Bobbie's landlord increases the rent she pays for her barbershop. If Bobbie pays an additional \$12 an hour in shop rent, her fixed cost increases by that amount. Her marginal cost and marginal revenue don't change, so her profit-maximizing output remains at 3 haircuts an hour. Her profit decreases by the additional rent of \$12 an hour to zero. If Bobbie pays more than an additional \$12 an hour for rent, she incurs an economic loss. If this situation were permanent, Bobbie would go out of business. But monopoly entrepreneurs are creative, and Bobbie might find another shop at a lower rent.

FIGURE 12.4

A Monopoly's Profit-Maximizing Output and Price

MyEconLab Animation



In part (a), economic profit is maximized when total revenue (*TR*) minus total cost (*TC*) is greatest. ① Economic profit, the vertical distance between *TR* and *TC*, is \$12 an hour at 3 haircuts an hour.

In part (b), economic profit is maximized when marginal cost (*MC*) equals marginal revenue (*MR*). The price is determined by the demand curve (*D*) and is \$14. ② Economic profit, the blue rectangle, is \$12—the profit per haircut (\$4) multiplied by 3 haircuts.

MyEconLab

You can work these problems in Study Plan 12.2 and get instant feedback.

TABLE 1

| Price (dollars per bottle) | Quantity (bottles per hour) | Total cost (dollars per hour) |
|----------------------------|-----------------------------|-------------------------------|
| 10 | 0 | 1 |
| 9 | 1 | 2 |
| 8 | 2 | 4 |
| 7 | 3 | 7 |
| 6 | 4 | 12 |
| 5 | 5 | 18 |

TABLE 2

| Quantity (bottles per hour) | Total revenue (dollars per hour) | Marginal revenue (dollars per bottle) |
|-----------------------------|----------------------------------|---------------------------------------|
| 0 | 0 | 9 |
| 1 | 9 | 7 |
| 2 | 16 | 5 |
| 3 | 21 | 3 |
| 4 | 24 | 1 |
| 5 | 25 | |

TABLE 3

| Quantity (bottles per hour) | Total cost (dollars per hour) | Marginal cost (dollars per bottle) |
|-----------------------------|-------------------------------|------------------------------------|
| 0 | 1 | 1 |
| 1 | 2 | 2 |
| 2 | 4 | 3 |
| 3 | 7 | 5 |
| 4 | 12 | 7 |
| 5 | 18 | |

CHECKPOINT 12.2

Explain how a single-price monopoly determines its output and price.

Practice Problems

Minnie’s Mineral Springs is a single-price monopoly. Table 1 shows the demand schedule for Minnie’s spring water (columns 1 and 2) and the firm’s total cost schedule (columns 2 and 3).

1. Calculate Minnie’s total revenue and marginal revenue schedules.
2. Draw the demand curve and Minnie’s marginal revenue curve.
3. Calculate Minnie’s profit-maximizing output, price, and economic profit.
4. If Minnie’s is hit with a conservation tax of \$14 an hour, what are Minnie’s new profit-maximizing output, price, and economic profit?

In the News

Comcast offers faster home broadband in some U.S. cities

Comcast, the largest U.S. internet-service provider, introduced a new home-broadband package called Extreme 105, which can download files many times faster than most connections.

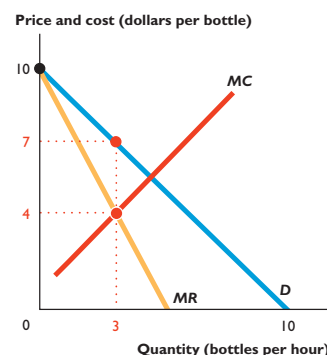
Source: CNN, April 14, 2011

How does Comcast determine the price of its broadband service?

Solutions to Practice Problems

1. Total revenue equals price multiplied by quantity sold. Marginal revenue equals the change in total revenue when the quantity increases by one unit (Table 2).
2. Figure 1 shows the demand curve and Minnie’s marginal revenue curve.
3. Marginal cost, MC , is the change in total cost when the quantity produced increases by 1 bottle (Table 3). Profit is maximized when $MR = MC$ by producing 3 bottles an hour (Figure 1). The price is \$7 a bottle. Economic profit equals total revenue (\$21) minus total cost (\$7), which is \$14 an hour.
4. With a conservation tax of \$14 an hour, Minnie’s fixed cost increases but marginal cost doesn’t change, so the profit-maximizing output and price are unchanged. Economic profit is zero.

FIGURE 1



Solution to In the News

Comcast is the only supplier of broadband service in many cities. Comcast undertakes a marketing survey to estimate the demand for its new faster service. Comcast knows its production costs, so to calculate its total costs it adds its marketing costs. Then Comcast calculates its profit-maximizing quantity of service. From its estimated demand for the service, Comcast calculates the highest price at which it expects it can sell the profit-maximizing quantity of the service.

12.3 MONOPOLY AND COMPETITION COMPARED

Imagine a market in which many small firms operate in perfect competition. Then suppose that a single firm buys out all these small firms and creates a monopoly. What happens in this market to the quantity produced, the price, and efficiency?

Output and Price

Figure 12.5 shows the market that we'll study. The market demand curve is D . Initially, with many small firms in the market, the market supply curve is S , which is the sum of the supply curves—and marginal cost curves—of the firms. The equilibrium price is P_C , which makes the quantity demanded equal the quantity supplied. The equilibrium quantity is Q_C . Each firm takes the price P_C and maximizes its profit by producing the output at which its own marginal cost equals the price.

A single firm now buys all the firms in this market. Consumers don't change, so the demand curve doesn't change. But the monopoly recognizes this demand curve as a constraint on its sales and knows that its marginal revenue curve is MR .

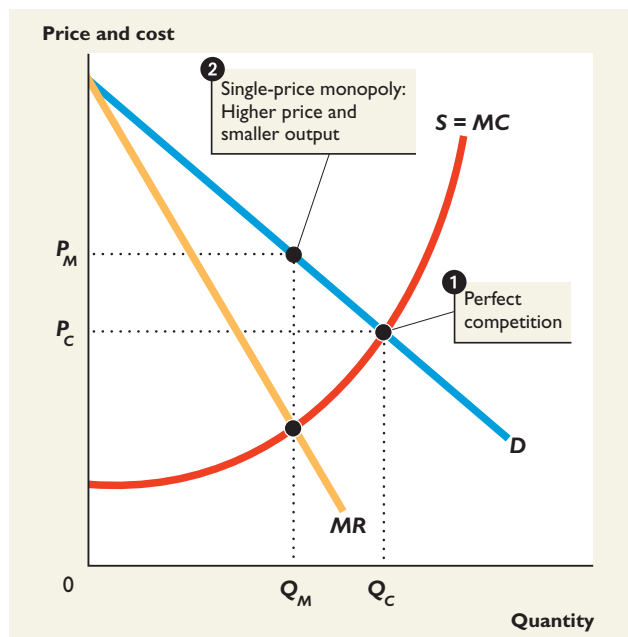
The market supply curve in perfect competition is the sum of the marginal cost curves of the firms in the industry. So the monopoly's marginal cost curve is the market supply curve of perfect competition—labeled $S = MC$. The monopoly maximizes profit by producing the quantity at which marginal revenue equals marginal cost, which is Q_M . This output is smaller than the competitive output, Q_C . The monopoly charges the price P_M , which is higher than P_C .

Compared to perfect competition, a single-price monopoly produces a smaller output and charges a higher price.

FIGURE 12.5

Monopoly's Smaller Output and Higher Price

MyEconLab Animation



- 1 A competitive industry produces the quantity Q_C at price P_C .
- 2 A single-price monopoly produces the quantity Q_M at which marginal revenue equals marginal cost and sells that quantity for the price P_M . Compared to perfect competition, a single-price monopoly produces a smaller output and raises the price.

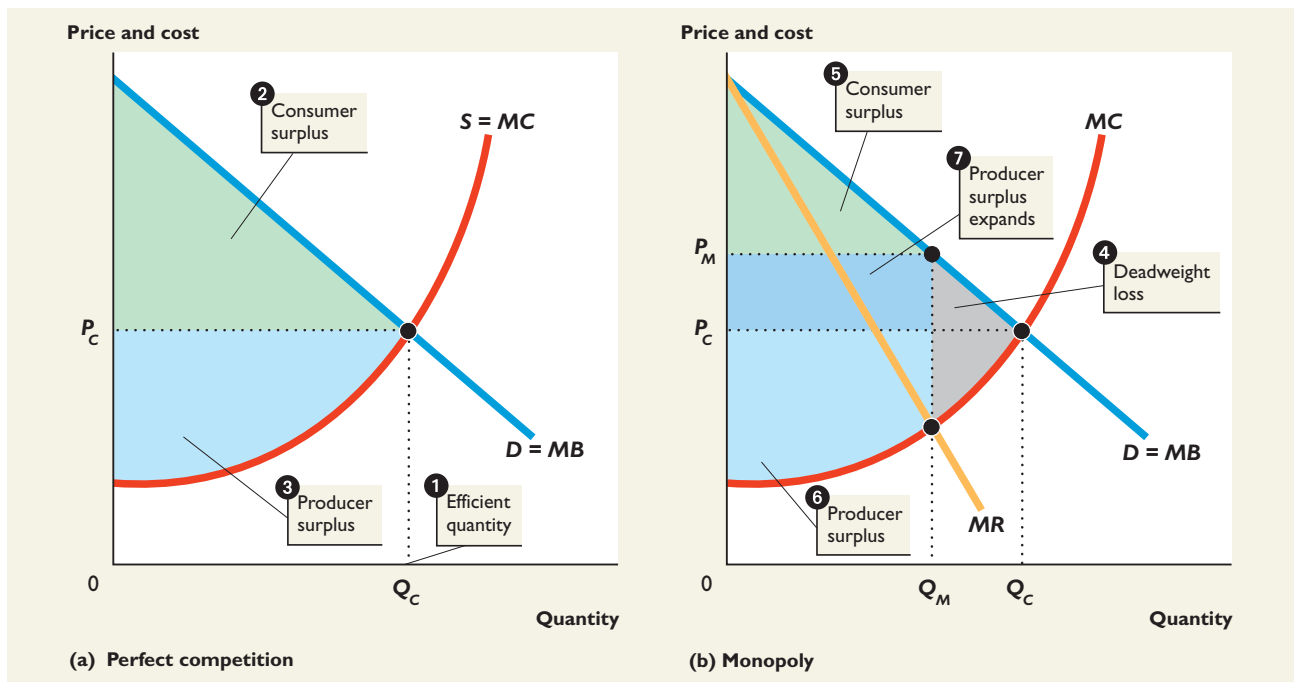
■ Is Monopoly Efficient?

You learned in Chapter 6 that resources are used efficiently when marginal benefit equals marginal cost. Figure 12.6(a) shows that perfect competition achieves this efficient use of resources. The demand curve ($D = MB$) shows the marginal benefit to consumers. The supply curve ($S = MC$) shows the marginal cost (opportunity cost) to producers. At the competitive equilibrium, the price is P_C and the quantity is Q_C . Marginal benefit equals marginal cost, and resource use is efficient. Total surplus (Chapter 6, p. 153), the sum of *consumer surplus*, the green triangle, and *producer surplus*, the blue area, is maximized.

Figure 12.6(b) shows that monopoly is inefficient. Monopoly output is Q_M and price is P_M . Price (marginal benefit) exceeds marginal cost and the underproduction creates a *deadweight loss* (Chapter 6, p. 155), which is shown by the gray area. Consumers lose partly by getting less of the good, shown by the gray triangle above P_C , and partly by paying more for the good. Consumer surplus shrinks to the smaller green triangle. Producers lose by selling less of the good, shown by the part of the gray area below P_C , but gain by selling their output for a higher price, shown by the dark blue rectangle. Producer surplus expands and is larger in monopoly than in perfect competition.

FIGURE 12.6
The Inefficiency of Monopoly

MyEconLab Animation



In perfect competition, **1** the equilibrium quantity is the efficient quantity, Q_C , because at that quantity the price, P_C , equals marginal benefit and marginal cost. The sum of **2** consumer surplus and **3** producer surplus is maximized.

In a single-price monopoly, the equilibrium quantity, Q_M , is inefficient because the price, P_M , which equals marginal benefit, exceeds marginal cost. **4** A deadweight loss arises. **5** Consumer surplus shrinks, and **6** producer surplus expands by the area **7**.

■ Is Monopoly Fair?

Monopoly is inefficient because it creates a deadweight loss. But monopoly also *redistributes* consumer surplus. The producer gains, and the consumers lose.

Figure 12.6 shows this redistribution. The monopoly gets the difference between the higher price, P_M , and the competitive price, P_C , on the quantity sold, Q_M . So the dark blue rectangle shows the part of the consumer surplus taken by the monopoly. This portion of the loss of consumer surplus is not a loss to society. It is redistribution from consumers to the monopoly producer.

Are the gain for the monopoly and loss for consumers fair? You learned about two standards of fairness in Chapter 6: *fair results* and *fair rules*. Redistribution from the rich to the poor is consistent with the fair results view. So on this view of fairness, whether monopoly redistribution is fair or unfair depends on who is richer: the monopoly or the consumers of its product. It might be either. Whether the *rules* are fair depends on whether the monopoly has benefited from a protected position that is not available to anyone else. If everyone is free to acquire the monopoly, then the rules are fair. So monopoly is inefficient and it might be, but is not always, unfair.

The pursuit of monopoly profit leads to an additional costly activity that we'll now describe: rent seeking.

■ Rent Seeking

Rent seeking is the lobbying for special treatment from the government to create economic profit or to divert consumer surplus or producer surplus away from others. ("Rent" is a general term in economics that includes all forms of surplus such as consumer surplus, producer surplus, and economic profit.) Rent seeking does not always create a monopoly, but it always restricts competition and often creates a monopoly.

Scarce resources can be used to produce the goods and services that people value or they can be used in rent seeking. Rent seeking is potentially profitable for the rent seeker but costly to society because it uses scarce resources purely to transfer wealth from one person or group to another person or group rather than to produce the things that people value.

To see why rent seeking occurs, think about the two ways in which a person might become the owner of a monopoly:

- Buy a monopoly.
- Create a monopoly by rent seeking.

Buy a Monopoly

A person might try to make a monopoly profit by buying a firm (or a right) that is protected by a barrier to entry. Buying a taxicab medallion in New York City is an example. The number of medallions is restricted, so their owners are protected from unlimited entry into the industry. A person who wants to operate a taxi must buy a medallion from someone who already has one.

But anyone is free to enter the bidding for a medallion. So competition among buyers drives the price up to the point at which they make only zero economic profit. For example, competition for the right to operate a taxi in New York City has led to a price of \$600,000 for a taxi medallion, which is sufficiently high to eliminate economic profit for taxi operators and leave entrepreneurs with only normal profit.

Rent seeking

The lobbying for special treatment from the government to create economic profit or to divert consumer surplus or producer surplus away from others.

■ Create a Monopoly by Rent Seeking

Because buying a monopoly means paying a price that soaks up the economic profit, creating a monopoly by rent seeking is an attractive alternative to buying one. Rent seeking is a political activity. It takes the form of lobbying and trying to influence the political process to get laws that create legal barriers to entry. Such influence might be sought by making campaign contributions in exchange for legislative support or by indirectly seeking to influence political outcomes through publicity in the media or by direct contact with politicians and bureaucrats. An example of a rent created in this way is the law that restricts the quantities of textiles that can be imported into the United States. Another is a law that limits the quantity of tomatoes that can be imported into the United States. These laws restrict competition, which decreases the quantity for sale and increases prices.

■ Rent-Seeking Equilibrium

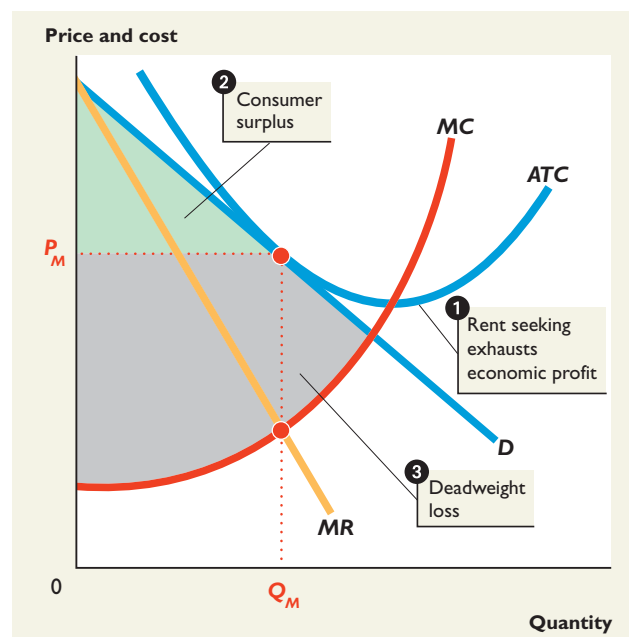
Rent seeking is a competitive activity. If an economic profit is available, a rent seeker will try to get some of it. Competition among rent seekers pushes up the cost of rent seeking until it leaves the monopoly earning only a zero economic profit after paying the rent-seeking costs.

Figure 12.7 shows a rent-seeking equilibrium. The cost of rent seeking is a fixed cost that must be added to a monopoly's other costs. The average total cost curve, which includes the fixed cost of rent seeking, shifts upward until it just touches the demand curve. Consumer surplus is unaffected. But the deadweight loss of monopoly now includes the original deadweight loss plus the economic profit consumed by rent seeking, which the enlarged gray area shows.

FIGURE 12.7
Rent-Seeking Equilibrium

MyEconLab Animation

- 1 Rent-seeking costs exhaust economic profit. The firm's rent-seeking costs are fixed costs. They increase total fixed cost and average total cost. The ATC curve shifts upward until, at the profit-maximizing price, the firm breaks even.
- 2 Monopoly profit-maximization shrinks consumer surplus relative to its maximum level in perfect competition, but rent-seeking doesn't shrink consumer surplus any further.
- 3 The deadweight loss increases.



CHECKPOINT 12.3

Compare the performance of a single-price monopoly with that of perfect competition.

Practice Problems

Township is a small isolated community served by one newspaper that can meet the market demand at a lower cost than two or more newspapers could. The *Township Gazette* is the only source of news. Figure 1 shows the marginal cost of printing the *Township Gazette* and the market demand for it. The *Township Gazette* is a profit-maximizing, single-price monopoly.

1. How many copies of the *Township Gazette* are printed each day and what is the price of the *Township Gazette*?
2. What is the efficient number of copies of the *Township Gazette* and what is the price at which the efficient number of copies could be sold?
3. Is the number of copies printed the efficient quantity? Explain your answer.
4. On the graph, show the consumer surplus that is redistributed from consumers to the *Township Gazette* and the deadweight loss that arises because the *Township Gazette* is a monopoly.

In the News

Ticketmaster's near monopoly challenged as technology changes

In the 1990s, to see Michael Jordan or Garth Brooks live you had to buy the ticket through Ticketmaster, or from a scalper. Today, Ticketmaster merged with concert promoter Live Nation and now controls the sale of tickets to sports and music events. Competitors have entered the market, and events tickets are now sold through Internet auction markets.

How will the increased competition in the sale of tickets affect the service fee component of the price and the efficiency of the market? Will scalpers survive?

Solutions to Practice Problems

1. The profit-maximizing quantity of the *Township Gazette* is 150 a day, where marginal revenue equals marginal cost. The price is 70¢ a copy (Figure 2).
2. The efficient quantity is 250 copies, where quantity demanded (marginal benefit) equals marginal cost and the price would be 50¢ a copy (Figure 2).
3. The number of copies printed is not efficient because the marginal benefit of the 150th copy (70¢) exceeds its marginal cost (40¢) (Figure 2).
4. In Figure 2, the blue rectangle ① shows the consumer surplus transferred from the consumers to the *Township Gazette* and the gray triangle ② shows the deadweight loss created.

Solution to In the News

The price you pay for an event ticket is the sum of the price of the event plus a service fee. As a monopoly, Ticketmaster charges the profit-maximizing fee. The monopoly has weakened and competition has increased, but sellers still charge the profit-maximizing fee, although a lower fee. The ticket-selling market is more efficient, but scalpers now compete with resale auctions and appear to survive.

MyEconLab

You can work these problems in Study Plan 12.3 and get instant feedback.

FIGURE 1

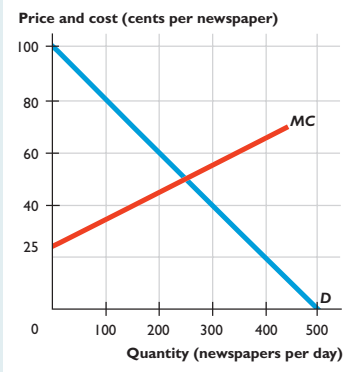
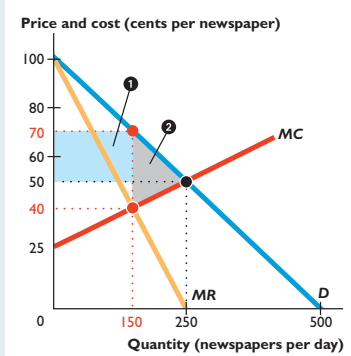


FIGURE 2



12.4 PRICE DISCRIMINATION



Why does a hairdresser charge seniors \$2 less than other customers?

Price discrimination—selling a good or service at a number of different prices—is widespread. You encounter it when you travel, go to the movies, get your hair cut, buy pizza, or visit an art museum. At first sight, it appears that price discrimination contradicts the assumption of profit maximization. Why would a movie operator allow children to see movies at half price? Why would a hairdresser charge students and senior citizens less? Aren't these firms losing profit by being nice to their customers?

Deeper investigation shows that far from lowering profit, price discriminators make a bigger profit than they would otherwise. So a monopoly has an incentive to find ways of discriminating and charging each buyer the highest possible price. Some people pay less with price discrimination, but others pay more.

Most price discriminators are *not* monopolies, but monopolies do price discriminate when they can. To be able to price discriminate, a firm must

- Identify and separate different types of buyers.
- Sell a product that cannot be resold.

Price discrimination is charging different prices for a single good or service because the willingness to pay varies across buyers. Not all price *differences* are price *discrimination*. Some goods that are similar but not identical have different prices because they have different production costs. For example, the cost of producing electricity depends on time of day. If an electric power company charges a higher price for consumption between 7:00 and 9:00 in the morning and between 4:00 and 7:00 in the evening than it does at other times of the day, the company is not price discriminating.

Price Discrimination and Consumer Surplus

The key idea behind price discrimination is to convert consumer surplus into economic profit. To extract every dollar of consumer surplus from every buyer, the monopoly would have to offer each individual customer a separate price schedule based on that customer's own willingness to pay. Such price discrimination cannot be carried out in practice because a firm does not have enough information about each consumer's demand curve. But firms try to extract as much consumer surplus as possible, and to do so, they discriminate in two broad ways:

- Among groups of buyers
- Among units of a good

Discriminating Among Groups of Buyers

To price discriminate among groups of buyers, the firm offers different prices to different types of buyers, based on things such as age, employment status, or some other easily distinguished characteristic. This type of price discrimination works when each group has a different average willingness to pay for the good or service.

For example, a face-to-face sales meeting with a customer might bring a large and profitable order. For salespeople and other business travelers, the marginal benefit from an airplane trip is large and the price that such a traveler will pay for a trip is high. In contrast, for a vacation traveler, any of several different trips or even no vacation trip are options. So for vacation travelers, the marginal benefit of

a trip is small and the price that such a traveler will pay for a trip is low. Because business travelers are willing to pay more than vacation travelers are, it is possible for an airline to profit by price discriminating between these two groups.

Discriminating Among Units of a Good

To price discriminate among units of a good, the firm charges the same prices to all its customers but offers a lower price per unit for a larger number of units bought. When Pizza Hut charges \$10 for one home-delivered pizza and \$14 for two, it is using this type of price discrimination. In this example, the price of the second pizza is only \$4.

Let's see how an airline exploits the differences in demand by business and vacation travelers and increases its profit by price discriminating.

Profiting by Price Discriminating

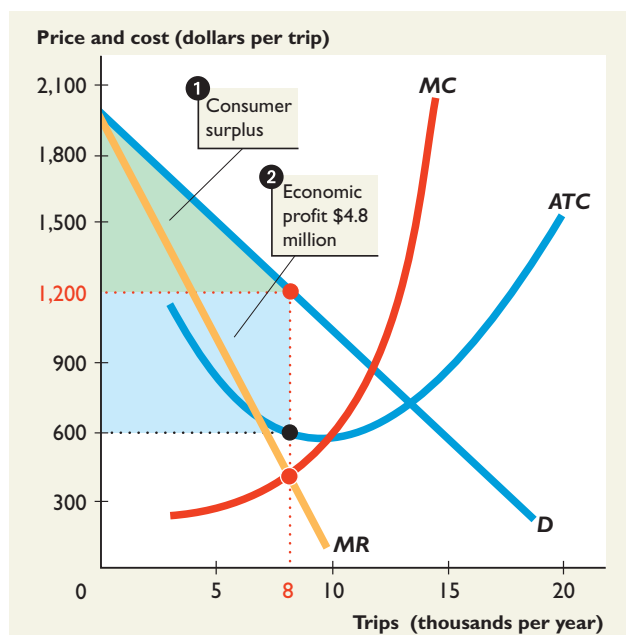
Global Air has a monopoly on an exotic route. Figure 12.8 shows the demand curve (D) for travel on this route and Global Air's marginal revenue curve (MR). It also shows Global Air's marginal cost (MC) and average total cost (ATC) curves.

Initially, Global is a single-price monopoly and maximizes its profit by producing 8,000 trips a year (the quantity at which MR equals MC). The price is \$1,200 a trip. The average total cost of a trip is \$600, so economic profit is \$600 a trip. On 8,000 trips, Global's economic profit is \$4.8 million a year, shown by the blue rectangle. Global's customers enjoy a consumer surplus shown by the green triangle.

FIGURE 12.8

A Single-Price Monopoly's Price and Economic Profit

MyEconLab Animation



Global Air has a monopoly on an air route. The demand curve for travel on this route is D , and Global's marginal revenue curve is MR . Its marginal cost curve is MC , and its average total cost curve is ATC .

As a single-price monopoly, Global maximizes profit by selling 8,000 trips a year at \$1,200 a trip.

- 1 Global's customers enjoy a consumer surplus—the green triangle.
- 2 Global's economic profit is \$4.8 million a year—the blue rectangle.

Global is struck by the fact that many of its customers are business travelers, and Global suspects that they are willing to pay more than \$1,200 a trip. So Global does some market research, which tells Global that some business travelers are willing to pay as much as \$1,800 a trip. Also, these customers almost always make their travel plans at the last moment. Another group of business travelers is willing to pay \$1,600. These customers know a week ahead when they will travel, and prefer a refundable ticket. Yet another group is willing to pay up to \$1,400. These travelers know two weeks ahead when they will travel, and they are happy to buy a nonrefundable ticket.

So Global announces a new fare schedule: No restrictions, \$1,800; 7-day advance purchase, refundable, \$1,600; 14-day advance purchase, nonrefundable, \$1,400; 14-day advance purchase, must stay at least 7 days, \$1,200.

Figure 12.9 shows the outcome with this new fare structure and also shows why Global is pleased with its new fares. It sells 2,000 trips at each of its four prices. Global's economic profit increases by the area of the blue steps in the figure. Its economic profit is now its original \$4.8 million a year plus an additional \$2.4 million from its new higher fares. Consumer surplus has shrunk to the sum of the smaller green triangles.

Perfect Price Discrimination

But Global thinks that it can do even better. It plans to achieve **perfect price discrimination**, which extracts the entire consumer surplus by charging the highest price that consumers are willing to pay for each unit. To do so, Global must get creative and come up with a host of additional business fares ranging between \$2,000 and \$1,200, each one of which appeals to a small segment of the business market.

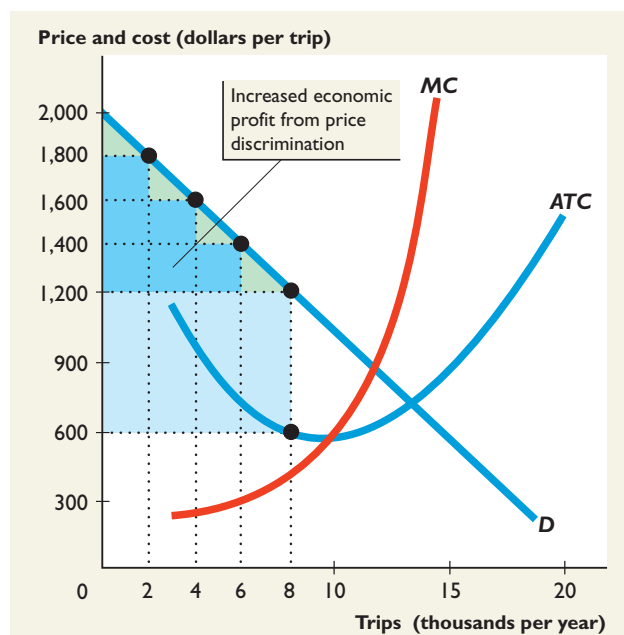
Perfect price discrimination
Price discrimination that extracts the entire consumer surplus by charging the highest price that consumers are willing to pay for each unit.

FIGURE 12.9
Price Discrimination

MyEconLab Animation

Global revises its fare structure. It now offers no restrictions at \$1,800, 7-day advance purchase, refundable at \$1,600, 14-day advance purchase, nonrefundable at \$1,400, and 14-day advance purchase, must stay at least 7 days, at \$1,200.

Global sells 2,000 units at each of its four new fares. Its economic profit increases by \$2.4 million a year to \$7.2 million a year, which is shown by the original blue rectangle plus the blue steps. Global's customers' consumer surplus shrinks to the sum of the green areas.



Once Global is discriminating finely between different customers and getting from each customer the maximum he or she is willing to pay, something special happens to marginal revenue. Recall that for the single-price monopoly, marginal revenue is less than price. The reason is that when the price is cut to sell a larger quantity, the price is lower on all units sold. But with perfect price discrimination, Global sells only the marginal seat at the lower price. All the other customers continue to buy for the highest price they are willing to pay. So for the perfect price discriminator, marginal revenue equals price and the demand curve becomes the marginal revenue curve.

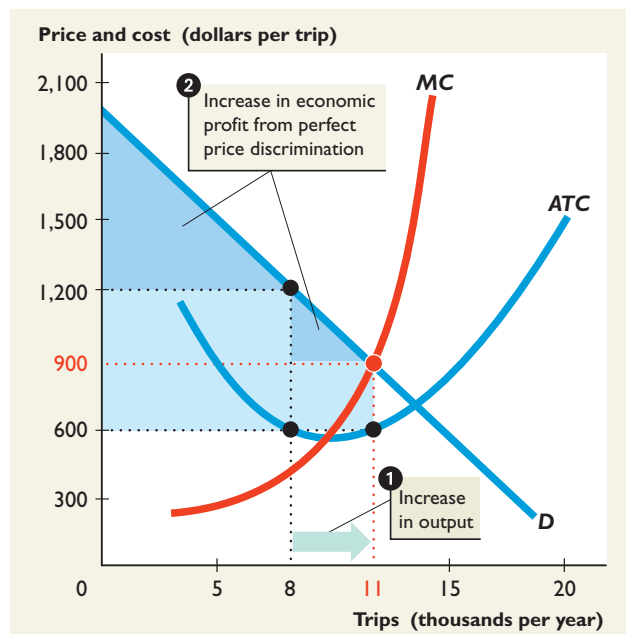
With marginal revenue equal to price, Global can obtain yet greater profit by increasing output up to the point at which price (and marginal revenue) is equal to marginal cost.

So Global now seeks additional travelers who will not pay as much as \$1,200 a trip but who will pay more than marginal cost. More creative pricing comes up with vacation specials and other fares that have combinations of advance reservation, minimum stay, and other restrictions that make these fares unattractive to Global's existing customers but attractive to a further group of travelers. With all these fares and specials, Global extracts the entire consumer surplus and maximizes economic profit.

Figure 12.10 shows the outcome with perfect price discrimination. The dozens of fares paid by the original travelers who are willing to pay between \$1,200 and \$2,000 have extracted the entire consumer surplus from this group and converted it into economic profit for Global. The new fares between \$900 and \$1,200 have attracted 3,000 additional travelers but have taken their entire consumer surplus also. Global is earning an economic profit of more than \$9 million a year.

FIGURE 12.10
Perfect Price Discrimination

MyEconLab Animation



With perfect price discrimination, the demand curve becomes Global's marginal revenue curve. Economic profit is maximized when the lowest price equals marginal cost.

- ① Output increases to 11,000 passengers a year, and
- ② Global's economic profit increases to \$9.35 million a year.



EYE on the U.S. ECONOMY

Airline Price Discrimination

The normal coach fare from San Francisco to Washington, D.C., is \$1,555, refundable and with no charge for a checked bag. With a checked baggage charge, a refundable ticket is \$850 and a nonrefundable ticket is \$271. On a typical flight, passengers might be paying as many as 20 different fares.

The airlines sort their customers according to their willingness to pay by offering a variety of options that attract price-sensitive leisure travelers but don't get bought by business travelers.

Despite the sophistication of the airlines' pricing schemes, almost 20 percent of seats fly empty. The marginal cost of filling an empty seat is

close to zero, so a ticket sold at a few dollars would be profitable.

Low fares are now feasible, thanks to priceline.com and dozens of other online travel agents. Shopping around the airlines with bids from travelers, these agents broker thousands of tickets a day and obtain the lowest possible fares for their customers.



Would it bother you to hear how little I paid for this flight?

From William Hamilton, "Voodoo Economics," © 1992 by the Chronicle Publishing Company, p. 3. Reprinted with permission of Chronicle Books.

Price Discrimination and Efficiency

With perfect price discrimination, the monopoly increases output to the point at which price equals marginal cost. This output is identical to that of perfect competition. Perfect price discrimination pushes consumer surplus to zero but increases producer surplus to equal the sum of consumer surplus and producer surplus in perfect competition. Deadweight loss with perfect price discrimination is zero. So perfect price discrimination produces the efficient quantity.

But there are two differences between perfect competition and perfect price discrimination. First, the distribution of the total surplus is different. It is shared by consumers and producers in perfect competition while the producer gets it all with perfect price discrimination. Second, because the producer grabs all the total surplus, rent seeking becomes profitable.

Rent seekers use resources in pursuit of monopoly, and the bigger the rents, the greater is the incentive to use resources to pursue those rents. With free entry into rent seeking, the long-run equilibrium outcome is that rent seekers use up the entire producer surplus.

CHECKPOINT 12.4

Explain how price discrimination increases profit.

Practice Problems

Village, a small isolated town, has one doctor. For a 30-minute consultation, the doctor charges a rich person twice as much as a poor person.

1. Does the doctor practice price discrimination? Is the doctor using resources efficiently? Does the doctor's pricing scheme redistribute consumer surplus? If so, explain how.
2. If the doctor decided to charge everyone the maximum price that he or she would be willing to pay, what would be the consumer surplus? Would the market for medical service in Village be efficient?

In the News

Feast on these great dining deals

Entrées at Patina in Los Angeles start at \$40, but the four-course fixed menu is \$59. And pair that with the waived corkage fee on Tuesdays. At Michael Mina, San Francisco, enjoy a three-course, prix-fixe lunch for \$49 or pay up to \$65 when ordering the same items individually at dinner.

Source: *USA Today*, July 29, 2011

Are Patina and Michael Mina price discriminating? Explain your answer.

Solutions to Practice Problems

1. The doctor practices price discrimination because rich people and poor people pay a different price for the same service: a 30-minute consultation. The doctor provides the profit-maximizing number of consultations and charges rich people more than poor people. As a monopoly, the total number of consultations is less than that at which marginal benefit equals the marginal cost of providing the medical service. Because marginal benefit does not equal marginal cost, the doctor is not using resources efficiently. With price discrimination, some consumer surplus is redistributed to the doctor as profit.
2. The doctor decides to practice perfect price discrimination. If successful, with perfect price discrimination, marginal revenue equals price. To maximize economic profit, the doctor increases the number of consultations to make the lowest price charged equal to the marginal cost of providing the service. The doctor takes the entire consumer surplus, so consumer surplus is zero.
Marginal benefit equals price, so resources are being used efficiently.

Solution to In the News

A restaurant meal cannot be resold, so price discrimination is possible. Offering a four-course fixed menu at a lower price than the sum of the prices of the individual items is price discrimination. Diners who want fewer than four courses and want to be more selective about what they eat pay more. Waiving the corkage fee on Tuesdays is not price discrimination. Demand is lower on Tuesdays, so the profit-maximizing price is lower. Waiving the corkage fee is a way of price cutting without reprinting the menu.

MyEconLab

You can work these problems in Study Plan 12.4 and get instant feedback.

12.5 MONOPOLY REGULATION

Natural monopoly presents a dilemma. With economies of scale, a natural monopoly produces at the lowest possible cost. But with market power, the monopoly has an incentive to raise the price above the competitive price and produce too little—to operate in the self-interest of the monopoly and not in the social interest.

Regulation

Rules administered by a government agency to influence prices, quantities, entry, and other aspects of economic activity in a firm or industry.

Regulation—rules administered by a government agency to influence prices, quantities, entry, and other aspects of economic activity in a firm or industry—is a possible solution to this dilemma.

To implement regulation, the government establishes agencies to oversee and enforce the rules. For example, the Surface Transportation Board regulates prices on interstate railroads and some trucking and bus lines, and water and oil pipelines. By the 1970s, almost a quarter of the nation's output was produced by regulated industries (far more than just natural monopolies) and a process of deregulation began.

Deregulation

The process of removing regulation of prices, quantities, entry, and other aspects of economic activity in a firm or industry.

Deregulation is the process of removing regulation of prices, quantities, entry, and other aspects of economic activity in a firm or industry. During the past 30 years, deregulation has occurred in domestic air transportation, telephone service, interstate trucking, and banking and financial services. Cable TV was deregulated in 1984, re-regulated in 1992, and deregulated again in 1996.

Regulation is a *possible* solution to the dilemma presented by natural monopoly but not a sure bet solution. There are two theories about how regulation actually works: the *social interest theory* and the *capture theory*.

Social interest theory

The theory that regulation achieves an efficient allocation of resources.

The **social interest theory** is that the political and regulatory process relentlessly seeks out inefficiency and introduces regulation that eliminates deadweight loss and allocates resources efficiently.

Capture theory

The theory that the regulation serves the self-interest of the producer and results in maximum profit, underproduction, and deadweight loss.

The **capture theory** is that the political and regulatory process gets captured by the regulated firm and ends up serving its self-interest, with maximum economic profit, underproduction, and deadweight loss. The regulator gets captured because the producer's gain is large and visible while each individual consumer's is small and invisible. No individual consumer has an incentive to oppose the regulation, but the producer has a big incentive to lobby for it.

Which theory of regulation best explains real-world regulations? Does regulation serve the social interest or the self-interest of monopoly producers?

■ Efficient Regulation of a Natural Monopoly

A cable TV company is a *natural monopoly* (pp. xxx–xxx)—it can supply the entire market at a lower price than two or more competing firms can. Cox Communications, based in Atlanta, supplies cable TV to households in 16 states. It has invested heavily in satellite receiving dishes, cables, and control equipment and so has large fixed costs. These fixed costs are part of the company's average total cost. Its average total cost decreases as the number of households served increases because the fixed cost is spread over a larger number of households. Unregulated, Cox Communications serves the number of households that maximizes profit. Like all single-price monopolies, the profit-maximizing quantity is less than the efficient quantity and underproduction results in a deadweight loss (see Figure 12.6, p. xxx).

How can Cox be regulated to produce the efficient quantity of cable TV service? The answer is by being regulated to set its price equal to marginal cost, known as the **marginal cost pricing rule**. The quantity demanded at a price equal

Marginal cost pricing rule

A rule that sets price equal to marginal cost to achieve an efficient output.

to marginal cost is the efficient quantity—the quantity at which marginal benefit equals marginal cost.

Figure 12.11 illustrates the marginal cost pricing rule. The demand curve for cable TV is D . Cox's marginal cost curve is MC . That marginal cost curve is (assumed to be) horizontal at \$10 per household per month—that is, the cost of providing each additional household with a month of cable programming is \$10. The efficient outcome occurs if the price is regulated at \$10 per household per month with 8 million households served.

But there is a problem: Because average total cost exceeds marginal cost, a firm that follows the marginal cost pricing rule incurs an economic loss. So a cable TV company that is required to use a marginal cost pricing rule will not stay in business for long. How can the firm cover its costs and, at the same time, obey a marginal cost pricing rule?

One possibility is price discrimination (see pp. xxx–xxx). Another possibility is to use a two-part price (called a *two-part tariff*). For example, local telephone companies charge consumers a monthly fee for being connected to the telephone system and then charge a price equal to marginal cost (zero) for each local call. A cable TV operator can charge a one-time connection fee that covers its fixed cost and then charge a monthly fee equal to marginal cost.

■ Second-Best Regulation of a Natural Monopoly

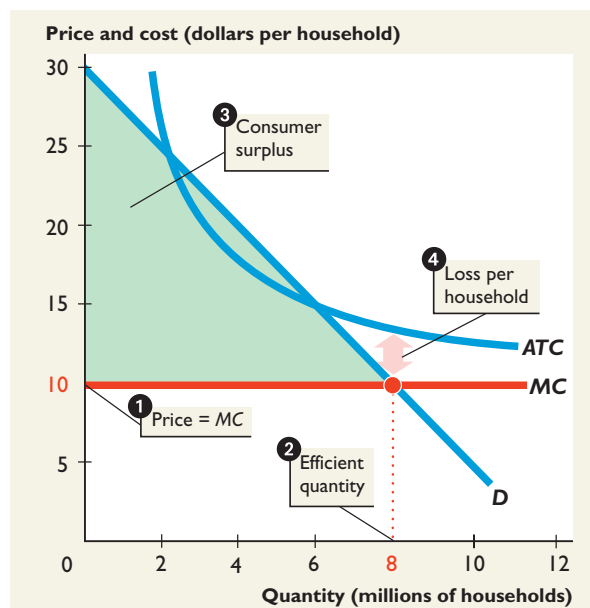
A natural monopoly cannot always be regulated to achieve an efficient outcome. Two possible ways of enabling a regulated monopoly to avoid an economic loss are

- Average cost pricing
- Government subsidy

■ FIGURE 12.11

Natural Monopoly: Marginal Cost Pricing

MyEconLab Animation



The market demand curve for cable TV is D . A cable TV operator's marginal cost MC is a constant \$10 per household per month. Its fixed cost is large, and the average total cost curve, which includes average fixed cost, is ATC .

① Price is set equal to marginal cost at \$10 a month.

At this price, ② the efficient quantity (8 million households) is served.

③ Consumer surplus is maximized as shown by the green triangle.

④ The firm incurs a loss on each household served, shown by the red arrow.

Average cost pricing rule

A rule that sets price equal to average total cost to enable a regulated firm to avoid economic loss.

Average Cost Pricing

The **average cost pricing rule** sets price equal to average total cost. With this rule the firm produces the quantity at which the average total cost curve cuts the demand curve. This rule results in the firm making zero economic profit—breaking even. But because for a natural monopoly average total cost exceeds marginal cost, the quantity produced is less than the efficient quantity and a deadweight loss arises. Figure 12.12 illustrates the average cost pricing rule. The price is \$15 a month and 6 million households get cable TV. The gray triangle shows the deadweight loss.

Government Subsidy

A government subsidy is a direct payment to the firm equal to its economic loss. But to pay a subsidy, the government must raise the revenue by taxing some other activity. Taxes themselves generate deadweight loss.

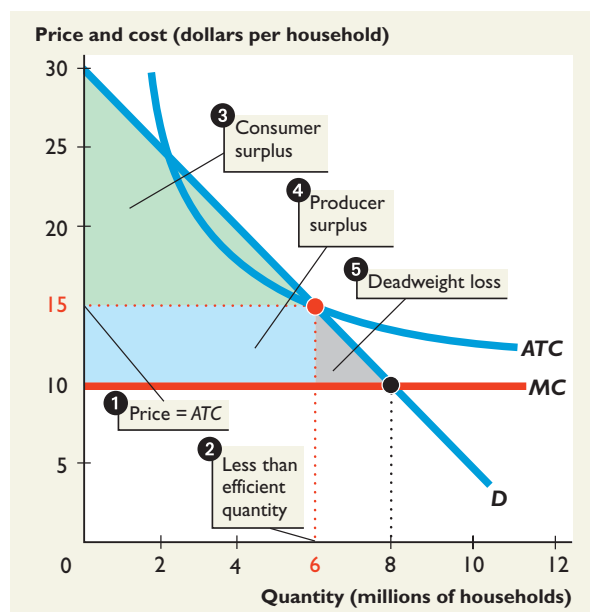
And the Second-Best Is...

Which is the better option, average cost pricing or marginal cost pricing with a government subsidy? The answer turns on the relative magnitudes of the two deadweight losses. Average cost pricing generates a deadweight loss in the market served by the natural monopoly. A subsidy generates deadweight losses in the markets for the items that are taxed to pay the subsidy. The smaller deadweight loss is the second-best solution to regulating a natural monopoly. Making this calculation in practice is too difficult and average cost pricing is generally preferred to a subsidy.

FIGURE 12.12
Natural Monopoly: Average Cost Pricing

MyEconLab Animation

- 1 Price is set equal to average total cost at \$15 a month.
- At this price, 2 the quantity served (6 million households) is less than the efficient quantity (8 million households).
- 3 Consumer surplus shrinks to the smaller green triangle.
- 4 A producer surplus enables the firm to pay its total fixed cost and break even.
- 5 A deadweight loss, shown by the gray triangle, arises.





EYE on MICROSOFT

Are Microsoft's Prices Too High?

Microsoft's prices are too high in the sense that they exceed marginal cost and result in fewer copies of the Windows operating system and Office application than the efficient quantities.

Profit Maximization

The figure illustrates how Microsoft prices its products to maximize profit. The demand for copies of the Windows Vista operating system is D . The marginal revenue curve is MR . The marginal cost of an additional copy of Vista is very small and we assume it to be zero, with marginal cost curve MC .

Profit is maximized by producing the quantity at which marginal revenue equals marginal cost. In the figure, that quantity is 4 million copies of Vista per month. The price is \$300 per copy and Microsoft receives a producer surplus shown by the blue rectangle.

Inefficiency

The efficient quantity is 8 million copies per month, where price and marginal benefit equal marginal cost. Because the actual quantity is smaller than the efficient quantity, a deadweight loss arises and the gray triangle shows its magnitude. The green triangle shows the consumer surplus.

Fixed Cost

The marginal cost of a copy of Windows Vista might be close to zero but the fixed cost of developing the software is large. Microsoft must at least earn enough revenue to pay these fixed costs.

Earning enough to pay the firm's fixed costs does not inevitably lead to inefficiency. Some firms with zero marginal cost and the market power to charge a high price do choose to provide the efficient quantity of their services at a zero price.

The Google Solution

Google is one such firm. The price of an Internet search on Google is zero. The quantity of searches is that at which the marginal benefit of a search equals the zero marginal cost, so the quantity of searches is the efficient quantity.

Google earns revenue, and a very large revenue, by selling advertising that

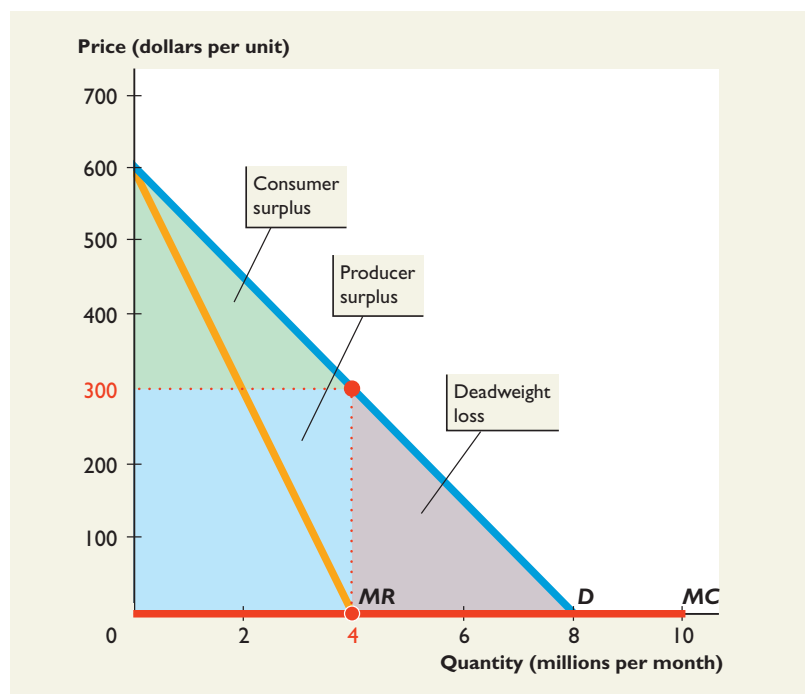
more than pays its fixed operating costs.

Efficiency

Advertising on Google is more effective than a TV or poster advertisement because it is targeted at potential buyers of products based on the topics of their searches.

The Google solution delivers the efficient quantity of zero-marginal-cost Internet search activity.

The Google solution might also deliver the efficient quantity of advertising. It will do so if Google is able to achieve perfect price discrimination in the market for advertising.



Implementing average cost pricing presents the regulator with a challenge because it is not possible to be sure of a firm's costs. So regulators use one of two practical rules:

- Rate of return regulation
- Price cap regulation

Rate of return regulation

A regulation that sets the price at a level that enables a firm to earn a specified target rate of return on its capital.

Rate of Return Regulation

Under **rate of return regulation**, the price is set at a level that enables the firm to earn a specified target rate of return on its capital. This type of regulation can end up serving the self-interest of the firm rather than the social interest. The firm's managers have an incentive to inflate costs by spending on items such as private jets, free baseball tickets (disguised as public relations expenses), and lavish entertainment. Managers also have an incentive to use more capital than the efficient amount. The *rate* of return on capital is regulated but not the *total* return on capital, and the greater the amount of capital, the greater is the total return.

Price cap regulation

A rule that specifies the highest price that a firm is permitted to set—a price ceiling.

Price Cap Regulation

For the reason that we've just examined, rate of return regulation is increasingly being replaced by price cap regulation. A **price cap regulation** is a price ceiling—a rule that specifies the highest price the firm is permitted to set. This type of regulation lowers the price and gives the firm an incentive to minimize its costs. But what happens to the quantity produced?

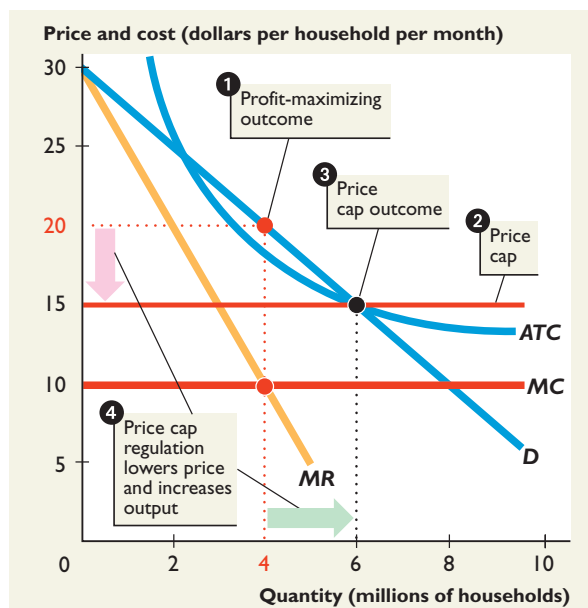
Recall that in a competitive market, a price ceiling set below the equilibrium price decreases output and creates a shortage. In contrast, in natural monopoly a price

FIGURE 12.13

Natural Monopoly: Price Cap Regulation

MyEconLab Animation

- 1 With no regulation, a cable TV operator serves 4 million households at a price of \$20 a month.
- 2 A price cap regulation sets the maximum price at \$15 a month.
- 3 Only when 6 million households are served can the firm break even. (When fewer than 6 million households are served or more than 6 million households are served, the firm incurs an economic loss.) The firm has an incentive to keep costs as low as possible and to produce the quantity demanded at the price cap.
- 4 The price cap regulation lowers the price and increases the quantity.



ceiling increases output. The reason is that at the regulated price, the firm can sell any quantity it chooses up to the quantity demanded. So each additional unit sold brings in the same additional revenue: marginal revenue equals price. The regulated price exceeds marginal cost, so the profit-maximizing quantity becomes the quantity demanded at the price ceiling.

Figure 12.13 illustrates this outcome. Unregulated, a cable TV operator maximizes profit by serving 4 million households at a price of \$20 a month. With a price cap set at \$15 a month, the firm is permitted to sell any quantity it chooses at that price or at a lower price. The profit-maximizing quantity now increases to 6 million households. Serving fewer than 6 million households, the firm incurs a loss—average total cost exceeds the price cap. Serving more than 6 million households is possible but only by lowering the price along the demand curve. Again, average total cost exceeds price and the firm incurs a loss.

In Figure 12.13, the price cap delivers average cost pricing. In practice, the regulator might set the cap too high. For this reason, price cap regulation is often combined with **earnings sharing regulation**—a regulation that requires firms to make refunds to customers when profits rise above a target level.

Earnings sharing regulation

A regulation that requires firms to make refunds to customers when profits rise above a target level.



EYE on YOUR LIFE

Monopoly in Your Everyday Life

When Bill Gates decided to quit Harvard in 1975, he realized that PCs would need an operating system and applications programs to interact with the computer's hardware. He also knew that whoever owned the copy-

right on these programs would have a license to print money. And he wanted to be that person.

In less than 30 years, Bill Gates became the world's richest person. Such is the power of the right monopoly.

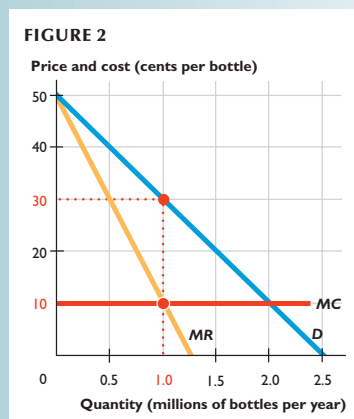
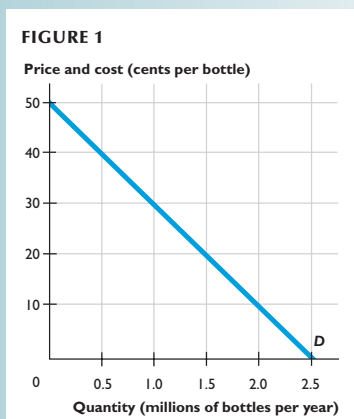
You, along with millions of other PC users, have willingly paid the monopoly price for Windows and Microsoft Office. Sure, the marginal cost of a copy of these programs is close to zero, so the quantity sold is way too few. There is a big deadweight loss.

Compared with the alternative of no Windows, you're better off. But are you better off than you would be if there were many alternatives to Windows competing for your attention? To answer this question, think about the applications—spreadsheets, word processing, and so on—that you need to make your computer useful. With lots of operating systems, what would happen to the cost of developing applications? Would you have more or less choice?



MyEconLab

You can work these problems in Study Plan 12.5 and get instant feedback.



CHECKPOINT 12.5

Explain why natural monopoly is regulated and the effects of regulation.

Practice Problems

An unregulated natural monopoly bottles Elixir, a unique health product that has no substitutes. The monopoly's total fixed cost is \$150,000, and its marginal cost is 10¢ a bottle. Figure 1 illustrates the demand for Elixir.

1. How many bottles of Elixir does the monopoly sell and what is the price of a bottle of Elixir? Is the monopoly's use of resources efficient?
2. Suppose that the government introduces a marginal cost pricing rule. What is the price of Elixir, the quantity sold, and the monopoly's economic profit?
3. Suppose that the government introduces an average cost pricing rule. What is the price of Elixir, the quantity sold, and the monopoly's economic profit?

In the News

Mexicans protest the plan to end the state oil monopoly

Protesters fight the plan to open Mexico's state oil monopoly to private investment. In Mexico, the government sets the price and taxes the monopoly's profit. The price in Mexico is \$2.48 a gallon and in the United States is \$3.37 a gallon.

Source: *USA Today*, April 13, 2008

Describe how the Mexican government regulates the domestic oil market.

Solutions to Practice Problems

1. The monopoly will produce 1 million bottles a year—the quantity at which marginal revenue equals marginal cost. The price is 30¢ a bottle—the highest price at which the monopoly can sell the 1 million bottles a year (Figure 2). The monopoly's use of resources is inefficient. If resource use were efficient, the monopoly would produce the quantity at which marginal benefit (price) equals marginal cost: 2 million bottles a year.
2. With a marginal cost pricing rule, the price is 10¢ a bottle and the monopoly produces 2 million bottles a year. The monopoly incurs an economic loss equal to its total fixed costs of \$150,000 a year. The monopoly would need a subsidy from the government to keep it in business.
3. With an average cost pricing rule, the firm produces the quantity at which price equals average total cost. Average total cost equals average variable cost plus average fixed cost. Average variable cost equals marginal cost and is 10¢ a bottle. Average fixed cost is \$150,000 divided by the quantity produced. For example, at 1 million bottles, average fixed cost is 15¢ and at 1.5 million bottles, average fixed cost is 10¢ a bottle. The average total cost of producing 1.5 million bottles is 20¢ a bottle and they can be sold for 20¢ a bottle. So the monopoly produces 1.5 million bottles a year and breaks even.

Solution to In the News

The price is not set equal to marginal cost (marginal cost pricing) because the oil company does not receive a subsidy. The price is not set equal to average total cost (average cost pricing) because the oil company does not break even. The government operates a price cap regulation and the company pays a profit tax.

CHAPTER SUMMARY

Key Points

- 1 Explain how monopoly arises and distinguish between single-price monopoly and price-discriminating monopoly.**
 - In monopoly, a single producer of a good or service that has no close substitutes operates behind natural, ownership, or legal barriers to entry.
 - A monopoly can price discriminate when there is no resale possibility.
 - Where resale is possible, a firm charges a single price.
- 2 Explain how a single-price monopoly determines its output and price.**
 - The demand for a monopoly's output is the market demand, and a single-price monopoly's marginal revenue is less than price.
 - A monopoly maximizes profit by producing the quantity at which marginal revenue equals marginal cost and by charging the maximum price that consumers are willing to pay for that quantity.
- 3 Compare the performance of a single-price monopoly with that of perfect competition.**
 - A single-price monopoly charges a higher price and produces a smaller quantity than does a perfectly competitive market and creates a deadweight loss.
 - Monopoly imposes a loss on society that equals its deadweight loss plus the cost of the resources devoted to rent seeking.
- 4 Explain how price discrimination increases profit.**
 - Perfect price discrimination captures the entire consumer surplus. Prices are the highest that each consumer is willing to pay for each unit.
 - With perfect price discrimination, the monopoly is efficient but rent seeking uses some or all of the producer surplus.
- 5 Explain why natural monopoly is regulated and the effects of regulation.**
 - Regulation might achieve an efficient use of resources or help the monopoly to maximize economic profit.
 - A natural monopoly is efficient if its price equals marginal cost, but a second-best outcome is for price to equal average total cost.
 - A price cap supported by earnings sharing regulation is the most effective practical method of regulating a natural monopoly.

Key Terms

Average cost pricing rule, 328
 Barrier to entry, 306
 Capture theory, 326
 Deregulation, 326
 Earnings sharing regulation, 331
 Legal monopoly, 307

Marginal cost pricing rule, 326
 Monopoly, 306
 Natural monopoly, 306
 Perfect price discrimination, 322
 Price cap regulation, 330
 Price-discriminating monopoly, 308

Rate of return regulation, 330
 Regulation, 326
 Rent seeking, 317
 Single-price monopoly, 308
 Social interest theory, 326

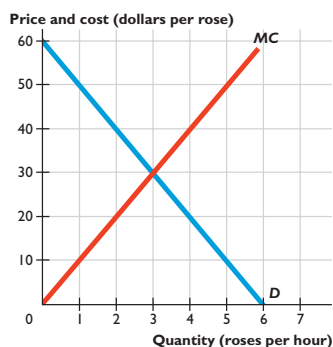
MyEconLab

You can work these problems in Chapter 12 Study Plan and get instant feedback.

TABLE 1

| Price (dollars per bottle) | Quantity (bottles per day) |
|-------------------------------|-------------------------------|
| 10 | 0 |
| 8 | 2,000 |
| 6 | 4,000 |
| 4 | 6,000 |
| 2 | 8,000 |
| 0 | 10,000 |

FIGURE 1



CHAPTER CHECKPOINT

Study Plan Problems and Applications

- Under what conditions does monopoly arise? Under what conditions can a monopoly price discriminate?

Use the following information to work Problems 2 to 4.

Elixir Spring produces a unique and highly prized mineral water. The firm's total fixed cost is \$5,000 a day, and its marginal cost is zero. Table 1 shows the demand schedule for Elixir water.

- On a graph, show the demand curve for Elixir water and Elixir Spring's marginal revenue curve. What are Elixir's profit-maximizing price, output, and economic profit?
- Compare Elixir's profit-maximizing price with the marginal cost of producing the profit-maximizing output. At the profit-maximizing price, is the demand for Elixir water inelastic or elastic?
- Suppose that there are 1,000 springs, all able to produce this water at zero marginal cost and with zero fixed costs. Compare the equilibrium price and quantity produced with the price and quantity produced by Elixir water.
- The Blue Rose Company is the only flower grower to have cracked the secret of making a blue rose. Figure 1 shows the demand for blue roses and the marginal cost of producing a blue rose. What is Blue Rose's profit-maximizing output? What price does it charge? Is the Blue Rose Company using its resources efficiently?

Hawaii Cable Television is a natural monopoly. Sketch a market demand curve and the firm's cost curves. Use your graph to work Problems 6 to 9.

- If Hawaii Cable is unregulated and maximizes profit, show in your graph the price, quantity, economic profit, consumer surplus, and deadweight loss.
- If Hawaii Cable is unregulated and it gives householders a 50 percent discount for second and third connections, describe how its economic profit, consumer surplus, and deadweight loss would change.
- If Hawaii Cable is regulated in the social interest, show in your graph the price, quantity, economic profit, consumer surplus, and deadweight loss.
- If Hawaii Cable is subject to a price cap regulation that enables it to break even, show in your graph the price, quantity, economic profit, consumer surplus, and deadweight loss.

Use the following information to work Problems 10 and 11.

FCC planning rules to open cable market

The Federal Communications Commission (FCC) will make it easier for independent programmers and rival video services to lease access to cable channels. The FCC will also limit the market share of a cable company to 30 percent.

Source: *The New York Times*, November 10, 2007

- What barriers to entry exist in the cable television market? Are high cable prices evidence of monopoly power?
- Draw a graph to illustrate the effects of the FCC's new regulations on the price, quantity, consumer surplus, producer surplus, and deadweight loss.

Instructor Assignable Problems and Applications



Use the following information to work Problems 1 and 2.

Microsoft: We're not gouging Europe on Windows 7 pricing

Regulators in the European Union have charged Microsoft with illegally tying Internet Explorer (IE) to Windows and mandated that a version of Windows be offered stripped of IE. A news report suggested that when Microsoft launches Windows 7, it will charge a higher price for the IE-stripped version than the price for a full version that includes IE. Microsoft denied this report but announced that it would offer the full version of Windows 7 at a lower upgrade price.

Source: computerworld.com

1. How does Microsoft set the price of Windows and would it be in the firm's self-interest to set a different price for a version stripped of IE?
2. Why might Microsoft offer the full version of Windows 7 to European customers at a lower upgrade price?

Use the following information to work Problems 3 and 4.

Bobbie's Hair Care is a natural monopoly. Table 1 shows the demand schedule (the first two columns) and Bobbie's marginal cost schedule (the middle and third columns). Bobbie has done a survey and discovered that she has four types of customers each hour: one woman who is willing to pay \$18, one senior who is willing to pay \$16, one student who is willing to pay \$14, and one boy who is willing to pay \$12. Suppose that Bobbie's fixed costs are \$20 an hour and Bobbie's price discriminates.

3. What is the price each type of customer is charged and how many haircuts an hour does Bobbie's sell? What is the increase in Bobbie's economic profit that results from price discrimination?
4. Who benefits from Bobbie's price discrimination? Is the quantity of haircuts efficient?

Use the following information to work Problems 5 to 10.

Big Top is the only circus in the nation. Table 2 sets out the demand schedule for circus tickets and the cost schedule for producing the circus.

5. Calculate Big Top's profit-maximizing price, output, and economic profit if it charges a single price for all tickets.
6. When Big Top maximizes profit, what is the consumer surplus and producer surplus and is the circus efficient? Explain why or why not.
7. At the market equilibrium price, no children under 10 years old attend the circus. Big Top offers children under 10 a discount of 50 percent. How will this discount change the consumer surplus and producer surplus? Will Big Top be more efficient by offering the discount to children?
8. If Big Top is regulated to produce the efficient output, what is the quantity of tickets sold, what is the price of a ticket, and what would be the consumer surplus?
9. If Big Top is regulated to charge a price equal to average total cost, what is the quantity of tickets sold, the price of a ticket, and economic profit?
10. Draw a graph to illustrate the circus market if regulators set a price cap that enables Big Top to break even. Show the deadweight loss in your graph.

Your instructor can assign these problems as homework, a quiz, or a test in [MyEconLab](#).

TABLE 1

| Price (dollars per haircut) | Quantity (haircuts per hour) | Marginal cost (dollars per hour) |
|-----------------------------|------------------------------|----------------------------------|
| 20 | 0 | — |
| 18 | 1 | 1 |
| 16 | 2 | 4 |
| 14 | 3 | 8 |
| 12 | 4 | 12 |
| 10 | 5 | 18 |

TABLE 2

| Price (dollars per ticket) | Quantity (tickets per show) | Total cost (dollars per show) |
|----------------------------|-----------------------------|-------------------------------|
| 20 | 0 | 1,000 |
| 18 | 100 | 1,600 |
| 16 | 200 | 2,200 |
| 14 | 300 | 2,800 |
| 12 | 400 | 3,400 |
| 10 | 500 | 4,000 |
| 8 | 600 | 4,600 |
| 6 | 700 | 5,200 |
| 4 | 800 | 5,800 |

MyEconLab

You can work this quiz in Chapter 12 Study Plan and get instant feedback.

Multiple Choice Quiz

1. A firm is a natural monopoly if _____.
 - A. it can produce the good at a price below its competitor's price
 - B. it can produce a larger quantity of the good than other firms could
 - C. the government grants it a public franchise or patent
 - D. it can satisfy the market demand at a lower average total cost than other firms can
2. A monopoly _____.
 - A. can choose its price and output and always has the option of price discriminating
 - B. is a price taker and by offering a range of discounts can price discriminate
 - C. that produces a good that cannot be resold might choose to price discriminate
 - D. book store that offers a discount on Tuesdays is price discriminating
3. A single-price monopoly maximizes profit by producing the quantity at which _____.
 - A. its total revenue will be as large as possible
 - B. marginal revenue equals marginal cost and setting the price equal to marginal revenue
 - C. marginal revenue equals marginal cost and setting the price equal to marginal cost
 - D. marginal revenue equals marginal cost and setting the price equal to the most people are willing to pay for that quantity
4. A monopoly sets its price such that demand for the good produced is _____.
 - A. unit elastic
 - B. inelastic
 - C. elastic
 - D. either elastic or inelastic, but never unit elastic
5. A single-price monopoly is _____.
 - A. inefficient because it converts consumer surplus to producer surplus
 - B. inefficient because it produces too small an output and creates a dead-weight loss
 - C. efficient because buyers are paying a price equal to their willingness to pay
 - D. efficient because it is the only producer of the good
6. A monopoly that price discriminates _____.
 - A. benefits buyers because it offers the good at a variety of prices
 - B. gains because it converts consumer surplus to economic profit
 - C. uses resources more efficiently than would a competitive market
 - D. enables buyers to maximize their consumer surplus
7. Governments regulate natural monopoly by capping the price at _____.
 - A. marginal revenue and allowing the monopoly to maximize profit
 - B. marginal cost so that the monopoly is efficient and makes zero economic profit
 - C. average total cost, which allows the monopoly to be inefficient but make zero economic profit
 - D. the buyers' willingness to pay, which makes the monopoly operate efficiently



Which cell phone?
Are two computer chip-makers
two too few?

Monopolistic Competition and Oligopoly



CHAPTER CHECKLIST

When you have completed your study of this chapter, you will be able to

- 1 Explain how a firm in monopolistic competition determines its price and quantity.
- 2 Explain why advertising costs are so high in monopolistic competition.
- 3 Explain the dilemma faced by firms in oligopoly.
- 4 Use game theory to explain how price and quantity are determined in oligopoly.

13.1 WHAT IS MONOPOLISTIC COMPETITION?

Most real-world markets lie between the extremes of perfect competition in Chapter 11 and monopoly in Chapter 12. Most firms possess some power to set their prices as monopolies do, and they face competition from the entry of new firms as the firms in perfect competition do. We call the markets in which such firms operate *monopolistic competition*. The other market structure that we study in this chapter, *Oligopoly*, also lies between perfect competition and monopoly.

Monopolistic competition is a market structure in which

- A large number of firms compete.
- Each firm produces a differentiated product.
- Firms compete on price, product quality, and marketing.
- Firms are free to enter and exit.

■ Large Number of Firms

In monopolistic competition, as in perfect competition, the industry consists of a large number of firms. The presence of a large number of firms has three implications for the firms in the industry.

Small Market Share

Each firm supplies a small part of the market. Consequently, while each firm can influence the price of its own product, it has little power to influence the average market price.

No Market Dominance

Each firm must be sensitive to the average market price of the product, but it does not pay attention to any one individual competitor. Because all the firms are relatively small, no single firm can dictate market conditions, so no one firm's actions directly affect the actions of the other firms.

Collusion Impossible

Firms sometimes try to profit from illegal agreements—collusion—with other firms to fix prices and not undercut each other. Collusion is impossible when the market has a large number of firms, as it does in monopolistic competition.

■ Product Differentiation

Product differentiation is making a product that is slightly different from the products of competing firms. A differentiated product has close substitutes but it does not have perfect substitutes. Some people will pay more for one variety of the product, so when its price rises, the quantity demanded decreases but it does not (necessarily) decrease to zero. For example, Adidas, Asics, Diadora, Etonic, Fila, New Balance, Nike, Puma, and Reebok all make differentiated running shoes. Other things remaining the same, if the price of Adidas running shoes rises and the prices of the other shoes remain constant, Adidas sells fewer shoes.

■ Competing on Quality, Price, and Marketing

Product differentiation enables a firm to compete with other firms in three areas: quality, price, and marketing.



About 20 firms, each with a small market share, produce a wide variety of treadmills.

Product differentiation

Making a product that is slightly different from the products of competing firms.

Quality

The quality of a product is the physical attributes that make it different from the products of other firms. Quality includes design, reliability, the service provided to the buyer, and the buyer's ease of access to the product. Quality lies on a spectrum that runs from high to low. Go to the J.D. Power Consumer Center at jdpower.com, and you'll see the many dimensions on which this rating agency describes the quality of autos, boats, financial services, travel and accommodation services, telecommunication services, and new homes—all examples of products that have a large range of quality variety.

Price

Because of product differentiation, a firm in monopolistic competition faces a downward-sloping demand curve. So, like a monopoly, the firm can set both its price and its output. But there is a tradeoff between the product's quality and price. A firm that makes a high-quality product can charge a higher price than a firm that makes a low-quality product.

Marketing

Because of product differentiation, a firm in monopolistic competition must market its product. Marketing takes two main forms: advertising and packaging. A firm that produces a high-quality product wants to sell it for a suitably high price. To be able to do so, it must advertise and package its product in a way that convinces buyers that they are getting the higher quality for which they are paying. For example, drug companies advertise and package their brand-name drugs to persuade buyers that these items are superior to the lower-priced generic alternatives. Similarly, a low-quality producer uses advertising and packaging to persuade buyers that although the quality is low, the low price more than compensates for this fact.

■ Entry and Exit

In monopolistic competition, there are no barriers to entry. Consequently, a firm cannot make an economic profit in the long run. When firms make economic profits, new firms enter the industry. This entry lowers prices and eventually eliminates economic profits. When economic losses are incurred, some firms leave the industry. This exit increases prices and profits of the remaining firms and eventually eliminates the economic losses. In long-run equilibrium, firms neither enter nor leave the industry and the firms in the industry make zero economic profit.

■ Identifying Monopolistic Competition

Several factors must be considered to identify monopolistic competition and distinguish it from perfect competition on the one side and oligopoly and monopoly on the other side. One of these factors is the extent to which a market is dominated by a small number of firms. To measure this feature of markets, economists use two indexes called measures of concentration. These indexes are

- The four-firm concentration ratio
- The Herfindahl-Hirschman Index

Four-firm concentration ratio

The percentage of the total revenue in an industry accounted for by the four largest firms in the industry.

Herfindahl-Hirschman Index

The square of the percentage market share of each firm summed over the 50 largest firms (or summed over all the firms if there are fewer than 50) in a market.

The **four-firm concentration ratio** is the percentage of the total revenue of the industry accounted for by the four largest firms in the industry. The range of the concentration ratio is from almost zero for perfect competition to 100 percent for monopoly. The boundary between monopolistic competition and oligopoly is generally regarded as being around 40 percent. A ratio of less than 40 percent is regarded as an indication of a competitive market—monopolistic competition.

The **Herfindahl-Hirschman Index**—also called the HHI—is the square of the percentage market share of each firm summed over the 50 largest firms (or summed over all the firms if there are fewer than 50) in a market. For example, if there are four firms in a market and the market shares of the firms are 50 percent, 25 percent, 15 percent, and 10 percent, the Herfindahl-Hirschman Index is

$$\text{HHI} = 50^2 + 25^2 + 15^2 + 10^2 = 3,450.$$

In perfect competition, the HHI is small. For example, if each of the 50 largest firms in an industry has a market share of 0.1 percent, the HHI is $0.1^2 \times 50 = 0.5$. In a monopoly, the HHI is 10,000—the firm has 100 percent of the market: $100^2 = 10,000$.

The HHI became a popular measure of the degree of competition during the 1980s, when the Justice Department used it to classify markets. A market in which the HHI is less than 1,000 is regarded as being competitive and an example of monopolistic competition. A market in which the HHI lies between 1,000 and 1,800 is regarded as being moderately competitive. It probably is an example of monopolistic competition. But a market in which the HHI exceeds 1,800 is regarded as being uncompetitive.

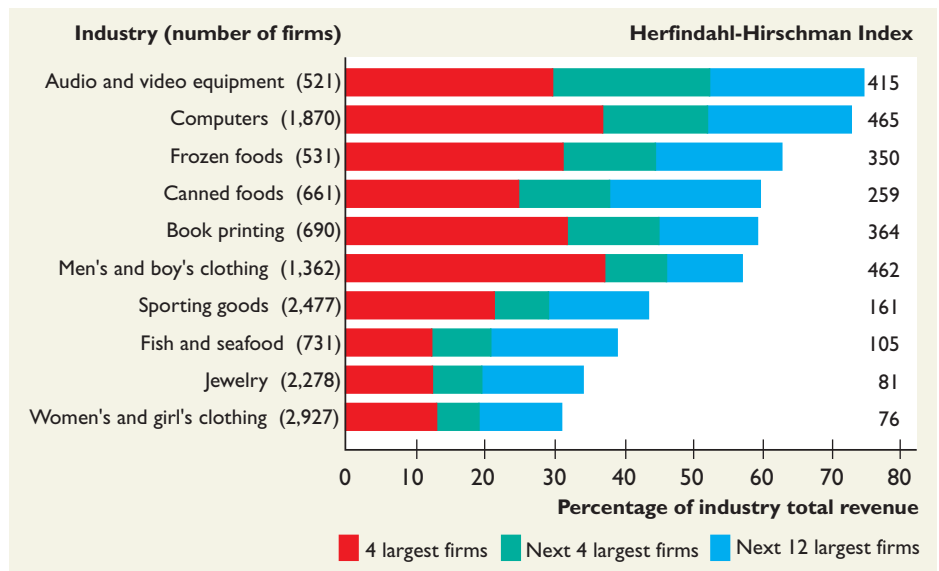
A market with a high concentration ratio or HHI might nonetheless be competitive because the few firms in a market face competition from many firms that can easily enter the market and will do so if economic profits are available.



EYE on the U.S. ECONOMY

Examples of Monopolistic Competition

These ten industries operate in monopolistic competition. They have a large number of firms, shown in parentheses after the industry's name. The red bars show the percentage of industry total revenue received by the 4 largest firms. The green bars show the percentage of industry total revenue received by the next 4 largest firms. The entire red, green, and blue bars show the percentage of industry total revenue received by the 20 largest firms. The Herfindahl-Hirschman Index is shown on the right.



Output and Price in Monopolistic Competition

Think about the decisions that Tommy Hilfiger must make about Tommy jeans. First, the firm must decide on the design and quality of its jeans and on its marketing program. We'll suppose that Tommy Hilfiger has already made these decisions so that we can concentrate on the firm's output and pricing decision. But we'll study quality and marketing decisions in the next section.

Because Tommy Hilfiger has chosen the quality of its jeans and the amount of marketing activity, it faces given costs and market demand. How, with these costs and market demand for its jeans, does Tommy Hilfiger decide the *quantity* of jeans to produce and the *price* at which to sell them?

The Firm's Profit-Maximizing Decision

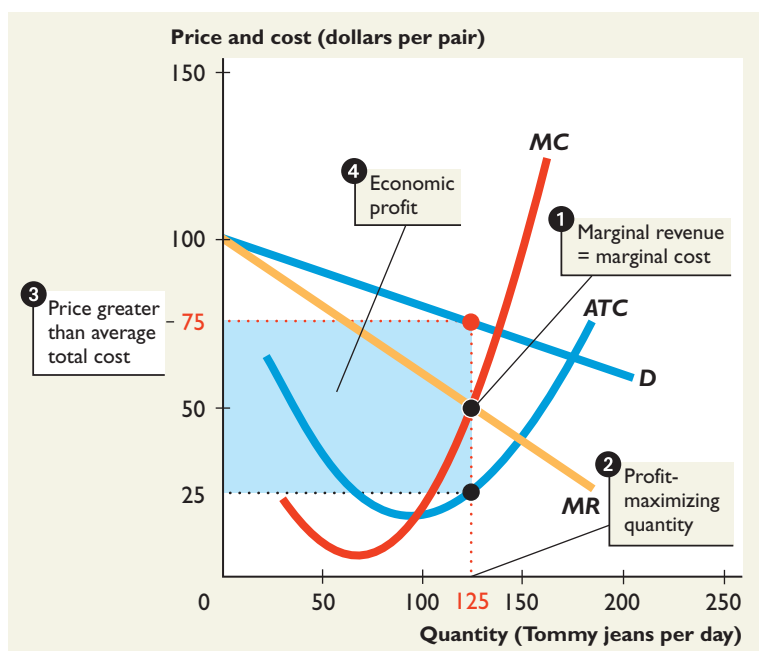
A firm in monopolistic competition makes its output and price decision just as a monopoly firm does. Tommy Hilfiger maximizes profit by producing the quantity at which marginal revenue equals marginal cost and by charging the highest price that buyers are willing to pay for this quantity.

Figure 13.1 illustrates this decision for Tommy jeans. The demand curve for Tommy jeans is D . The MR curve shows the marginal revenue curve associated with this demand curve and is derived just like the marginal revenue curve of a single-price monopoly in Chapter 12. The ATC curve shows the average total cost of producing Tommy jeans, and MC is the marginal cost curve. Profit is maximized by producing 125 pairs of jeans a day and selling them at a price of \$75 a pair. When Tommy Hilfiger produces 125 pairs of jeans a day, average total cost is \$25 a pair and economic profit is \$6,250 a day (\$50 a pair multiplied by 125 pairs a day). The blue rectangle shows Tommy Hilfiger's economic profit.

FIGURE 13.1

Output and Price in Monopolistic Competition

MyEconLab Animation



- 1 Profit is maximized where marginal revenue equals marginal cost.
- 2 The profit-maximizing quantity is 125 pairs of Tommy jeans a day.
- 3 The profit-maximizing price is \$75 a pair, which exceeds the average total cost of \$25 a pair, so the firm makes an economic profit of \$50 a pair.
- 4 The blue rectangle illustrates economic profit and its area, which equals \$6,250 a day (\$50 a pair multiplied by 125 pairs) measures economic profit.

So far, the firm in monopolistic competition looks like a single-price monopoly. It produces the quantity at which marginal revenue equals marginal cost and charges the price that buyers are willing to pay for that quantity. The key difference between monopoly and monopolistic competition lies in what happens next.

■ Long Run: Zero Economic Profit

In monopolistic competition there is no restriction on entry, so if firms in an industry are making economic profits, other firms have an incentive to enter that industry and each firm's economic profit falls. So in the long run, firms will enter until all firms are making zero economic profit.

Tommy Hilfiger is making an economic profit, which is an incentive for Gap and Calvin Klein to start to make jeans similar to Tommy jeans. As they enter the jeans market, the demand for Tommy jeans decreases. At each point in time, the firm maximizes its profit by producing the quantity at which marginal revenue equals marginal cost and by charging the highest price that buyers are willing to pay for this quantity. But as demand decreases, marginal revenue decreases and the profit-maximizing quantity and price fall.

Figure 13.2 shows the long-run equilibrium. The demand curve for Tommy jeans and the marginal revenue curve have shifted leftward. The firm produces 75 pairs of jeans a day and sells them for \$50 each. At this output level, average total cost is also \$50 a pair. So Tommy Hilfiger is making zero economic profit on its jeans. When all the firms in the industry are making zero economic profit, there is no incentive for new firms to enter.

If demand is so low relative to costs that firms incur economic losses, exit will occur. As firms leave an industry, the demand for the products of the remaining firms increases and their demand curves shift rightward. The exit process ends when all the firms in the industry are making zero economic profit.

■ **FIGURE 13.2**

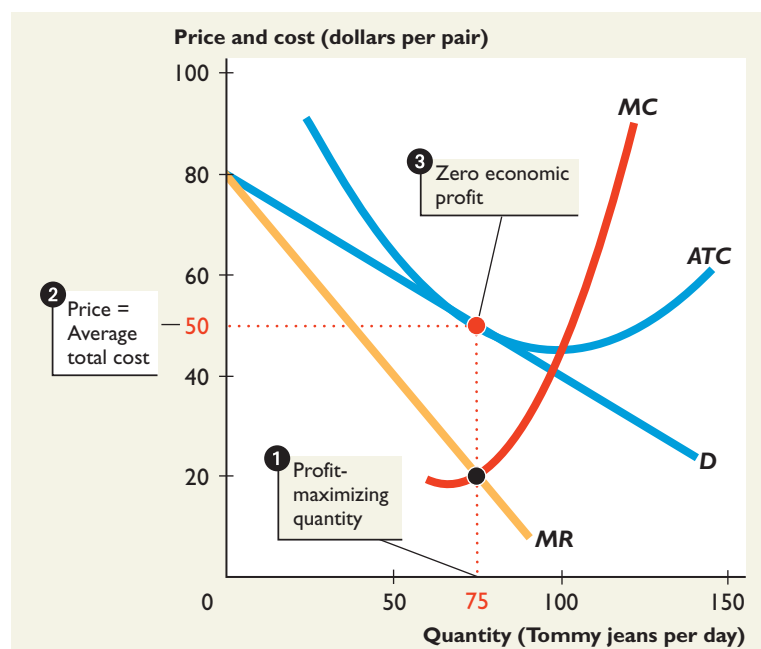
Output and Price in the Long Run

MyEconLab Animation

Economic profit encourages entry, which decreases the demand for each firm's product. Economic loss encourages exit, which increases the demand for each remaining firm's product.

When the demand curve touches the average total cost curve at the quantity at which marginal revenue equals marginal cost, the market is in long-run equilibrium.

- 1 The output that maximizes profit is 75 pairs of Tommy jeans a day.
- 2 The price, \$50 a pair, equals average total cost.
- 3 Economic profit is zero.



Monopolistic Competition and Perfect Competition

Efficiency requires that the marginal benefit of the consumer equal the marginal cost of the producer. Price measures marginal benefit, so efficiency requires price to equal marginal cost. In monopolistic competition, price exceeds marginal revenue and marginal revenue equals marginal cost, so price exceeds marginal cost—a sign of inefficiency.

But this inefficiency arises from product differentiation—variety—that consumers value and for which they are willing to pay. So the loss that arises because marginal benefit exceeds marginal cost must be weighed against the gain that arises from greater product variety. It is almost inconceivable that consumers would be better off with no variety and price equal to marginal cost. So in a broader view of efficiency, monopolistic competition brings gains for consumers.

Another interesting feature of firms in monopolistic competition is that they always have excess capacity in long-run equilibrium.

Excess Capacity

A firm's **efficient scale** is the quantity at which average total cost is a minimum—the quantity at the bottom of the U-shaped *ATC* curve. A firm's **excess capacity** is the amount by which its efficient scale exceeds the quantity that it produces. Figure 13.3 shows that in the long run Tommy Hilfiger produces 75 pairs of jeans a day and has excess capacity of 25 pairs of jeans a day. That is, Tommy Hilfiger produces a smaller output than that which minimizes average total cost. And because the demand curve slopes downward, the consumer pays a price that exceeds minimum average total cost. The demand curve slopes downward because of product differentiation. Product differentiation creates excess capacity.

Efficient scale

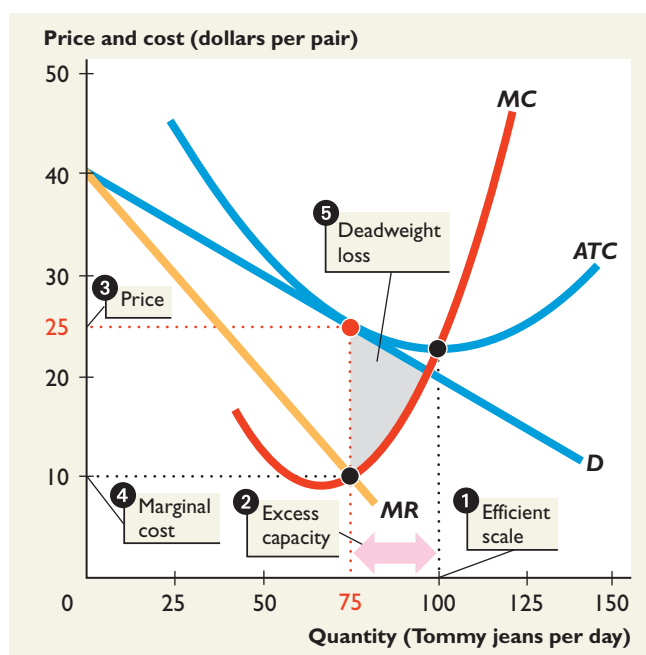
The quantity at which average total cost is a minimum.

Excess capacity

The amount by which the efficient scale exceeds the quantity that the firm produces.

FIGURE 13.3
Excess Capacity

MyEconLab Animation



1 The efficient scale (at minimum *ATC*) is 100 pairs a day.

In monopolistic competition in the long run, the firm produces 75 pairs of jeans a day and has 2 excess capacity of 25 pairs of jeans

3 Consumers pay a price that exceeds 4 marginal cost and a deadweight loss arises.

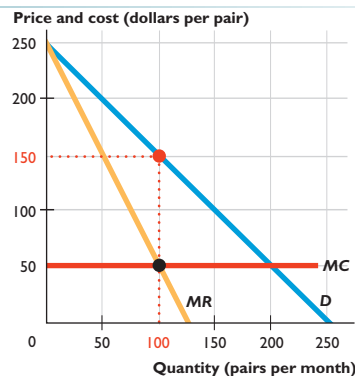
MyEconLab

You can work these problems in Study Plan 13.1 and get instant feedback.

TABLE 1

| Price (dollars per pair) | Quantity (pairs per month) |
|-----------------------------|-------------------------------|
| 250 | 0 |
| 200 | 50 |
| 150 | 100 |
| 100 | 150 |
| 50 | 200 |
| 0 | 250 |

FIGURE 1



CHECKPOINT 13.1

Explain how a firm in monopolistic competition determines its price and quantity.

Practice Problems

Natti is a dot.com entrepreneur who has established a Web site at which people can design and buy awesome sunglasses. Natti pays \$4,000 a month for her Web server and Internet connection. The sunglasses that her customers design are made to order by another firm, and Natti pays this firm \$50 a pair. Natti has no other costs. Table 1 shows the demand schedule for Natti's sunglasses.

1. Calculate Natti's profit-maximizing output, price, and economic profit.
2. Do you expect other firms to enter the market and compete with Natti?
3. What happens to the demand for Natti's sunglasses in the long run? What happens to Natti's economic profit in the long run?

In the News

Condé Nast shuts down Portfolio

Condé Nast Publications launched its monthly business magazine *Portfolio* less than two years ago. In late 2008, Condé Nast cut its payroll and advertising budgets by an average of 5 percent. *Portfolio* was hit with the biggest cuts. Recently, Condé Nast shut down *Portfolio*.

Source: *The Wall Street Journal*, April 28, 2009

Explain the effects of the payroll and advertising budget cuts on Condé Nast's economic loss in the short run. Why did Condé Nast shut down *Portfolio*?

Solutions to Practice Problems

1. Marginal cost, MC , is \$50 a pair—the price that Natti pays her supplier of sunglasses. To find marginal revenue, calculate the change in total revenue when the quantity increases by 1 pair of sunglasses. Figure 1 shows the demand curve, the marginal revenue curve, and the marginal cost curve. Profit is maximized when $MC = MR$ and Natti sells 100 pairs a month. The price is \$150, and average total cost, ATC , is \$90—the sum of \$50 marginal (and average variable) cost and \$40 average fixed cost. Economic profit is \$60 a pair on 100 pairs a month, so it is \$6,000 a month.
2. Natti is making an economic profit, so firms have an incentive to enter the Web sunglasses market and will do so.
3. As firms enter the market, the demand for Natti's sunglasses decreases, the price of Natti's sunglasses falls, and Natti's economic profit decreases. In the long run, Natti's will make zero economic profit.

Solution to In the News

Payroll and advertising budgets are fixed costs, so a cut in these costs shifts the ATC and MC curves downward. With no change in the prices of the magazines, Condé Nast's economic loss decreased. Condé Nast shut down *Portfolio* because its loss from *Portfolio* exceeded its total fixed cost and the company expected the loss to continue in the coming year.

13.2 PRODUCT DEVELOPMENT AND MARKETING

When we studied a firm's output and price decisions, we supposed that it had already made its product quality and marketing decisions. We're now going to study these decisions and the impact they have on the firm's output, price, and economic profit.

■ Innovation and Product Development

To enjoy economic profits, firms in monopolistic competition must be continually developing new products. The reason is that wherever economic profits are earned, imitators emerge and set up business. So to maintain its economic profit, a firm must seek out new products that will provide it with a competitive edge, even if only temporarily. A firm that manages to introduce a new and differentiated product will temporarily have a less elastic demand for its product and will be able to increase its price temporarily. It will make an economic profit. Eventually, new firms that make close substitutes for the innovative product will enter and compete away the economic profit. So to restore economic profit, the firm must again innovate.

Cost Versus Benefit of Product Innovation

The decision to innovate is based on the same type of profit-maximizing calculation that you've already studied. Innovation and product development are costly activities, but they also bring in additional revenues. The firm must balance the cost and benefit at the margin. At a low level of product development, the marginal revenue from a better product exceeds the marginal cost. When the marginal dollar of product development expenditure (the marginal cost of product development) brings in a dollar of additional revenue (the marginal benefit from product development), the firm is spending the profit-maximizing amount on product development.

For example, when Electronic Arts releases its latest version of Madden NFL, it is probably not the best game that Electronic Arts could have created. But it was a game with features whose marginal benefit—and consumers' willingness to pay—equaled the marginal cost of those features.

Efficiency and Product Innovation

Is product innovation an efficient activity? Does it benefit the consumer? There are two views about the answers to these questions. One view is that monopolistic competition brings to market many improved products that bring great benefits to the consumer. Clothing, kitchen and other household appliances, computers, computer programs, cars, and many other products keep getting better every year, and the consumer benefits from these improved products.

But many so-called improvements amount to little more than changing the appearance of a product or giving a different look to the packaging. In these cases, there is little objective benefit to the consumer.

But regardless of whether a product improvement is real or imagined, its value to the consumer is its marginal benefit, which equals the amount the consumer is willing to pay. In other words, the value of product improvements is the increase in price that the consumer is willing to pay. The marginal benefit to the producer is marginal revenue, which in equilibrium equals marginal cost. Because price exceeds marginal cost in monopolistic competition, product improvement is not pushed to its efficient level.



A profit-maximizing game has features that users value at least as highly as the marginal cost of programming the features.

■ Marketing

Firms differentiate their products by designing and developing features that differ from those of their competitors' products. But firms also attempt to create a consumer perception of product differentiation even when actual differences are small. Advertising and packaging are the principal means firms use to achieve this end. An American Express card is a different product from a Visa card, but the actual differences are not the main ones that American Express emphasizes in its marketing. The deeper message is that if you use an American Express card, you can be like a celebrity or a high-profile successful person.

Marketing Expenditures

Firms incur huge costs to ensure that buyers appreciate and value the differences between their own products and those of their competitors. So a large proportion of the price that we pay covers the cost of selling a good, and this proportion is increasing. Advertising in newspapers and magazines and on radio, television, and the Internet is one type of selling cost, but it is not the only one. Selling costs include the cost of shopping malls that look like movie sets; glossy catalogs and brochures; and the salaries, airfares, and hotel bills of salespeople.

The total scale of advertising costs is hard to estimate, but some components can be measured. A survey conducted by a commercial agency found that about 15 percent of the price of liquor, 12 percent of the prices of movies and medical doctors, and about 10 percent of the price of beer cover advertising expenditures.



EYE on CELL PHONES

Which Cell Phone?

There is a lot of product differentiation in cell phones: Nokia makes 143 versions; Samsung makes 103; and Sony Ericsson makes 100. In the three months from April through June 2011, hundreds of new varieties of cell phones were announced by the top 20 firms in this market. Why is there so much variety in cell phones?

The answer is that preferences are diverse and the cost of matching the diversity of preference is low.

Think about the ways in which cell phones differ: just a few of them are their dimensions, weight, navigation tools, talk time, standby time, screen, camera features, audio features, memory, connectivity, processor speed,

storage, and network capability.

Each one of these features comes in dozens of varieties. If we combine only 10 of these features, each having 6 varieties, there are 1 million different possible cell-phone designs.

Firms produce variety only when the marginal cost of doing so is less than the marginal benefit. The marginal cost of some cell-phone variety is not large. Adding a feature to a camera, making the memory a bit bigger, and using a more economical battery are all relatively low-cost adjustments that phone designers can make.

A new way of adding variety, at almost zero cost, brings product differentiation that makes each cell

phone unique to the preferences of each individual. This new way is the cell-phone application, or app.

Apple has only two versions of the iPhone, but because of the large and growing number of program apps, each iPhone owner can load their phone with exactly the apps they want.

In long-run equilibrium, entry and innovation by each competitor will drive economic profit toward zero. Each cell-phone maker will offer a degree of product differentiation that equates the marginal cost of variety with its marginal revenue. But the pursuit of economic profit will spur ever more innovation and consumers will be confronted with ever wider choice.

For the U.S. economy as a whole, there are some 20,000 advertising agencies, which employ more than 200,000 people and have total revenue of \$45 billion. But these numbers are only part of the total cost of advertising because many firms have their own internal advertising departments, the costs of which we can only guess.

Advertising expenditures and other selling costs affect firms' profits in two ways: They increase costs and they change demand. Let's look at these effects.

Selling Costs and Total Costs

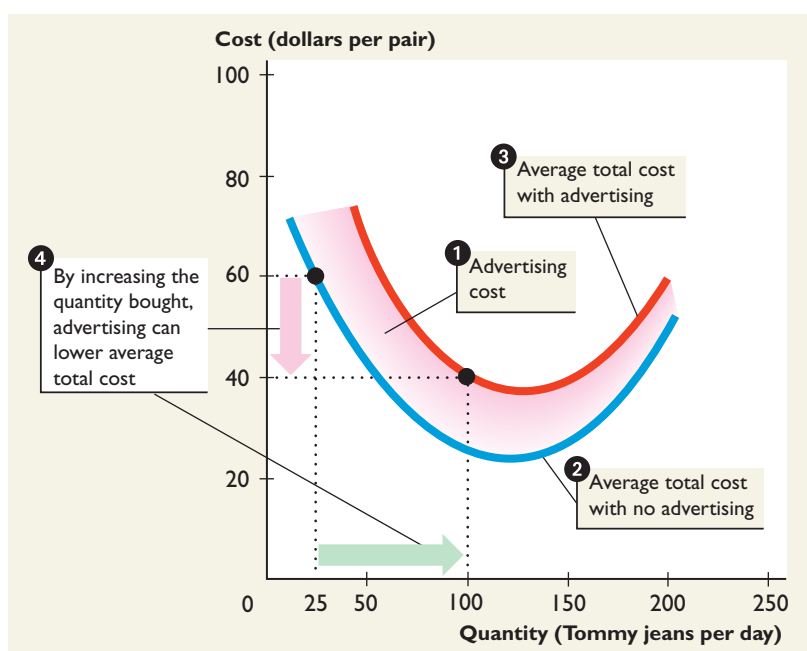
Selling costs such as advertising expenditures increase the costs of a monopolistically competitive firm above those of a perfectly competitive firm or a monopoly. Advertising costs and other selling costs are fixed costs. They do not vary as total output varies. So, just like fixed production costs, advertising costs per unit of output decrease as production increases.

Figure 13.4 shows how selling costs and advertising expenditures change a firm's average total cost. The blue curve shows the average total cost of production. The red curve shows the firm's average total cost of production plus advertising. The height of the shaded area between the two curves shows the average fixed cost of advertising. The *total* cost of advertising is fixed. But the *average* cost of advertising decreases as output increases.

Figure 13.4 shows that if advertising increases the quantity sold by a large enough amount, it can lower average total cost. For example, if the quantity sold increases from 25 pairs of jeans a day with no advertising to 100 pairs of jeans a day with advertising, average total cost falls from \$60 a pair to \$40 a pair. The reason is that although the *total* fixed cost has increased, the greater fixed cost is spread over a greater output, so average total cost decreases.

FIGURE 13.4
Selling Costs and Total Costs

MyEconLab Animation



Selling costs such as the cost of advertising are fixed costs.

- When advertising costs are added to the average total cost of production, average total cost increases by more at small outputs than at large outputs.
- If advertising enables the quantity sold to increase from 25 pairs of jeans a day to 100 pairs a day, it lowers average total cost from \$60 a pair to \$40 a pair.



EYE on YOUR LIFE

Some Selling Costs You Pay

When you buy a new pair of running shoes, you're buying materials that cost \$9, paying the producer in Asia and the shipping company for production and transportation costs of \$8, paying the U.S. government an import duty of \$3, and paying advertisers, retailers, and others who provide sales and distribution services \$50.

The table provides a breakdown of the cost of a pair of shoes. Notice the huge gap between the retailer's cost and the price that you pay. The retail markup is about 100 percent.

Running shoes are not unusual. Almost everything that you buy includes a selling cost component that exceeds one half of the total cost. Your clothing, food, electronic items, DVDs, magazines, and even your textbooks cost more to sell than they cost to produce.



Selling Costs and Demand

Advertising and other selling efforts change the demand for a firm's product. But how? Does demand increase or does it decrease? The most natural answer is that advertising increases demand. By informing people about the quality of its products or by persuading people to switch from the products of other firms, a firm might expect to increase the demand for its own products.

But all firms in monopolistic competition advertise. And all seek to persuade customers that they have the best deal. If advertising enables a firm to survive, it might increase the number of firms in the market. And to the extent that it increases the number of firms, it *decreases* the demand faced by any one firm.

Efficiency: The Bottom Line

The bottom line on the question of efficiency of monopolistic competition is ambiguous. In some cases, the gains from extra product variety unquestionably offset the selling costs and the extra cost arising from excess capacity. The tremendous varieties of magazines, clothing, food, and drinks are examples of such gains. It is less easy to see the gains from being able to buy brand-name drugs that have a chemical composition identical to that of a generic alternative, but many people do willingly pay more for the brand-name alternative.

CHECKPOINT 13.2

Explain why selling costs are high in monopolistic competition.

MyEconLab

You can work these problems in Study Plan 13.2 and get instant feedback.

Practice Problems

Bianca bakes delicious cookies. Her total fixed cost is \$40 a day, and her average variable cost is \$1 a bag. Few people know about Bianca's Cookies, and she maximizes her profit by selling 10 bags a day for \$5 a bag. Bianca thinks that if she spends \$50 a day on advertising, she will sell 25 bags a day for \$5 a bag.

1. If Bianca's belief about the effect of advertising is correct, can she increase her economic profit by advertising?
2. If Bianca advertises, will her average total cost increase or decrease at the quantity produced?
3. If Bianca advertises, will she continue to sell her cookies for \$5 a bag or will she raise her price or lower her price?

In the News

Purex tackles tough market, using new spin

Americans like to pour their own laundry detergent, but Dial plans to launch Purex Complete, a "3-in-1" laundry sheet embedded with detergent, fabric softener, and antistatic agents and in an easy to use container. Only about 50 percent of consumers currently use softener and antistatic agents (laundry additives). Dial will spend \$50 million marketing Purex Complete.

Source: *The Wall Street Journal*, April 28, 2009

Why create a new laundry detergent when there are so many? What "new spin" would you stress in the marketing campaign?

Solutions to Practice Problems

1. With no advertising, Bianca's total revenue is \$50 (10 bags at \$5 a bag) and her total cost is \$50 (\$40 total fixed cost plus \$10 total variable cost). Bianca's economic profit is zero. With \$50 a day advertising expenditure, total revenue is \$125 (25 bags at \$5 a bag) and total cost is \$115 (\$90 total fixed cost plus \$25 total variable cost). Bianca's economic profit with no price change is \$10, so Bianca can increase her economic profit by advertising.
2. If Bianca advertises, her average total cost will decrease. With no advertising, her average total cost is \$5 a bag ($\$50 \div 10$). With advertising, her average total cost is \$4.60 a bag ($\$115 \div 25$).
3. We can't say if Bianca will sell her cookies for \$5 a bag. Advertising changes the demand for her cookies. Although it increases fixed cost, marginal cost remains at \$1 a bag. Bianca will sell the profit-maximizing quantity at the highest price she can charge for that quantity.

Solution to In the News

A new product is developed and launched if the marginal benefit from its development exceeds the marginal cost of its development. Because many consumers seem to find separate laundry additives inconvenient, the marketing campaign should target these people and stress the convenience feature.

13.3 OLIGOPOLY

Another type of market that stands between the extremes of perfect competition and monopoly is oligopoly. *Oligopoly* is a market structure in which:

- A small number of firms compete.
- Natural or legal barriers prevent the entry of new firms.

Oligopoly is a market with a small number of firms. Each firm has a large market share, the firms are interdependent, and they face the temptation to collude. In any market, the price depends on the total quantity supplied. In monopoly, one firm controls this quantity and so also controls the price. In perfect competition, no firm is big enough to influence the total quantity supplied, so no firm can influence the price. Oligopoly is unlike both of these cases. More than one firm controls the quantity supplied, so no *one* firm controls the price. But each firm is large, and the quantity produced by each firm influences the price.

Like monopoly, the firms in an oligopoly operate behind a barrier to entry. And also like monopoly, the barriers to entry can arise for either natural reasons or legal reasons. A natural oligopoly is a market in which economies of scale exist but the output of a few firms is required to meet the market demand at the lowest possible cost. One firm could not meet the market demand at as low a price as a few firms could, but economies of scale are sufficiently large that more than a few firms could not survive and earn a zero profit.

A legal oligopoly arises when a legal barrier to entry protects the small number of firms in a market. A city might license two taxi firms, or two bus companies, for example.

Firms in an oligopoly might produce identical or differentiated products.

The problem for a firm in oligopoly is that its own profit-maximizing actions might decrease the profits of its competitors. But if each firm's actions decrease the profits of the other firms, all the firms end up with a lower profit.

■ Collusion

One possible way of avoiding a self-defeating outcome is for the firms in an oligopoly to form a cartel. A **cartel** is a group of firms acting together—in collusion—to limit output, raise price, and increase economic profit. Cartels are illegal in the United States (and in most other countries) and are undertaken in secret. Firms in an oligopoly would like to be able to agree with each other to fix the price at a level that maximizes their joint profit.

It turns out that collusion usually breaks down. To understand why, and to learn how price and output are determined in an oligopoly, we're going to study a special case called duopoly. **Duopoly** is a market in which there are only two producers. You can probably see some examples of duopoly where you live. Many cities have only two local newspapers, two taxi companies, two copy centers, or two college bookstores. In the global economy, there are only two major producers of commercial jet aircraft—Boeing in the United States and Airbus Industrie in Europe.

Although duopoly is common, the main reason for studying it is not its realism. We study it because it captures the essence of oligopoly and reveals the mutual interdependence of firms most effectively. Also, if collusion is difficult for a duopoly, it is even more difficult for an oligopoly with three or more firms.

Cartel

A group of firms acting together to limit output, raise price, and increase economic profit.

Duopoly

A market in which there are only two producers.

Duopoly in Airplanes

Airbus and Boeing are the only makers of large commercial jet aircraft. Suppose that they have identical production costs. To keep things simple, we'll assume that the marginal cost of an airplane is \$1 million and that total fixed cost is zero. Figure 13.5 shows the market for airplanes that Airbus and Boeing share.

Competitive Outcome

If this industry was perfectly competitive, the marginal cost curve would be the industry supply curve. The equilibrium is where the industry supply curve intersects the demand curve—12 airplanes a week would be sold for \$1 million each. Total cost would be \$12 million and total revenue would also be \$12 million, so economic profit would be zero—a long-run equilibrium in perfect competition.

Monopoly Outcome

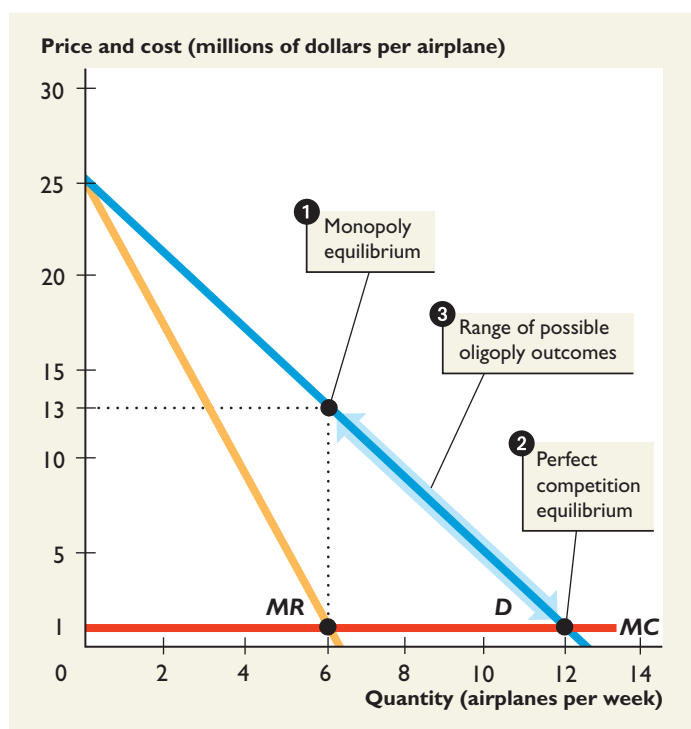
If this industry had only one firm, the firm would be a single-price monopoly because an airplane can be resold. The marginal revenue curve would be the one shown in Figure 13.5. The monopoly would produce 6 airplanes a week and sell them for \$13 million each. Total cost would be \$6 million and total revenue would be \$78 million, so economic profit would be \$72 million a week.



Boeing and Airbus share the market for big passenger airplanes.

FIGURE 13.5
A Market for Airplanes

MyEconLab Animation



- 1 With market demand curve, D , marginal revenue curve, MR , and marginal cost curve, MC , a monopoly airplane maker maximizes profit by producing 6 airplanes a week and selling them at a price of \$13 million an airplane.
- 2 With perfect competition among airplane makers, the market equilibrium quantity is 12 airplanes a week and the equilibrium price is \$1 million an airplane.
- 3 A cartel might achieve the monopoly equilibrium, break down and result in the perfect competition equilibrium, or operate somewhere between these two extreme outcomes.

Range of Possible Oligopoly Outcomes

Because oligopoly is a market structure that lies between perfect competition and monopoly, these extremes that we've just found provide the maximum range within which the oligopoly outcome might lie. If Airbus and Boeing persistently cut their prices to increase their production and quantity sold, they might drive the price down all the way to the perfectly competitive price and end up with no economic profit. In contrast, if the two firms were able to collude and set the monopoly price, they could end up sharing the maximum available monopoly profit.

■ The Duopolists' Dilemma

You've just seen that if this industry had only one firm, 6 airplanes a week would be produced and the price of an airplane would be \$13 million. Economic profit would be \$72 million a week. If this same outcome could be achieved with two firms in the industry, Airbus and Boeing might each produce 3 airplanes a week and make an economic profit of \$36 million each (see Table 13.1).

Because this outcome is the one that maximizes monopoly profit, we know that there is no better outcome for the two firms in total. That is, their joint profits cannot be any higher than the \$72 million a week that a monopoly can achieve.

But can one firm make a larger profit than \$36 million a week at the expense of the other firm? To answer this question, we need to see what happens if one of the firms increases output by 1 airplane a week. Because the two firms in this example are identical, we can explore this question with either Boeing or Airbus increasing production by 1 airplane a week and the other holding output at 3 a week. We'll suppose that Boeing increases output to 4 airplanes a week and Airbus at first continues to produce 3 airplanes a week.

Boeing Increases Output to 4 Airplanes a Week

Table 13.2 shows what happens if Boeing produces 4 airplanes a week and Airbus produces 3 airplanes a week. To sell a total output of 7 airplanes a week, the price must fall. The market demand curve in Figure 13.5 tells us that the quantity demanded is 7 airplanes a week when the price is \$11 million per airplane.

Market total revenue would now be \$77 million, total cost would be \$7 million, and economic profit would fall to \$70 million. But the distribution of this economic profit is now unequal. Boeing would gain, and Airbus would lose.

Boeing would now receive \$44 million a week in total revenue, have a total cost of \$4 million, and earn an economic profit of \$40 million. Airbus would receive \$33 million a week in total revenue, incur a total cost of \$3 million, and earn an economic profit of \$30 million.

So by increasing its output by 1 airplane a week, Boeing can increase its economic profit by \$4 million and cause the economic profit of Airbus to fall by \$6 million.

This situation is better for Boeing, but would Airbus go along with it? Would it be in Airbus's interest to hold its output at 3 airplanes a week?

To answer this question, we need to compare the economic profit Airbus makes if it maintains its output at 3 airplanes a week with the profit it makes if

TABLE 13.1 MONOPOLY OUTCOME

| | Boeing | Airbus | Market total |
|------------------------------------|--------|--------|--------------|
| Quantity (airplanes a week) | 3 | 3 | 6 |
| Price (\$ million per airplane) | 13 | 13 | 13 |
| Total revenue (\$ million) | 39 | 39 | 78 |
| Total cost (\$ million) | 3 | 3 | 6 |
| Economic profit (\$ million) | 36 | 36 | 72 |

TABLE 13.2 BOEING INCREASES OUTPUT TO 4 AIRPLANES A WEEK

| | Boeing | Airbus | Market total |
|------------------------------------|--------|--------|--------------|
| Quantity (airplanes a week) | 4 | 3 | 7 |
| Price (\$ million per airplane) | 11 | 11 | 11 |
| Total revenue (\$ million) | 44 | 33 | 77 |
| Total cost (\$ million) | 4 | 3 | 7 |
| Economic profit (\$ million) | 40 | 30 | 70 |

it produces 4 airplanes a week. How much economic profit does Airbus make if it produces 4 airplanes a week with Boeing also producing 4 a week?

Airbus Increases Output to 4 Airplanes a Week

With both firms producing 4 airplanes a week, total output is 8 airplanes a week. To sell 8 airplanes a week, the price must fall further. The market demand curve in Figure 13.5 tells us that the quantity demanded is 8 airplanes a week when the price is \$9 million an airplane.

Table 13.3 keeps track of the data. Market total revenue would now be \$72 million, total cost would be \$8 million, and economic profit would fall to \$64 million. With both firms producing the same output, the distribution of this economic profit is now equal.

Both firms would now receive \$36 million a week in total revenue, have a total cost of \$4 million, and earn an economic profit of \$32 million. For Airbus, this outcome is an improvement on the previous one by \$2 million a week. For Boeing, this outcome is worse than the previous one by \$8 million a week.

This situation is better for Airbus, but would Boeing go along with it? You know that Boeing would be worse off if it decreased its output to 3 airplanes a week because it would get the outcome that Airbus has in Table 13.2—an economic profit of only \$30 million a week. But would Boeing be better off if it increased output to 5 airplanes a week?

Boeing Increases Output to 5 Airplanes a Week

To answer the question we've just posed, we need to calculate Boeing's economic profit if Airbus maintains its output at 4 airplanes a week and Boeing increases output to 5 a week.

Table 13.4 keeps track of the data. Total output is now 9 airplanes a week. To sell this quantity, the price must fall to \$7 million per airplane. Market total revenue is \$63 million and total cost is \$9 million, so economic profit for the two firms is \$54 million. The distribution of this economic profit is again unequal. But now both firms would lose.

Boeing would now receive \$35 million a week in total revenue, have a total cost of \$5 million, and earn an economic profit of \$30 million—\$2 million less than if it maintained its output at 4 airplanes a week (in Table 13.3). Airbus would receive \$28 million a week in total revenue, incur a total cost of \$4 million, and earn an economic profit of \$24 million—\$8 million less than before.

So neither firm can gain by increasing output beyond 4 airplanes a week. But there is a dilemma. If both firms stick to the monopoly output, they both produce 3 airplanes and make \$36 million. If they both increase production to 4 airplanes a week, they both make \$32 million. If only one of them increases production to 4 airplanes a week, that firm makes an economic profit of \$40 million while the one that keeps production constant at 3 airplanes makes a lower economic profit of \$30 million. So what will the firms do?

We can speculate about what they will do. But to work out the answer, we need to use some game theory. We'll leave the question that we've just asked dangling and return to it after we've learned the basic ideas about game theory.

TABLE 13.3 AIRBUS INCREASES OUTPUT TO 4 AIRPLANES A WEEK

| | Boeing | Airbus | Market total |
|---------------------------------|--------|--------|--------------|
| Quantity (airplanes a week) | 4 | 4 | 8 |
| Price (\$ million per airplane) | 9 | 9 | 9 |
| Total revenue (\$ million) | 36 | 36 | 72 |
| Total cost (\$ million) | 4 | 4 | 8 |
| Economic profit (\$ million) | 32 | 32 | 64 |

TABLE 13.4 BOEING INCREASES OUTPUT TO 5 AIRPLANES A WEEK

| | Boeing | Airbus | Market total |
|---------------------------------|--------|--------|--------------|
| Quantity (airplanes a week) | 5 | 4 | 9 |
| Price (\$ million per airplane) | 7 | 7 | 7 |
| Total revenue (\$ million) | 35 | 28 | 63 |
| Total cost (\$ million) | 5 | 4 | 9 |
| Economic profit (\$ million) | 30 | 24 | 54 |

MyEconLab

You can work these problems in Study Plan 13.3 and get instant feedback.

CHECKPOINT 13.3

Explain the dilemma faced by firms in oligopoly.

Practice Problems

Isolated Island has two natural gas wells, one owned by Tom and the other owned by Jerry. Each well has a valve that controls the flow of gas. The marginal cost of producing gas is zero. Table 1 gives the demand schedule for the gas.

1. If Tom and Jerry form a cartel and maximize their joint profit, what will be the price of gas and the quantity produced?
2. If Tom and Jerry are forced to sell at the perfectly competitive price, what will be the price of gas and the total quantity produced?
3. If Tom and Jerry compete as duopolists, what will be the price of gas?

In the News

Asian rice exporters to discuss cartel

Thailand, the world’s largest rice exporter, proposed that the Asian rice exporters (Thailand, Cambodia, Laos, and Myanmar) form a cartel. The Philippines said it was a bad idea.

Source: CNN, May 6, 2008

Explain how an Asian profit-maximizing rice cartel would influence the global market for rice and the world price of rice. Is the Philippines correct?

Solutions to Practice Problems

1. If Tom and Jerry form a cartel and maximize their joint profit, they will charge the monopoly price. This price is the highest price the market will bear when together they produce the quantity at which marginal revenue equals marginal cost. Marginal cost is zero, so we need to find the price at which marginal revenue is zero. Marginal revenue is zero when total revenue is a maximum, which occurs when output is 6 units a day (Table 2) and price is \$6 a unit (see the demand schedule in Table 1).
2. If Tom and Jerry are forced to sell at the perfectly competitive price, the price will equal marginal cost. Marginal cost is zero, so in this case, the price will be zero and the total quantity produced will be 12 units a day.
3. If Tom and Jerry compete as duopolists, they will increase production to more than the monopoly quantity. The price will fall, but they will not drive the price down to zero.

Solution to In the News

A rice cartel would operate as a profit-maximizing monopoly and produce the quantity at which marginal revenue equals marginal cost. The profit-maximizing quantity that a monopoly produces is less than the quantity that competitive rice growers currently produce. The supply of rice on the world market will decrease and the world price of rice will rise. If the cartel does not break down, then the Philippines is correct: The price of rice, a staple for the people of Asia, will rise.

TABLE 1

| Price (dollars per unit) | Quantity demanded (units per day) |
|-----------------------------|---|
| 12 | 0 |
| 11 | 1 |
| 10 | 2 |
| 9 | 3 |
| 8 | 4 |
| 7 | 5 |
| 6 | 6 |
| 5 | 7 |
| 4 | 8 |
| 3 | 9 |
| 2 | 10 |
| 1 | 11 |
| 0 | 12 |

TABLE 2

| Quantity (units per day) | Total revenue (dollars per day) | Marginal revenue (dollars per unit) |
|--------------------------------|--|--|
| 0 | 0 | |
| 1 | 11 | 11 |
| 2 | 20 | 9 |
| 3 | 27 | 7 |
| 4 | 32 | 5 |
| 5 | 35 | 3 |
| 6 | 36 | 1 |
| 7 | 35 | -1 |
| 8 | 32 | -3 |
| 9 | 27 | -5 |
| 10 | 20 | -7 |
| 11 | 11 | -9 |
| 12 | 0 | -11 |

13.4 GAME THEORY

Game theory is the tool that economists use to analyze *strategic behavior*—behavior that recognizes mutual interdependence and takes account of the expected behavior of others. John von Neumann invented game theory in 1937, and today it is a major research field in economics.

Game theory helps us to understand oligopoly and many other forms of economic, political, social, and even biological rivalries. We will begin our study of game theory and its application to the behavior of firms by thinking about familiar games that we play for fun.

■ What Is a Game?

What is a game? At first thought, the question seems silly. After all, there are many different games. There are ball games and parlor games, games of chance and games of skill. But what is it about all these different activities that make them games? What do all these games have in common? All games share three features:

- Rules
- Strategies
- Payoffs

Let's see how these common features of games apply to a game called "the prisoners' dilemma." The **prisoners' dilemma** is a game between two prisoners that shows why it is hard to cooperate even when it would be beneficial to both players to do so. This game captures the essential feature of the duopolists' dilemma that we've just been studying. The prisoners' dilemma also provides a good illustration of how game theory works and how it generates predictions.

■ The Prisoners' Dilemma

Art and Bob have been caught red-handed, stealing a car. During the district attorney's interviews with the prisoners, he begins to suspect that he has stumbled on the two people who committed a multimillion-dollar bank robbery some months earlier. But this is just a suspicion. The district attorney has no evidence on which he can convict them of the greater crime unless he can get them to confess. He makes the prisoners play a game with the following rules.

Rules

Each prisoner (player) is placed in a separate room and cannot communicate with the other player. Each is told that he is suspected of having carried out the bank robbery and that

- If both of them confess to the larger crime, each will receive a reduced sentence of 3 years for both crimes.
- If he alone confesses and his accomplice does not, he will receive an even shorter sentence of 1 year, while his accomplice will receive a 10-year sentence.
- If neither of them confesses to the larger crime, each will receive a 2-year sentence for car theft.

Game theory

The tool that economists use to analyze *strategic behavior*—behavior that recognizes mutual interdependence and takes account of the expected behavior of others.

Prisoners' dilemma

A game between two prisoners that shows why it is hard to cooperate even when it would be beneficial to both players to do so.

Strategies

All the possible actions of each player in a game.

Payoff matrix

A table that shows the payoffs for each player for every possible combination of actions by the players.

TABLE 13.5 PRISONERS' DILEMMA PAYOFF MATRIX

| | | Art's strategies | |
|------------------|---------|-------------------|-------------------|
| | | Confess | Deny |
| Bob's strategies | Confess | 3 years / 3 years | 10 years / 1 year |
| | Deny | 1 year / 10 years | 2 years / 2 years |

Each square shows the payoffs for the two players, Art and Bob, for each possible pair of actions. In each square, the red triangle shows Art's payoff and the blue triangle shows Bob's. For example, if both confess, the payoffs are in the top left square.

Nash equilibrium

An equilibrium in which each player takes the best possible action given the action of the other player.

Strategies

In game theory, **strategies** are all the possible actions of each player. Art and Bob each have two possible strategies:

- Confess to the bank robbery.
- Deny having committed the bank robbery.

Payoffs

Because there are two players, each with two strategies, there are four possible outcomes:

- Both confess.
- Both deny.
- Art confesses and Bob denies.
- Bob confesses and Art denies.

Each prisoner can work out exactly what happens to him—his *payoff*—in each of these four situations. We can tabulate the four possible payoffs for each of the prisoners in what is called a payoff matrix for the game. A **payoff matrix** is a table that shows the payoffs for every possible action by each player given every possible action by the other player.

Table 13.5 shows a payoff matrix for Art and Bob. The squares show the payoffs for the two prisoners—the red triangle in each square shows Art's, and the blue triangle shows Bob's. If both prisoners confess (top left), each gets a prison term of 3 years. If Bob confesses but Art denies (top right), Art gets a 10-year sentence and Bob gets a 1-year sentence. If Art confesses and Bob denies (bottom left), Art gets a 1-year sentence and Bob gets a 10-year sentence. Finally, if both of them deny (bottom right), neither can be convicted of the bank robbery charge but both are sentenced for the car theft—a 2-year sentence.

Equilibrium

The equilibrium of a game occurs when each player takes the best possible action given the action of the other player. This equilibrium concept is called **Nash equilibrium**. It is so named because John Nash of Princeton University, who received the Nobel Prize for Economic Science in 1994, proposed it. (The same John Nash was portrayed by Russell Crowe in *A Beautiful Mind*.)

In the case of the prisoners' dilemma, equilibrium occurs when Art makes his best choice given Bob's choice and when Bob makes his best choice given Art's choice. Let's find the equilibrium.

First, look at the situation from Art's point of view. If Bob confesses, it pays Art to confess because in that case, he is sentenced to 3 years rather than 10 years. If Bob does not confess, it still pays Art to confess because in that case, he receives 1 year rather than 2 years. So no matter what Bob does, Art's best action is to confess.

Second, look at the situation from Bob's point of view. If Art confesses, it pays Bob to confess because in that case, he is sentenced to 3 years rather than 10 years. If Art does not confess, it still pays Bob to confess because in that case, he receives 1 year rather than 2 years. So no matter what Art does, Bob's best action is to confess.

Because each player's best action is to confess, each does confess, each gets a 3-year prison term, and the district attorney has solved the bank robbery. This is the equilibrium of the game.

Not the Best Outcome

The equilibrium of the prisoners' dilemma game is not the best outcome for the prisoners. Isn't there some way in which they can cooperate and get the smaller 2-year prison term? There is not, because the players cannot communicate with each other. Each player can put himself in the other player's place and can figure out what the other will do. The prisoners are in a dilemma. Each knows that he can serve only 2 years if he can trust the other to deny. But each also knows that it is not in the best interest of the other to deny. So each prisoner knows that he must confess, thereby delivering a bad outcome for both.

Let's now see how we can use the ideas we've just developed to understand the behavior of firms in oligopoly. We'll start by returning to the duopolists' dilemma.

■ The Duopolists' Dilemma

The dilemma of Airbus and Boeing is similar to that of Art and Bob. Each firm has two strategies. It can produce airplanes at the rate of

- 3 a week
- 4 a week

Because each firm has two strategies, there are four possible combinations of actions for the two firms:

- Both firms produce 3 a week (monopoly outcome).
- Both firms produce 4 a week.
- Airbus produces 3 a week and Boeing produces 4 a week.
- Boeing produces 3 a week and Airbus produces 4 a week.

The Payoff Matrix

Table 13.6 sets out the payoff matrix for this game. It is constructed in exactly the same way as the payoff matrix for the prisoners' dilemma in Table 13.5. The squares show the payoffs for Airbus and Boeing. In this case, the payoffs are economic profits. (In the case of the prisoners' dilemma, the payoffs were losses.)

The table shows that if both firms produce 4 a week (top left), each firm makes an economic profit of \$32 million. If both firms produce 3 a week (bottom right), they make the monopoly profit, and each firm makes an economic profit of \$36 million. The top right and bottom left squares show what happens if one firm produces 4 a week while the other produces 3 a week. The firm that increases production makes an economic profit of \$40 million, and the one that keeps production at the monopoly quantity makes an economic profit of \$30 million.

Equilibrium of the Duopolists' Dilemma

What do the firms do? To answer this question, we must find the equilibrium of the duopoly game.

TABLE 13.6 DUOPOLISTS' DILEMMA
PAYOFF MATRIX

| | | Airbus's strategies | |
|---------------------|----------|---------------------|---------------|
| | | 4 a week | 3 a week |
| Boeing's strategies | 4 a week | \$32m / \$32m | \$30m / \$40m |
| | 3 a week | \$40m / \$30m | \$36m / \$36m |

Each square shows the payoffs from a pair of actions. For example, if both firms produce 3 airplanes a week, the payoffs are recorded in the bottom right square. The red triangle shows Airbus's payoff, and the blue triangle shows Boeing's.

TABLE 13.7 THE NASH EQUILIBRIUM

| | | Airbus's strategies | |
|---------------------|----------|---------------------|----------|
| | | 4 a week | 3 a week |
| Boeing's strategies | 4 a week | \$32m | \$30m |
| | 3 a week | \$40m | \$36m |

The Nash equilibrium is for each firm to produce 4 airplanes a week.

Using the information in Table 13.7, look at things from Airbus's point of view. Airbus reasons as follows: Suppose that Boeing produces 4 airplanes a week. If I, Airbus, produce 3 a week, I will make an economic profit of \$30 million. If I also produce 4 a week, I will make an economic profit of \$32 million. So I'm better off producing 4 airplanes a week. Airbus continues to reason: Now suppose Boeing produces 3 a week. If I produce 4 a week, I will make an economic profit of \$40 million, and if I produce 3 a week, I will make an economic profit of \$36 million. An economic profit of \$40 million is better than an economic profit of \$36 million, so I'm better off if I produce 4 airplanes a week. So regardless of whether Boeing produces 3 a week or 4 a week, it pays Airbus to produce 4 airplanes a week.

Because the two firms face identical situations, Boeing comes to the same conclusion as Airbus, so both firms produce 4 a week. The equilibrium of the duopoly game is that both firms produce 4 airplanes a week.

Collusion Is Profitable but Difficult to Achieve

In the duopolists' dilemma that you've just studied, Airbus and Boeing end up in a situation that is similar to that of the prisoners in the prisoners' dilemma game. They don't achieve the best joint outcome. Because each produces 4 airplanes a week, each makes an economic profit of \$32 million a week.

If firms were able to collude, they would agree to limit their production to 3 airplanes a week each and they would each make the monopoly profit of \$36 million a week.

The outcome of the duopolists' dilemma shows why it is difficult for firms to collude. Even if collusion were a legal activity, firms in duopoly would find it difficult to implement an agreement to restrict output. Like the players of the prisoners' dilemma game, the duopolists would reach a Nash equilibrium in which they produce more than the joint profit-maximizing quantity.

If two firms have difficulty maintaining a collusive agreement, oligopolies with more than two firms have an even harder time. The operation of the Organization of the Petroleum Exporting Countries (OPEC) illustrates this difficulty. To raise the price of oil, OPEC must limit global oil production. The members of this cartel meet from time to time and set a production limit for each member nation. Almost always, within a few months of a decision to restrict production, some (usually smaller) members of the cartel break their quotas, production increases, and the price sags below the cartel's desired target. The OPEC cartel plays an oligopoly dilemma game similar to the prisoners' dilemma. Only in 1973, 1979–1980, and 2005–2007 did OPEC manage to keep its members' production under control and raise the price of oil.

■ Advertising and Research Games in Oligopoly

Every month, Coke and Pepsi, Nike and Adidas, Procter & Gamble and Kimberly-Clark, Nokia and Motorola, and hundreds of other pairs of big firms locked in fierce competition spend millions of dollars on advertising campaigns and on research and development (R&D). They make decisions about whether to increase or cut the advertising budget or whether to undertake a large R&D effort aimed at lowering production costs or at making the product more reliable (usually, the more reliable a product, the more expensive it is to produce, but the more people are willing to pay for it). These choices can be analyzed as games. Let's look at some examples of these types of games.

Advertising Game

A key to success in the soft drink industry is to run huge advertising campaigns. These campaigns affect market share but are costly to run. Table 13.8 shows some hypothetical numbers for the advertising game that Pepsi and Coke play. Each firm has two strategies: Advertise or don't advertise. If neither firm advertises, they each make \$50 million (bottom right of the payoff matrix). If each firm advertises, each firm's profit is lower by the amount spent on advertising (top left square of the payoff matrix). If Pepsi advertises but Coke does not, Pepsi gains and Coke loses (top right square of the payoff matrix). Finally, if Coke advertises and Pepsi does not, Coke gains and Pepsi loses (bottom left square).

Pepsi reasons as follows: Regardless of whether Coke advertises, we're better off advertising. Coke reasons similarly: Regardless of whether Pepsi advertises, we're better off advertising. Because advertising is the best strategy for both players, it is the Nash equilibrium. The outcome of this game is that both firms advertise and make less profit than they would if they could collude to achieve the cooperative outcome of no advertising.

TABLE 13.8 THE ADVERTISING GAME PAYOFF MATRIX

| | | Coke's strategies | |
|--------------------|-----------------|-------------------|-----------------|
| | | Advertise | Don't advertise |
| Pepsi's strategies | Advertise | \$20m / -\$10m | \$80m / -\$10m |
| | Don't advertise | -\$10m / \$80m | \$50m / \$50m |

For each pair of strategies, the red triangle shows Coke's payoff, and the blue triangle shows Pepsi's. If both firms advertise, they make less than if neither firm advertises. But each firm is better off advertising if the other doesn't advertise. The Nash equilibrium for this prisoners' dilemma advertising game is for both firms to advertise.

Research and Development Game

A key to success in the disposable diaper industry is to design a product that people value highly relative to the cost of producing it. The firm that develops the most highly valued product and also develops the least-cost technology for producing it gains a competitive edge. It can undercut the rest of the market, increase its market share, and increase its economic profit. But it is costly to undertake the R&D that can ultimately result in an improved product and increased profit. So the cost of R&D must be deducted from the increased profit. If no firm does R&D, every firm can be better off, but if one firm initiates the R&D activity, all firms must follow.

Table 13.9 illustrates the dilemma (with hypothetical numbers) for the R&D game that Kimberly-Clark and Procter & Gamble play. Each firm has two strategies: Do R&D or do no R&D. If neither firm does R&D, Kimberly-Clark makes \$30 million and Procter & Gamble makes \$70 million (bottom right of the payoff matrix). If each firm does R&D, each firm's profit is lower by the amount spent on R&D (top left square of the payoff matrix). If Kimberly-Clark does R&D but Procter & Gamble does not, Kimberly-Clark gains and Procter & Gamble loses (top right square of the payoff matrix). Finally, if Procter & Gamble conducts R&D and Kimberly-Clark does not, Procter & Gamble gains and Kimberly-Clark loses (bottom left square).

Kimberly-Clark reasons as follows: Regardless of whether Procter & Gamble undertakes R&D, we're better off doing R&D. Procter & Gamble reasons similarly: Regardless of whether Kimberly-Clark does R&D, we're better off doing R&D.

Because R&D is the best strategy for both players, it is the Nash equilibrium. The outcome of this game is that both firms conduct R&D. They make less profit than they would if they could collude to achieve the cooperative outcome of no R&D.

The real-world situation has more players than Kimberly-Clark and Procter & Gamble. A large number of other firms strive to capture market share from Procter & Gamble and Kimberly-Clark. So the R&D effort by these two firms not only serves the purpose of maintaining shares in their own battle but also helps to keep barriers to entry high enough to preserve their joint market share.

TABLE 13.9 THE R&D GAME PAYOFF MATRIX

| | | Procter & Gamble's strategies | |
|-----------------------------|--------|-------------------------------|----------------|
| | | R&D | No R&D |
| Kimberly-Clark's strategies | R&D | \$5m / -\$10m | \$85m / -\$10m |
| | No R&D | -\$10m / \$85m | \$70m / \$30m |

For each pair of strategies, the red triangle shows Procter & Gamble's payoff, and the blue triangle shows Kimberly-Clark's. If both firms do R&D, they make less than if neither firm undertakes R&D. But each firm is better off doing R&D if the other does no R&D. The Nash equilibrium for this prisoners' dilemma R&D game is for both firms to do R&D.



EYE on YOUR LIFE

A Game You Might Play

The payoff matrix here describes a game that might be familiar to you. But it isn't a prisoners' dilemma. It's a lovers' dilemma.

Jane and Jim have more fun if they do something together than if they do things alone.

But Jane likes the movies more than the ball game, and Jim likes the ball game more than the movies.

The payoff matrix describes how much they like the various outcomes (measured in units of utility).

What do they do?

By comparing the utility numbers

for different strategies, you can figure out that Jim never goes to the movies alone and Jane never goes to the ball game alone.

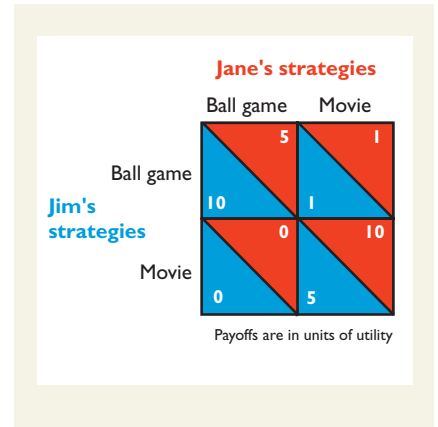
You can also figure out that Jim doesn't go to the ball game alone and Jane doesn't go to the movies alone.

They always go out together. But do they go to the movies or the ball game?

The answer is that we can't tell. This game has no unique equilibrium. The payoffs tell you that Jane and Jim might go to either the game or the movies.

In a repeated game, they'll probably alternate between the two and might

even toss a coin to decide which to go to on any given evening.



Repeated Games

The games that we've studied are played just once. In contrast, most real-world games get played repeatedly. This fact suggests that real-world duopolists might find some way of learning to cooperate so that they can enjoy a monopoly profit. If a game is played repeatedly, one player has the opportunity to penalize the other player for previous "bad" behavior. If Airbus produces 4 airplanes this week, perhaps Boeing will produce 4 next week. Before Airbus produces 4 this week, won't it take account of the possibility of Boeing producing 4 next week? What is the equilibrium of this more complicated dilemma game when it is repeated indefinitely?

The monopoly equilibrium might occur if each firm knows that the other will punish overproduction with overproduction, "tit for tat." Let's see why.

Table 13.10 keeps track of the numbers. Suppose that Boeing contemplates producing 4 airplanes in week 1. This move will bring it an economic profit of \$40 million and will cut the economic profit of Airbus to \$30 million. In week 2, Airbus will punish Boeing and produce 4 airplanes. But Boeing must go back to 3 airplanes to induce Airbus to cooperate again in week 3. So in week 2, Airbus makes an economic profit of \$40 million, and Boeing makes an economic profit of \$30 million. Adding up the profits over these two weeks of play, Boeing would have made \$72 million by cooperating (2 × \$36 million) compared with \$70 million from producing 4 airplanes in week 1 and generating Airbus's tit-for-tat response.

What is true for Boeing is also true for Airbus. Because each firm makes a larger profit by sticking to the monopoly output, both firms do so and the monopoly price, quantity, and profit prevail.

In reality, whether a duopoly (or more generally an oligopoly) works like a one-play game or a repeated game depends primarily on the number of players and the ease of detecting and punishing overproduction. The larger the number of players, the harder it is to maintain the monopoly outcome.

TABLE 13.10 PAYOFFS WITH PUNISHMENT

| Period of play | Cooperate | | Overproduce | |
|----------------|-----------------------|---------------|---------------|---------------|
| | Boeing profit | Airbus profit | Boeing profit | Airbus profit |
| | (millions of dollars) | | | |
| 1 | 36 | 36 | 40 | 30 |
| 2 | 36 | 36 | 30 | 40 |



EYE on the CHIPS DUOPOLY

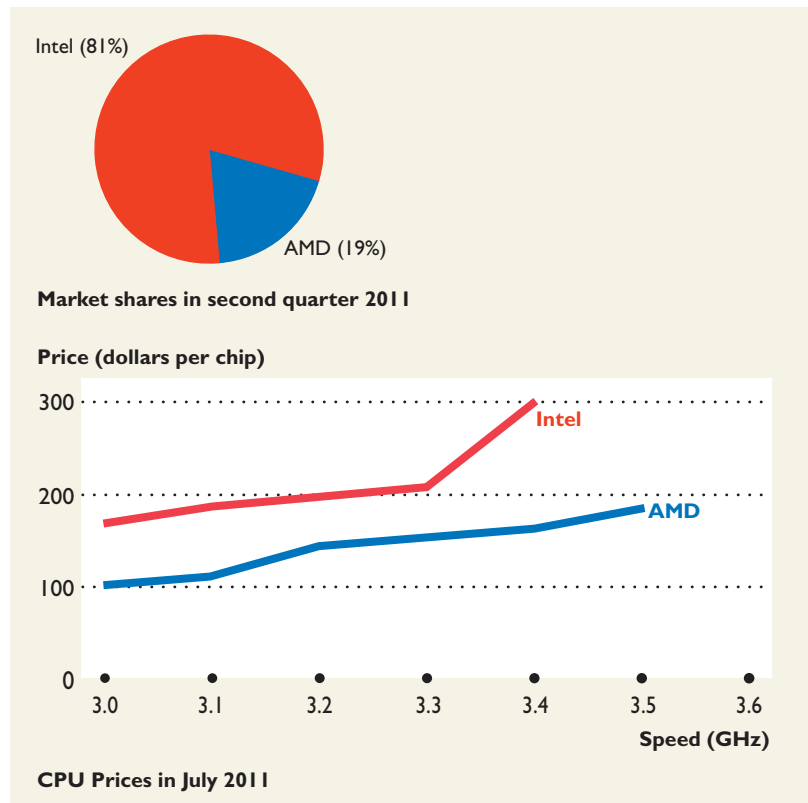
Are Two Computer Chip-Makers Two Too Few?

The CPU in your computer or your game box—the brainpower of the machine—is made either by Intel Corporation or by Advanced Micro Devices, Inc. (AMD). Does competition between these duopolists achieve an efficient outcome—a win for the consumer—or just a win for one or both of the producers?

The answer is that Intel is the big winner. The pie chart shows that it dominates this market and the CPU prices graph shows that Intel's prices are generally higher than AMD's prices.

In the game that Intel and AMD play, the outcome is closer to monopoly than perfect competition. Producer surplus is maximized and consumer surplus is less than it would be in a competitive market. There is underproduction and a deadweight loss.

SOURCES OF DATA: Intel, AMD, and sharkyextreme.com.



■ Is Oligopoly Efficient?

The quantity produced of any good or service is the efficient quantity if the price (which measures marginal benefit) equals marginal cost. Does oligopoly produce efficient quantities of goods and services?

You've seen that if firms in oligopoly play a repeated prisoners' dilemma game, they can end up restricting output to the monopoly level and making the same economic profit as a monopoly would make. You've also seen that even when the firms don't cooperate, they don't necessarily drive the price down to marginal cost. So generally, oligopoly is not efficient. It suffers from the same source of inefficiency as monopoly.

Also, firms in oligopoly might end up operating at a higher average total cost than the lowest attainable cost because their advertising and research budgets are higher than the socially efficient level.

Because oligopoly creates inefficiency and firms in oligopoly have an incentive to try to behave like a monopoly, the United States has established antitrust laws that seek to reduce market power and move the oligopoly outcome closer to that of competition and efficiency.

MyEconLab

You can work these problems in Study Plan 13.4 and get instant feedback.

CHECKPOINT 13.4

Use game theory to explain how price and quantity are determined in oligopoly.

Practice Problems

Bud and Wise are the only two producers of a New Age beer, which is designed to displace root beer. Bud and Wise are trying to work out the quantity to produce. They know that if:

- Both limit production to 10,000 gallons a day, they will make the maximum attainable joint profit of \$200,000 a day—\$100,000 a day each.
 - One produces 20,000 gallons a day while the other produces 10,000 a day, the one that produces 20,000 gallons will make an economic profit of \$150,000 and the one that sticks with 10,000 gallons will incur an economic loss of \$50,000.
 - Both produce 20,000 gallons a day, each will make zero economic profit.
1. Construct a payoff matrix for the game that Bud and Wise must play.
 2. Find the Nash equilibrium of the game that Bud and Wise play.
 3. What is the equilibrium of the game if Bud and Wise play it repeatedly?

In the News

Microsoft Internet Explorer is faster than Mozilla Firefox

Promotions of the new Internet Explorer IE8 say it is faster, more reliable, and more secure than rival browsers. One reviewer noted that IE8 is slower than Firefox, but if you're a light-duty user and attracted to the new IE's strong suite of fresh features, you might prefer it to Firefox. Another says the point isn't which browser is hundredths of a second faster, but other features.

Source: *USA Today*, March 23, 2009

What is the game that Microsoft and Mozilla have played in the past few years? How do you think the game will change in the coming years?

TABLE 1

| | | Bud's strategies | |
|-------------------|----------------|------------------|----------------|
| | | 10,000 gallons | 20,000 gallons |
| Wise's strategies | 10,000 gallons | 100 | 150 |
| | 20,000 gallons | 100 | -50 |
| | | 10,000 gallons | 20,000 gallons |
| | | -50 | 0 |
| | | 150 | 0 |

Payoffs are in thousands of dollars

Solutions to Practice Problems

1. Table 1 shows the payoff matrix for the game that Bud and Wise must play.
2. The Nash equilibrium is for both to produce 20,000 gallons a day. To see why, notice that regardless of the quantity that Bud produces, Wise makes more profit by producing 20,000 gallons a day. The same is true for Bud. So Bud and Wise each produce 20,000 gallons a day.
3. If Bud and Wise play this game repeatedly, each produces 10,000 gallons a day and makes maximum economic profit. They can achieve this outcome by playing a tit-for-tat strategy.

Solution to In the News

They played a product development game: improving speed or adding features. The outcome is that both allocated development to increasing speed and as the reviewers imply their speeds are only hundredths of a second apart (basically the same). In the coming years, the development game will probably move away from speed and to additional features to maintain or expand market share.

CHAPTER SUMMARY

Key Points

1 Explain how a firm in monopolistic competition determines its price and quantity.

- The firm in monopolistic competition faces a downward-sloping demand curve and produces the quantity at which marginal revenue equals marginal cost.
- Entry and exit result in zero economic profit and excess capacity in long-run equilibrium.

2 Explain why advertising costs are high and why firms use brand names in monopolistic competition.

- Firms in monopolistic competition innovate and develop new products to maintain economic profit.
- Advertising expenditures increase total cost, but they might lower average total cost if the quantity sold increases by enough.
- Advertising expenditures might increase demand, but they might also increase competition and decrease the demand facing a firm.
- Whether monopolistic competition is inefficient depends on the value people place on product variety.

3 Explain the dilemma faced by firms in oligopoly.

- If firms in oligopoly act together to restrict output, they make the same economic profit as a monopoly, but each firm can make a larger profit by increasing production.
- The oligopoly dilemma is whether to restrict or expand output.

4 Use game theory to explain how price and quantity are determined in oligopoly.

- In the prisoners' dilemma game, two players acting in their own interests harm their joint interest. Oligopoly is a prisoners' dilemma game.
- If firms cooperated, they could earn the monopoly profit, but in a one-play game, they overproduce and can drive the price and economic profit to the levels of perfect competition.
- Advertising and research and development create a prisoners' dilemma for firms in oligopoly.
- In a repeated game, a punishment strategy can lead to monopoly output, price, and economic profit.
- Oligopoly is usually inefficient because the price (marginal benefit) exceeds marginal cost and cost might not be the lowest attainable.

Key Terms

Cartel, 350

Duopoly, 350

Efficient scale, 343

Excess capacity, 343

Four-firm concentration ratio, 340

Game theory, 355

Herfindahl-Hirschman Index, 340

Nash equilibrium, 356

Payoff matrix, 356

Prisoners' dilemma, 355

Product differentiation, 338

Strategies, 356

MyEconLab

You can work these problems in Chapter 13 Study Plan and get instant feedback.

LIST 1

- Cable TV service
- Wheat
- Athletic shoes
- Soda
- Toothbrushes
- Ready-mix concrete

FIGURE 1

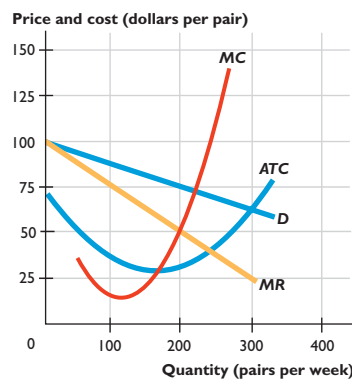
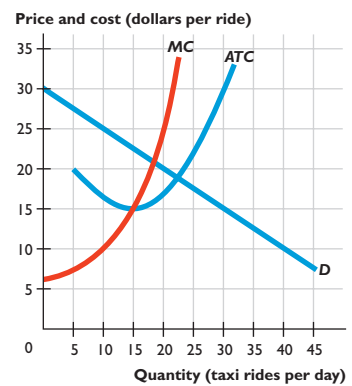


FIGURE 2



CHAPTER CHECKPOINT

Study Plan Problems and Applications

1. Which of the items in List 1 are sold by firms in monopolistic competition? Explain your selections.

Use Figure 1, which shows the demand curve, marginal revenue curve, and cost curves of Lite and Kool, Inc., a producer of running shoes in monopolistic competition, to work Problems 2 to 4.

2. In the short run, what quantity does Lite and Kool produce, what price does it charge, and does it make an economic profit?
3. In the short run, does Lite and Kool have excess capacity and what is its markup?
4. Do you expect firms to enter the running shoes market or exit from that market in the long run? Explain your answer.

Use the following information to work Problems 5 and 6.

Isolated Island has two taxi companies, one owned by Ann and the other owned by Zack. Figure 2 shows the demand curve for taxi rides, *D*, and the average total cost curve of one of the firms, *ATC*. Suppose that Ann and Zack have two strategies: Collude, fix the monopoly price, and limit the number of rides, or break the collusion, cut the price, and produce more rides.

5. Create a payoff matrix for the game that Ann and Zack play, and find the Nash equilibrium for this game if it is played just once. Do the people of Isolated Island get the efficient quantity of taxi rides?
6. If Ann and Zack play the game repeatedly, what additional strategies become available to them and how might the outcome change?

Use the following information to work Problems 7 and 8.

Cola wars: What's your soft drink of choice?

Soft drink sales have fallen for six straight years as consumers switched to healthier alternatives such as juices, and cut back on spending in the recession. The two rivals have moved into bottled water, fruit juices, energy drinks, and sports drinks to try to maintain market share. Both companies saw decreased sales, but Pepsi had the greater loss. Overall, Coke product sales were down 0.5 percent while Pepsi saw a 2.6 percent decline.

Source: CBC News, March 18, 2011

7. Describe the strategies in the advertising and product development game that Coca-Cola and PepsiCo play. Why would you expect these strategies to not include cutting price?
8. With some assumed payoffs, create a payoff matrix for the advertising and product development game that Coca-Cola and PepsiCo play. Find and explain the equilibrium outcome.

Instructor Assignable Problems and Applications



1. Washtenaw Dairy in Ann Arbor, Michigan, sells 63 flavors of Strohs Mooney’s ice cream. Ben and Jerry’s Web site also lists 63 different flavors of ice cream. These numbers are similar to the varieties of cell phones sold by Samsung, Nokia, and Motorola. Toyota makes only 16 varieties of vehicle and Boeing makes 16 varieties of airplane. Why is there more variety in cell phones and ice cream than in automobiles and airplanes?



2. Intel and AMD have two pricing strategies: Set a high (monopoly) price or set a low (competitive) price. Suppose that if they both set a competitive price, economic profit for both is zero. If both set a monopoly price, Intel makes an economic profit of \$860 million and AMD of \$140 million. If Intel sets a low price and AMD sets a high price, Intel makes an economic profit of \$100 million and AMD incurs an economic loss of \$10 million; if Intel sets a high price and AMD sets a low price, Intel incurs an economic loss of \$100 million and AMD makes an economic profit of \$10 million.

- Create the payoff matrix for this game.
- What is the equilibrium of this game?
- Is the equilibrium efficient?
- Is this game a prisoners’ dilemma?

Use Figure 1, which shows the demand curve, marginal revenue curve, and cost curves of La Bella Pizza, a firm in monopolistic competition, to work Problems 3 and 4.

3. In the short run what is the quantity that La Bella Pizza produces, the price it charges, and its excess capacity?
4. In the long run, how will the number of pizza producers change? What are the excess capacity and the deadweight loss created? Explain your answer.
5. Which of the items in List 1 are sold by firms in monopolistic competition? Explain your selection.
6. **Sparks fly for Energizer**
Energizer is gaining market share against competitor Duracell and its profit is rising despite the sharp rise in the price of zinc, a key battery ingredient.

Source: www.businessweek.com, August 2007

In what type of market are batteries sold? Explain your answer.

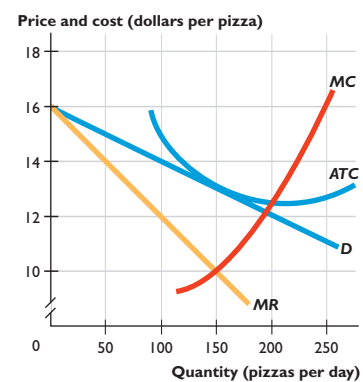
Use the following information to work Problems 7 and 8.

The United States claims that Canada subsidizes its softwood lumber production and that imports of Canadian lumber damage the interests of U.S. producers. The United States has levied a tariff on Canadian imports to counter the subsidy. Canada is thinking of retaliating by refusing to export water to California. Table 1 shows a payoff matrix for the game that the United States and Canada play.

7. What is the United States’ best strategy? What is Canada’s best strategy? What is the outcome of this game? Explain.
8. Is this game like a prisoners’ dilemma or different in some crucial way? Explain. Which country would benefit more from a free trade agreement?

Your instructor can assign these problems as homework, a quiz, or a test in [MyEconLab](#).

FIGURE 1



LIST 1

- Orange juice
- Canned soup
- PCs
- Chewing gum
- Breakfast cereals
- Corn

TABLE 1

| | | Canada | |
|---------------|-----------|----------------|----------------|
| | | Export | Don't export |
| United States | No tariff | \$100m / \$25m | \$100m / \$50m |
| | Tariff | \$50m / \$125m | \$0m / \$75m |

MyEconLab

You can work this quiz in Chapter 13 Study Plan and get instant feedback.

Multiple Choice Quiz

1. Monopolistic competition differs from _____.
 - A. monopoly because firm's cannot set their own price
 - B. oligopoly because firms produce differentiated goods or services
 - C. perfect competition because the goods or services produced are differentiated
 - D. monopoly because the good produced by each firm has no close substitute
2. A firm in monopolistic competition maximizes its profit by _____.
 - A. differentiating its good and producing the quantity at which price equals marginal revenue
 - B. producing the quantity at which marginal revenue equals marginal cost and then adding a markup.
 - C. raising its price and producing so that it always has excess capacity
 - D. producing the quantity at which marginal cost equals marginal revenue and charging the highest price at which it can sell that quantity
3. A firm in monopolistic competition that is maximizing profit _____.
 - A. always makes a positive economic profit in the short run
 - B. never needs to shut down because its price always exceeds minimum average variable cost
 - C. might, in the short run, sell at a price that is less than average total cost
 - D. shuts down temporarily if it incurs a loss equal to total variable cost
4. If one firm advertises and other firms in the market don't, then _____.
 - A. the demand for the advertised good becomes more elastic
 - B. the profit-maximizing quantity of the advertised good decreases because total fixed costs increase
 - C. the average cost of producing a small quantity of the advertised good rises but the average total cost of producing a large quantity might fall
 - D. the economic profit made from the advertised good increases
5. The oligopoly dilemma is whether to _____.
 - A. act together to restrict output and raise the price
 - B. raise the price to the monopoly profit-maximizing price
 - C. cheat on others in the cartel to take advantage of profit opportunities
 - D. lower the price to the perfectly competitive price
6. In the prisoners' dilemma game, each player _____.
 - A. consults the other player to determine his best action
 - B. chooses the best outcome for the other player
 - C. chooses the best outcome for himself
 - D. chooses the best outcome for both players together
7. A Nash equilibrium _____.
 - A. is the outcome that delivers maximum economic profit
 - B. is the outcome in which each player takes the best action given the other player's action
 - C. changes each time the game is played
 - D. is the best possible outcome for the two players



How do we track our economy's booms and busts?

GDP: A Measure of Total Production and Income



CHAPTER CHECKLIST

When you have completed your study of this chapter, you will be able to

- 1 Define GDP and explain why the value of production, income, and expenditure are the same for an economy.
- 2 Describe how economic statisticians measure GDP and distinguish between nominal GDP and real GDP.
- 3 Describe the uses of real GDP and explain its limitations as a measure of the standard of living.

14.1 GDP, INCOME, AND EXPENDITURE

Where is the U.S. economy heading? Will it remain weak, begin to expand more rapidly, or sink into a deeper recession?

Everyone wants to know the answers to these questions. The people who make business decisions—homebuilders, auto producers, cell-phone service providers, airlines, oil producers, airplane makers, farmers, and retailers—want to know the answers so they can plan their production to align with demand. Governments want the answers because the amount of tax revenue that they collect depends on how much people earn and spend, which in turn depends on the state of the economy. Governments and the Federal Reserve want to know because they might be able to take actions that avoid excessive bust or boom. Ordinary citizens want the answers to plan their big decisions such as how long to remain in school, whether to rent or buy a new home, and how much to save toward retirement.

To assess the state of the economy we measure gross domestic product, or GDP. You're about to discover that GDP measures the value of total production, total income, and total expenditure.

■ GDP Defined

We measure total production as **gross domestic product**, or **GDP**, which is the market value of all the final goods and services produced within a country in a given time period. This definition has four parts, which we'll examine in turn.

Value Produced

To measure total production, we must add together the production of apples and oranges, bats and balls. Just counting the items doesn't get us very far. Which is the greater total production: 100 apples and 50 oranges or 50 apples and 100 oranges?

GDP answers this question by valuing items at their *market value*—at the prices at which the items are traded in markets. If the price of an apple is 10 cents and the price of an orange is 20 cents, the market value of 100 apples plus 50 oranges is \$20 and the market value of 50 apples and 100 oranges is \$25. By using market prices to value production, we can add the apples and oranges together.

What Produced

A **final good or service** is something that is produced for its final user and not as a component of another good or service. A final good or service contrasts with an **intermediate good or service**, which is used as a component of a final good or service. For example, a Ford car is a final good, but a Firestone tire that Ford buys and installs on the car is an intermediate good. In contrast, if you buy a replacement Firestone tire for your car, then that tire is a final good. The same good can be either final or intermediate depending on how it is used.

GDP does not count the value of everything that is produced. With one exception, it includes only those items that are traded in markets and does not include the value of goods and services that people produce for their own use. For example, if you buy a car wash, the value produced is included in GDP. But if you wash your own car, your production is not counted as part of GDP. The exception is the market value of homes that people own. GDP puts a rental value on these homes and pretends that the owners rent their homes to themselves.

Gross domestic product (GDP)

The market value of all the final goods and services produced within a country in a given time period.

Final good or service

A good or service that is produced for its final user and not as a component of another good or service.

Intermediate good or service

A good or service that is used as a component of a final good or service.

Where Produced

Only goods and services that are produced *within a country* count as part of that country's GDP. Nike Corporation, a U.S. firm, produces sneakers in Vietnam, and the market value of those shoes is part of Vietnam's GDP, not part of U.S. GDP. Toyota, a Japanese firm, produces automobiles in Georgetown, Kentucky, and the value of this production is part of U.S. GDP, not part of Japan's GDP.

When Produced

GDP measures the value of production *during a given time period*. This time period is either a quarter of a year—called the quarterly GDP data—or a year—called the annual GDP data. The Federal Reserve and others use the quarterly GDP data to keep track of the short-term evolution of the economy, and economists use the annual GDP data to examine long-term trends.

GDP measures not only the value of total production but also total income and total expenditure. The circular flow model that you studied in Chapter 2 explains why.

■ Circular Flows in the U.S. Economy

Four groups buy the final goods and services produced: households, firms, governments, and the rest of the world. Four types of expenditure correspond to these groups:

- Consumption expenditure
- Investment
- Government expenditure on goods and services
- Net exports of goods and services

Consumption Expenditure

Consumption expenditure is the expenditure by households on consumption goods and services. It includes expenditures on *nondurable goods* such as orange juice and pizza, *durable goods* such as televisions and DVD players, and *services* such as rock concerts and haircuts. Consumption expenditure also includes house and apartment rents, including the rental value of owner-occupied housing.

Consumption expenditure
The expenditure by households on consumption goods and services.

Investment

Investment is the purchase of new *capital goods* (tools, instruments, machines, and buildings) and additions to inventories. Capital goods are *durable goods* produced by one firm and bought by another. Examples are PCs produced by Dell and bought by Ford Motor Company, and airplanes produced by Boeing and bought by United Airlines. Investment also includes the purchase of new homes by households.

Investment
The purchase of new *capital goods* (tools, instruments, machines, buildings) and additions to inventories.

At the end of a year, some of a firm's output might remain unsold. For example, if Ford produces 4 million cars and sells 3.9 million of them, the other 0.1 million (100,000) cars remain unsold. In this case, Ford's inventory of cars increases by 100,000. When a firm adds unsold output to inventory, we count those items as part of investment.

It is important to note that investment does *not* include the purchase of stocks and bonds. In macroeconomics, we reserve the term "investment" for the purchase of new capital goods and the additions to inventories.

Government expenditure on goods and services

The expenditure by all levels of government on goods and services.

Net exports of goods and services

The value of exports of goods and services minus the value of imports of goods and services.

Exports of goods and services

Items that firms in the United States produce and sell to the rest of the world.

Imports of goods and services

Items that households, firms, and governments in the United States buy from the rest of the world.

Government Expenditure on Goods and Services

Government expenditure on goods and services is expenditure by all levels of government on goods and services. For example, the U.S. Defense Department buys missiles and other weapons systems, the State Department buys travel services, the White House buys Internet services, and state and local governments buy cruisers for law enforcement officers.

Net Exports of Goods and Services

Net exports of goods and services is the value of exports of goods and services minus the value of imports of goods and services. **Exports of goods and services** are items that firms in the United States produce and sell to the rest of the world. **Imports of goods and services** are items that households, firms, and governments in the United States buy from the rest of the world. Imports are produced in other countries, so expenditure on imports is not included in expenditure on U.S.-produced goods and services. If exports exceed imports, net exports are positive and expenditure on U.S.-produced goods and services increases. If imports exceed exports, net exports are negative and expenditure on U.S.-produced goods and services decreases.

Total Expenditure

Total expenditure on goods and services produced in the United States is the sum of the four items that you've just examined. We call consumption expenditure C , investment I , government expenditure on goods and services G , and net exports of goods and services NX . So total expenditure, which is also the total amount received by the producers of final goods and services, is

$$\text{Total expenditure} = C + I + G + NX.$$

Income

Labor earns wages, capital earns interest, land earns rent, and entrepreneurship earns profits. Households receive these incomes. Some part of total income, called *undistributed profit*, is a combination of interest and profit that firms retain and do not pay to households. But from an economic viewpoint, undistributed profit is income paid to households and then loaned to firms.

■ Expenditure Equals Income

Figure 14.1 shows the circular flows of income and expenditure that we've just described. The figure is based on Figures 2.5 and 2.6 (on p. 47 and p. 49), but it includes some more details and additional flows.

We call total income Y and show it by the blue flow from firms to households. When households receive their incomes, they pay some in taxes and save some. Some households receive benefits from governments. **Net taxes** equal taxes paid minus cash benefits received and are the green flow from households to governments labeled NT . **Saving** is the amount of income that is not paid in net taxes or spent on consumption goods and services. Saving flows from households to financial markets and is the green flow labeled S . These two green flows are not expenditures on goods and services. They are just flows of money. Because households allocate all their incomes after paying net taxes to consumption and saving,

$$Y = C + S + NT.$$

Net taxes

Taxes paid minus cash benefits received from governments.

Saving

The amount of income that is not paid in net taxes or spent on consumption goods and services.

The red flows show the four expenditure flows: consumption expenditure from households to firms, government expenditure from governments to firms, and net exports from the rest of the world to firms. Investment flows from the financial markets, where firms borrow, to the firms that produce capital goods.

Because firms pay out everything they receive as incomes to the factors of production, total expenditure equals total income. That is,

$$Y = C + I + G + NX.$$

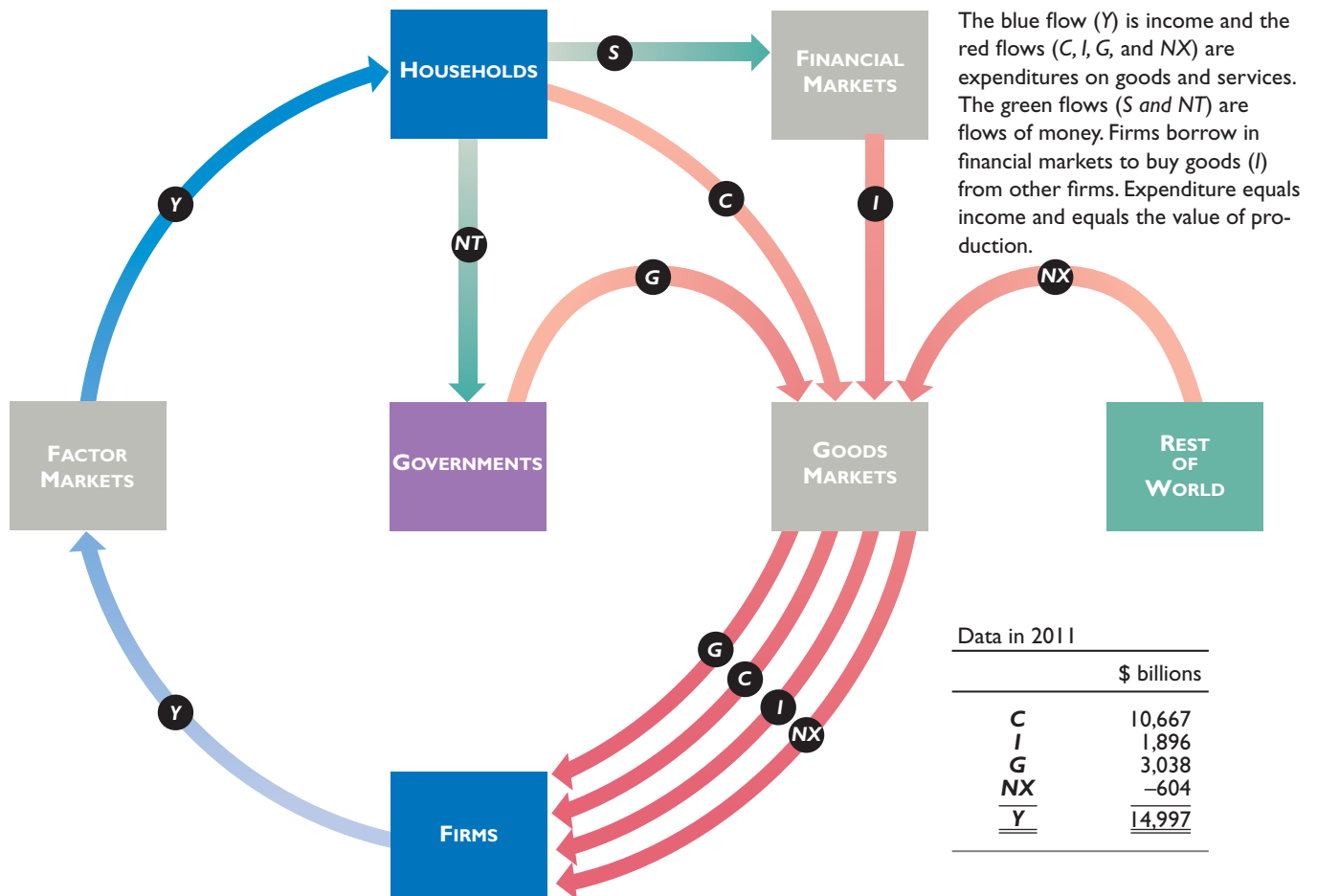
From the viewpoint of firms, the value of production is the cost of production, which equals income. From the viewpoint of purchasers of goods and services, the value of production is the cost of buying it, which equals expenditure. So

The value of production equals income equals expenditure.

The circular flow and the equality of income and expenditure provide two approaches to measuring GDP that we'll study in the next section.

FIGURE 14.1
The Circular Flow of Income and Expenditure

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MyEconLab

You can work these problems in Study Plan 14.1 and get instant feedback.

LIST 1

- Banking services bought by a student
- New cars bought by Hertz, the car rental firm
- Newsprint bought by *USA Today* from International Paper
- The purchase of a new aircraft for the vice president
- New house bought by Beyoncé

CHECKPOINT 14.1

Define GDP and explain why the value of production, income, and expenditure are the same for an economy.

Practice Problems

1. Classify each of the items in List 1 as a final good or service or as an intermediate good or service and identify which is a component of consumption expenditure, investment, or government expenditure on goods and services.
2. Figure 1 shows the flows of expenditure and income on Lotus Island. In 2011, R was \$10 billion; W was \$30 billion; U was \$12 billion; X was \$15 billion; and Z was \$3 billion. Calculate total expenditure and total income.

In the News

U.S. economy grew slower in spring than previously reported

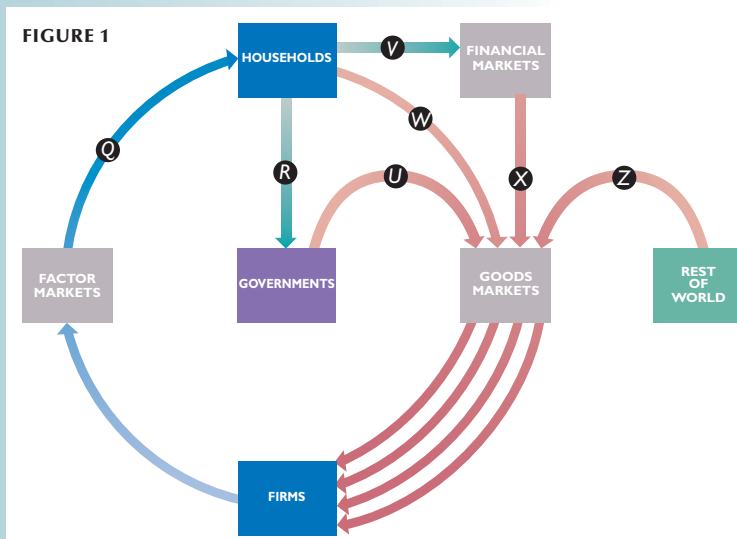
Real GDP increased at an annual rate of 1.0 percent in the second quarter of 2011. Investment, exports, consumption expenditure, and government expenditure increased faster than 1.0 percent.

Source: BEA News Release, August 26, 2011

Use Figure 1 to indicate the flows in which the items in the news clip occur. How can GDP increase by 1.0 percent if the other items in the news clip increased faster than 1.0 percent?

Solutions to Practice Problems

1. The student's banking service is a final service and part of consumption expenditure. Hertz's new cars are additions to capital, so they are part of investment and final goods. Newsprint is an input into the newspaper, so it is an intermediate good and not a final expenditure. The new aircraft for the vice president is a final good and part of government expenditure. The new house is a final good and part of investment.
2. Total expenditure is the sum of C , I , G , and NX . In Figure 1, C is the flow W ; I is the flow X ; G is the flow U ; and NX is the flow Z . So total expenditure equals $W + X + U + Z$, which is \$60 billion. Total income is the blue flow, Q . But total income equals total expenditure, so total income is \$60 billion.



Solution to In the News

GDP is the sum of flows W , X , U , and Z . Investment is X , consumption expenditure is W , government expenditure is U , and exports are part of Z .

$GDP = C + I + G + X - M$, so if $C + I + G + X$ grew faster than 1 percent, then M must have grown faster than $C + I + G + X$.

14.2 MEASURING U.S. GDP

U.S. GDP is the market value of all the final goods and services produced within the United States during a year. In 2011, U.S. GDP was \$15 trillion. The Bureau of Economic Analysis in the U.S. Department of Commerce measures GDP by using two approaches:

- Expenditure approach
- Income approach

■ The Expenditure Approach

The expenditure approach measures GDP by using data on consumption expenditure, investment, government expenditure on goods and services, and net exports. This approach is like attaching a meter to the circular flow diagram on all the flows running through the goods markets to firms and measuring the magnitudes of those flows. Table 14.1 shows this approach. The first column gives the terms used in the U.S. National Income and Product Accounts. The next column gives the symbols we used in the previous section.

Using the expenditure approach, GDP is the sum of consumption expenditure on goods and services (*C*), investment (*I*), government expenditure on goods and services (*G*), and net exports of goods and services (*NX*). The third column gives the expenditures in 2011. GDP measured by the expenditure approach was \$14,997 billion (the data are based on the second quarter of 2011).

Net exports were negative in 2011 because imports exceeded exports. Imports were \$2,686 billion and exports were \$2,082 billion, so net exports—exports minus imports—were $-\$604$ billion as shown in the table.

The fourth column in Table 14.1 shows the relative magnitudes of the expenditures. Consumption expenditure is by far the largest component of total expenditure; government expenditure is the next largest. Investment and exports are a similar size; and net exports is the smallest component. In 2011, consumption expenditure was 71.1 percent, investment was 12.6 percent, government expenditure was 20.3 percent, and net exports were a negative 4.0 percent of GDP.

■ TABLE 14.1

GDP: The Expenditure Approach

| Item | Symbol | Amount in 2011 (second quarter) (billions of dollars) | Percentage of GDP |
|-------------------------|-----------|---|----------------------|
| Consumption expenditure | <i>C</i> | 10,667 | 71.1 |
| Investment | <i>I</i> | 1,896 | 12.6 |
| Government expenditure | <i>G</i> | 3,038 | 20.3 |
| Net exports | <i>NX</i> | <u>-604</u> | <u>-4.0</u> |
| GDP | <i>Y</i> | <u>14,997</u> | <u>100.0</u> |

The expenditure approach measures GDP by adding together consumption expenditure (*C*), investment (*I*), government expenditure (*G*), and net exports (*NX*).

In 2011, GDP measured by the expenditure approach was \$14,997 billion.

SOURCE OF DATA: U.S. Department of Commerce, Bureau of Economic Analysis.

Expenditures Not in GDP

Total expenditure (and GDP) does not include all the things that people and businesses buy. GDP is the value of *final goods and services*, so spending that is *not* on final goods and services is not part of GDP. Spending on intermediate goods and services is not part of GDP, although it is not always obvious whether an item is an intermediate good or a final good (see *Eye on the U.S. Economy* below). Also, we do not count as part of GDP spending on

- Used goods
- Financial assets

Used Goods Expenditure on used goods is not part of GDP because these goods were part of GDP in the period in which they were produced and during which time they were new goods. For example, a 2008 automobile was part of GDP in 2008. If the car is traded on the used car market in 2012, the amount paid for the car is not part of GDP in 2012.

Financial Assets When households buy financial assets such as bonds and stocks, they are making loans, not buying goods and services. The expenditure on newly produced capital goods is part of GDP, but the purchase of financial assets is not.



EYE on the U.S. ECONOMY

Is a Computer Program an Intermediate Good or a Final Good?

When American Airlines buys a new reservations software package, is that like General Motors buying tires? If it is, then software is an *intermediate good* and it is not counted as part of GDP. Airline ticket sales, like GM cars, are part of GDP, but the intermediate goods that are used to produce air transportation or cars are *not* part of GDP.

Or when American Airlines buys new software, is that like General Motors buying a new assembly-line robot? If it is, then the software is a capital good and its purchase is the purchase of a final good. In this case, the software purchase is an *investment* and it *is* counted as part of GDP.

Brent Moulton worked as a government economist in the Bureau of Economic Analysis (BEA). Moulton's job was to oversee periodic adjustments to the GDP estimates to incorporate new data and new ideas about the economy.

The biggest change made was in how the purchase of computer software by firms is classified. Before 1999, it was regarded as an *intermediate good*. But since 1999, it has been treated as an *investment*.

How big a deal is this? When the BEA recalculated the 1996 GDP, the change increased the estimate of the 1996 GDP by \$115 billion. That is a lot of money. To put it in perspective, GDP

in 1996 was \$7,662 billion. So the adjustment was 1.5 percent of GDP.

This change is a good example of the ongoing effort by the BEA to keep the GDP measure as accurate as possible.



■ The Income Approach

To measure GDP using the income approach, the Bureau of Economic Analysis uses income data collected by the Internal Revenue Service and other agencies. The BEA takes the incomes that firms pay households for the services of the factors of production they hire—wages for labor services, interest for the use of capital, rent for the use of land, and profits for entrepreneurship—and sums those incomes. This approach is like attaching a meter to the circular flow diagram on all the flows running through factor markets from firms to households and measuring the magnitudes of those flows. Let's see how the income approach works.

The U.S. National Income and Product Accounts divide incomes into two big categories:

- Wage income
- Interest, rent, and profit income

Wage Income

Wage income, called *compensation of employees* in the national accounts, is the total payment for labor services. It includes net wages and salaries plus fringe benefits paid by employers such as health-care insurance, Social Security contributions, and pension fund contributions.

Interest, Rent, and Profit Income

Interest, rent, and profit income, called *net operating surplus* in the national accounts, is the total income earned by capital, land, and entrepreneurship.

Interest income is the interest that households receive on capital. A household's capital is equal to its net worth—its assets minus its borrowing.

Rent includes payments for the use of land and other rented factors of production. It includes payments for rented housing and imputed rent for owner-occupied housing. (Imputed rent is an estimate of what homeowners would pay to rent the housing they own and use themselves. By including this item in the national accounts, we measure the total value of housing services, whether they are owned or rented.)

Profit includes the profits of corporations and the incomes of proprietors who run their own businesses. These incomes are a mixture of interest and profit.

Table 14.2 shows these two components of incomes and their relative magnitudes. The sum of wages, interest, rent, and profit is **net domestic product at factor cost**.

Net domestic product at factor cost is not GDP, and we must make two further adjustments to get to GDP: one from factor cost to market prices and another from net product to gross product.

From Factor Cost to Market Price

The expenditure approach values goods and services at market prices, and the income approach values them at factor cost—the cost of the factors of production used to produce them. Indirect taxes (such as sales taxes) and subsidies (payments by government to firms) make these two values differ. Sales taxes make market prices exceed factor cost, and subsidies make factor cost exceed market prices. To convert the value at factor cost to the value at market prices, we must add indirect taxes and subtract subsidies.

Net domestic product at factor cost

The sum of the wages, interest, rent, and profit.

■ TABLE 14.2

GDP: The Income Approach

The sum of all incomes equals net domestic product at factor cost. GDP equals net domestic product at factor cost plus indirect taxes less subsidies plus depreciation (capital consumption).

In 2011, GDP measured by the income approach was \$15,070 billion. This amount is \$73 billion more than GDP measured by the expenditure approach—a statistical discrepancy of −\$73 billion.

Wages are by far the largest part of total income.

| Item | Amount in 2011 (second quarter) (billions of dollars) | Percentage of GDP |
|---|---|----------------------|
| Wages (compensation of employees) | 8,273 | 55.2 |
| Interest, rent, and profit (net operating surplus) | 3,818 | 25.5 |
| Net domestic product at factor cost | 12,091 | 80.7 |
| Indirect taxes less subsidies | 1,039 | 6.9 |
| Depreciation (capital consumption) | 1,940 | 12.9 |
| GDP (income approach) | 15,070 | 100.5 |
| Statistical discrepancy | −73 | −0.5 |
| GDP (expenditure approach) | 14,997 | 100.0 |

SOURCE OF DATA: U.S. Department of Commerce, Bureau of Economic Analysis.

Depreciation

The decrease in the value of capital that results from its use and from obsolescence.

From Net to Gross

The income approach measures *net* product and the expenditure approach measures *gross* product. The difference is **depreciation**, which is the decrease in the value of capital that results from its use and from obsolescence. Firms' profits, which are included in the income approach, are net of depreciation, so the income approach gives a *net* measure. Investment, which is included in the expenditure approach, includes the purchase of capital to replace worn out or obsolete capital, so the expenditure approach gives a *gross* measure. To get *gross* domestic product from the income approach, we must *add* depreciation to total income.

Table 14.2 summarizes these adjustments and shows that the income approach gives almost the same estimate of GDP as the expenditure approach.

Statistical Discrepancy

The expenditure approach and income approach do not deliver exactly the same estimate of GDP. If a taxi driver doesn't report all his tips, they get missed in the income approach, but they get caught by the expenditure approach when he spends his income. So the sum of expenditures might exceed the sum of incomes. But most income gets reported to the Internal Revenue Service on tax returns while many items of expenditure are not recorded and must be estimated. So the sum of incomes might exceed the sum of estimated expenditures.

The discrepancy between the expenditure approach and the income approach is called the **statistical discrepancy**, and it is calculated as the GDP expenditure total minus the GDP income total.

The two measures of GDP provide a check on the accuracy of the numbers. If the two are wildly different, we will want to know what mistakes we've made. Have we omitted some item? Have we counted something twice? The fact that the two estimates are close gives some confidence that they are reasonably accurate. But the expenditure total is regarded as the more reliable estimate of GDP, so the discrepancy is added to or subtracted from income to reconcile the two estimates.

Statistical discrepancy

The discrepancy between the expenditure approach and the income approach estimates of GDP, calculated as the GDP expenditure total minus the GDP income total.

■ GDP and Related Measures of Production and Income

Although GDP is the main measure of total production, you will sometimes encounter another: gross *national* product or GNP.

Gross National Product

A country's **gross national product**, or **GNP**, is the market value of all the final goods and services produced anywhere in the world in a given time period by the factors of production supplied by the residents of that country. For example, Nike's income from the capital that it supplies to its Vietnam shoe factory is part of U.S. GNP but not part of U.S. GDP. It is part of Vietnam's GDP. Similarly, Toyota's income on the capital it supplies to its Kentucky auto plant is part of U.S. GDP but not part of U.S. GNP. It is part of Japan's GNP.

GNP equals GDP plus net factor income received from or paid to other countries. The difference between U.S. GDP and GNP is small. But in an oil-rich Middle Eastern country such as Bahrain, where a large amount of capital is owned by foreigners, GNP is much smaller than GDP; and in a poor country such as Bangladesh, whose people work abroad and send income home, GNP is much larger than GDP.

Disposable Personal Income

You've seen that consumption expenditure is the largest component of aggregate expenditure. The main influence on consumption expenditure is **disposable personal income**, which is the income received by households minus personal income taxes paid. Because disposable personal income plays an important role in influencing spending, the national accounts measure this item along with a number of intermediate totals that you can see in Figure 14.2. This figure shows how disposable personal income is calculated and how it relates to GDP and GNP.

Gross national product (GNP)

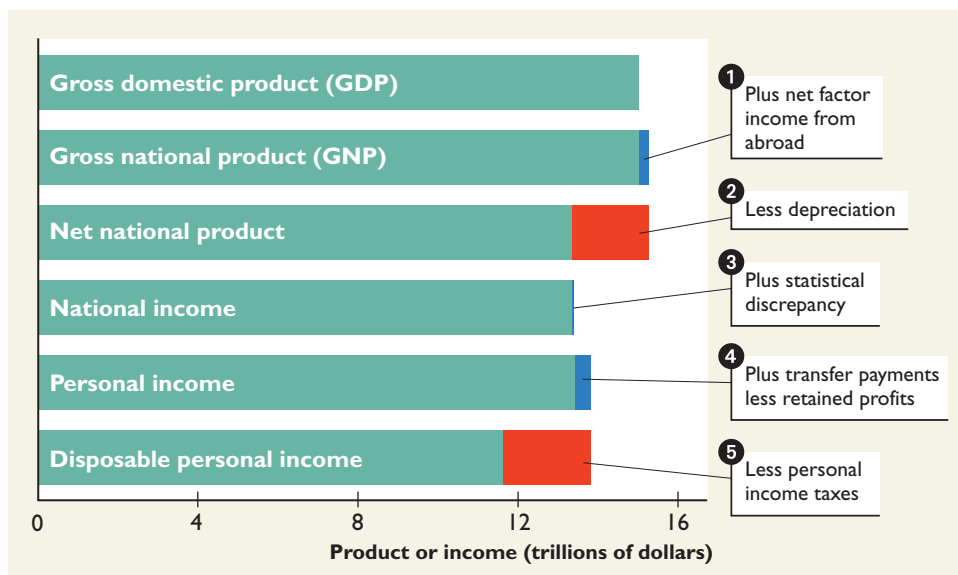
The market value of all the final goods and services produced anywhere in the world in a given time period by the factors of production supplied by the residents of the country.

Disposable personal income

Income received by households minus personal income taxes paid.

FIGURE 14.2
GDP and Related Product and Income Measures

MyEconLab Animation



The bars show six related product and income measures and the relationship among them.

- 1 Add net factor income from abroad to GDP to get GNP.
- 2 Subtract depreciation from GNP to get net national product.
- 3 Add the statistical discrepancy between the expenditure and income measures (almost invisible in the figure because it is tiny) to get national income.
- 4 Add transfer payments by governments less profits retained by firms to get personal income.
- 5 Finally, subtract personal income taxes to get disposable personal income.

SOURCE OF DATA: U.S. Department of Commerce, Bureau of Economic Analysis.

■ Real GDP and Nominal GDP

You've seen that GDP measures total expenditure on final goods and services in a given period. Suppose that we want to compare GDP in two periods, say 2005 and 2011. In 2005, GDP was \$12,623 billion and by 2011, it was \$14,997 billion—18.8 percent higher than in 2005. What does this 18.8 percent increase mean?

The answer is a combination of two things:

- We produced more goods and services.
- We paid higher prices for our goods and services.

Producing more goods and services contributes to an improvement in our standard of living. Paying higher prices means that our *cost of living* has increased but our standard of living has not. So it matters a great deal why GDP has increased. If the 18.8 percent increase is accounted for mainly by higher prices, our standard of living hasn't changed much. But if the 18.8 percent increase is accounted for mainly by the production of more goods and services, our standard of living might have increased a lot.

You're now going to see how economists at the Bureau of Economic Analysis isolate the effects on GDP of an increase in production. Their first step is to distinguish between two GDP concepts: real GDP and nominal GDP.

Real GDP is the value of final goods and services produced in a given year expressed in terms of the prices in a *reference base year*. The *reference base year* is the year we choose against which to compare all other years. In the United States today, the *reference base year* is 2005.

Real GDP contrasts with **nominal GDP**, which is the value of the final goods and services produced in a given year expressed in terms of the prices of that same year. Nominal GDP is just a more precise name for GDP.

The method used to calculate real GDP has changed in recent years and is now a bit technical, but the essence of the calculation hasn't changed. Here, we describe the essence of the calculation. An appendix to this chapter describes the technical details of the method used by the Bureau of Economic Analysis.

■ Calculating Real GDP

The goal of calculating *real GDP* is to measure the extent to which total production has increased and remove from the nominal GDP numbers the influence of price changes. To focus on the principles and keep the numbers easy to work with, we'll calculate real GDP for an economy that produces only one good in each of the GDP categories: consumption expenditure (C), investment (I), and government expenditure (G). We'll ignore exports and imports by assuming that net exports (exports minus imports) is zero.

Table 14.3 shows the quantities produced and the prices in 2005 (the *base year*) and in 2011. In part (a), we calculate nominal GDP in 2005. For each item, we multiply the quantity produced by its price to find the total expenditure on the item. We then sum the expenditures to find nominal GDP, which in 2005 is \$100 million. Because 2005 is the base year, real GDP and nominal GDP are equal in 2005.

In part (b) of Table 14.3, we calculate nominal GDP in 2011. Again, we calculate nominal GDP by multiplying the quantity of each item produced by its price to find the total expenditure on the item. We then sum the expenditures to find nominal GDP, which in 2011 is \$300 million. Nominal GDP in 2011 is three times its value in 2005. But by how much has the quantity of final goods and services produced increased? That's what real GDP will tell us.

Real GDP

The value of the final goods and services produced in a given year expressed in terms of the prices in a base year.

Nominal GDP

The value of final goods and services produced in a given year expressed in terms of the prices of that same year.

TABLE 14.3

Calculating Nominal GDP and Real GDP in 2005 and 2011

| | Item | Quantity (millions of units) | Price (dollars per unit) | Expenditure (millions of dollars) |
|--|----------------------------------|---------------------------------|-----------------------------|--------------------------------------|
| (a) In 2005 | | | | |
| C | T-shirts | 10 | 5 | 50 |
| I | Computer chips | 3 | 10 | 30 |
| G | Security services | 1 | 20 | 20 |
| Y | Real GDP and Nominal GDP in 2005 | | | <u>100</u> |
| (b) In 2011 | | | | |
| C | T-shirts | 4 | 5 | 20 |
| I | Computer chips | 2 | 20 | 40 |
| G | Security services | 6 | 40 | 240 |
| Y | Nominal GDP in 2011 | | | <u>300</u> |
| (c) Quantities of 2011 valued at prices of 2005 | | | | |
| C | T-shirts | 4 | 5 | 20 |
| I | Computer chips | 2 | 10 | 20 |
| G | Security services | 6 | 20 | 120 |
| Y | Real GDP in 2011 | | | <u>160</u> |

The base year is 2005, so real GDP and nominal GDP are equal in that year.

Between 2005 and 2011, the production of security services (G) increased, but the production of T-shirts (C) and computer chips (I) decreased. In the same period, the price of a T-shirt remained constant, but the other two prices doubled.

Nominal GDP increased from \$100 million in 2005 in part (a) to \$300 million in 2011 in part (b).

Real GDP in part (c), which is calculated by using the quantities of 2011 in part (b) and the prices of 2005 in part (a), increased from \$100 million in 2005 to \$160 million in 2011, a 60 percent increase.

In part (c) of Table 14.3, we calculate real GDP in 2011. You can see that the quantity of each good and service produced in part (c) is the same as that in part (b). They are the quantities of 2011. You can also see that the prices in part (c) are the same as those in part (a). They are the prices of the base year—2005.

For each item, we now multiply the quantity produced in 2011 by its price in 2005 to find what the total expenditure would have been in 2011 if prices had remained the same as they were in 2005. We then sum these expenditures to find real GDP in 2011, which is \$160 million.

Nominal GDP in 2011 is three times its value in 2005, but real GDP in 2011 is only 1.6 times its 2005 value—a 60 percent increase in *real* GDP.

Using the Real GDP Numbers

In the example that we've just worked through, we found the value of real GDP in 2011 based on the prices of 2005. This number alone enables us to compare production in two years only. By repeating the calculation that we have done for 2011 using the data for each year between 2005 and 2011, we can calculate the *annual* percentage change of real GDP—the annual growth rate of real GDP. This is the most common use of the real GDP numbers. Also, by calculating real GDP every three months—known as *quarterly real GDP*—the Bureau of Economic Analysis is able to provide valuable information that is used to interpret the current state of the economy. This information is used to guide both government macroeconomic policy and business production and investment decisions.

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TABLE 1

| Item | Amount (trillions of dollars) |
|----------------------------------|-------------------------------------|
| Consumption expenditure | 10.0 |
| Government expenditure | 2.9 |
| Indirect taxes less subsidies | 0.8 |
| Depreciation | 1.9 |
| Net factor income from abroad | 0.2 |
| Investment | 2.1 |
| Net exports | -0.7 |
| Statistical discrepancy | 0 |

TABLE 2

| (a) In 2010: | | |
|--------------|----------|--------|
| Item | Quantity | Price |
| Apples | 60 | \$0.50 |
| Oranges | 80 | \$0.25 |
| (b) In 2011: | | |
| Item | Quantity | Price |
| Apples | 160 | \$1.00 |
| Oranges | 220 | \$2.00 |

CHECKPOINT 14.2

Describe how economic statisticians measure GDP and distinguish between nominal GDP and real GDP.

Practice Problems

Table 1 shows some of the items in the U.S. National Income and Product Accounts in 2008. Use Table 1 to work Problems 1 to 3.

1. Use the expenditure approach to calculate U.S. GDP in 2008.
2. What was U.S. GDP as measured by the income approach in 2008? By how much did gross domestic product and net domestic product differ in 2008?
3. Calculate U.S. GNP and U.S. national income in 2008.
4. Table 2 shows some data for an economy. If the base year is 2010, calculate the economy's nominal GDP and real GDP in 2011.

In the News

As consumers reduce their spending, inventories are rising

The Commerce Department reported that sales of nondurable goods fell 0.6 percent, while sales of durable goods decreased 1.5 percent in August. Inventories of durable goods increased 1.4 percent.

Source: Reuters, October 9, 2008

Which component of GDP changed when sales of (i) nondurable goods fell and (ii) durable goods decreased, and (iii) inventories of durable goods increased? Provide an example of each item of expenditure.

Solutions to Practice Problems

1. GDP was \$14.3 trillion. The expenditure approach sums the expenditure on final goods and services. That is, $GDP = C + I + G + NX$. In 2008, U.S. GDP = $(\$10.0 + \$2.1 + \$2.9 - \$0.7)$ trillion = \$14.3 trillion.
2. GDP as measured by the income approach was \$14.3 trillion. With the statistical discrepancy zero, GDP (expenditure approach) = GDP (income approach). Gross domestic product minus net domestic product equals depreciation, which was \$1.9 trillion.
3. $GNP = GDP + \text{Net factor income from abroad}$. In 2008, GNP was \$14.5 trillion $(\$14.3 \text{ trillion} + \$0.2 \text{ trillion})$. National income = $GNP - \text{Depreciation}$, which equals $\$14.5 \text{ trillion} - \$1.9 \text{ trillion} = \$12.6 \text{ trillion}$.
4. Nominal GDP in 2011 equals $(160 \text{ apples} \times \$1) + (220 \text{ oranges} \times \$2) = \$600$. Real GDP in 2011 at 2010 prices equals $(160 \text{ apples} \times \$0.50 \text{ per apple}) + (220 \text{ oranges} \times \$0.25 \text{ per orange}) = \135 .

Solution to In the News

(i) Nondurable goods such as coffee are bought by households and are part of consumption expenditure, C . (ii) Durable goods such as iPhones are bought by households and are part of consumption expenditure, C , and durable goods such as tower cranes are bought by firms and are part of investment, I . (iii) An inventory of durable goods, such as the auto parts at a Ford plant, is part of investment, I .

14.3 THE USES AND LIMITATIONS OF REAL GDP

We use estimates of real GDP for three main purposes:

- To compare the standard of living over time
- To track the course of the business cycle
- To compare the standard of living among countries

■ The Standard of Living Over Time

A nation's **standard of living** is measured by the value of goods and services that its people enjoy, *on average*. Income per person determines what people can afford to buy and real GDP is a measure of real income. So **real GDP per person**—real GDP divided by the population—is a commonly used measure for comparing the standard of living over time.

Real GDP per person tells us the value of goods and services that the average person can enjoy. By using *real* GDP, we remove any influence that rising prices and a rising cost of living might have had on our comparison.

A handy way of comparing real GDP per person over time is to express it as a ratio of its value in some reference year. Table 14.4 provides the numbers for the United States that compare 2011 with 50 years earlier, 1961. In 1961, real GDP per person was \$15,754 and in 2011 it was \$42,206, or 2.7 times its 1961 level. To the extent that real GDP per person measures the standard of living, people were 2.7 times as well off in 2011 as their grandparents had been in 1961.

Figure 14.3 shows the entire 50 years of real GDP per person from 1961 to 2011 and displays two features of our changing standard of living:

1. The growth of potential GDP per person
2. Fluctuations of real GDP per person around potential GDP

Potential GDP is the level of real GDP when all the economy's factors of production—labor, capital, land, and entrepreneurial ability—are fully employed. When some factors of production are *unemployed*, real GDP is *below* potential GDP. And when some factors of production are *over-employed* and working harder and for longer hours than can be maintained in the long run, real GDP *exceeds* potential GDP.

You've seen that real GDP per person in 2011 was 2.7 times that of 1961. But in 2011, some labor and other factors of production were unemployed and the economy was producing less than potential GDP. To measure the trend in the standard of living, we must remove the influence of short-term fluctuations and focus on the path of potential GDP.

The growth rate of potential GDP fluctuates less than real GDP. During the 1960s, potential GDP per person grew at an average rate of 2.8 percent a year, but since 1970, its growth rate has slowed to 1.9 percent a year. This growth slowdown means that potential GDP is lower today (and lower by a large amount) than it would have been if the 1960s growth rate could have been maintained. If potential GDP had kept growing at the 1960s pace, potential GDP per person in 2011 would have been \$20,000 more than it actually was. The cumulatively lost income from the growth slowdown of the 1970s is a staggering \$300,000 per person. Understanding the reasons for the growth slowdown is one of the major tasks of macroeconomists.

Standard of living

The level of consumption of goods and services that people enjoy, *on average*.

Real GDP per person

Real GDP divided by the population.

TABLE 14.4 REAL GDP PER PERSON IN 1961 AND 2011

| Year | 1961 | 2011 |
|-----------------------|----------|----------|
| Real GDP (billions) | \$2,894 | \$13,088 |
| Population (millions) | 183.7 | 310.1 |
| Real GDP per person | \$15,754 | \$42,206 |

Potential GDP

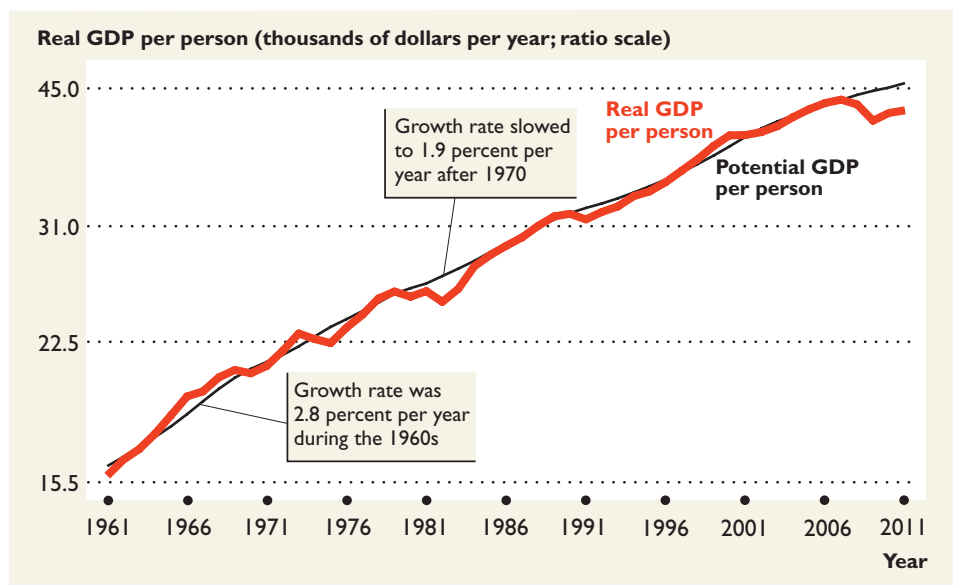
The value of real GDP when all the economy's factors of production—labor, capital, land, and entrepreneurial ability—are fully employed.

FIGURE 14.3

Real GDP and Potential GDP Per Person in the United States: 1961–2011

MyEconLab Animation

Real GDP grows and fluctuates around the growth path of potential GDP. Potential GDP per person grew at an annual rate of 2.8 percent during the 1960s and slowed to 1.9 percent after 1970.



SOURCES OF DATA: Bureau of Economic Analysis and the Congressional Budget Office.

Business cycle

A periodic but irregular up-and-down movement of total production and other measures of economic activity.

Tracking the Course of the Business Cycle

We call the fluctuations in the pace of economic activity the business cycle. A **business cycle** is a periodic but irregular up-and-down movement of total production and other measures of economic activity such as employment and income. The business cycle isn't a regular, predictable, and repeating cycle like the phases of the moon. The timing and the intensity of the business cycle vary a lot, but every cycle has two phases:

1. Expansion
2. Recession

and two turning points:

1. Peak
2. Trough

Figure 14.4 shows these features of the most recent U.S. business cycle using real GDP as the measure of economic activity. An *expansion* is a period during which real GDP increases. In the early stage of an expansion, real GDP remains below potential GDP and as the expansion progresses, real GDP eventually exceeds potential GDP.

Recession

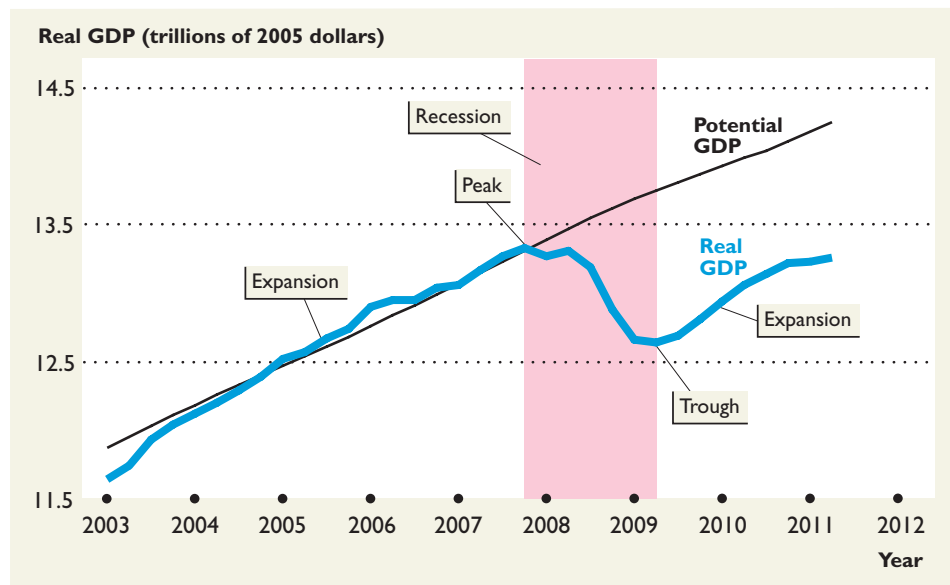
A period during which real GDP decreases for at least two successive quarters; or defined by the NBER as “a period of significant decline in total output, income, employment, and trade, usually lasting from six months to a year, and marked by contractions in many sectors of the economy.”

A common definition of **recession** is a period during which real GDP decreases—its growth rate is negative—for at least two successive quarters. The National Bureau of Economic Research (NBER), which dates the U.S. business cycle phases and turning points, defines a recession more broadly as “a period of significant decline in total output, income, employment, and trade, usually lasting from

FIGURE 14.4

The Most Recent U.S. Business Cycle

MyEconLab Real-time data



SOURCES OF DATA: Bureau of Economic Analysis, the Congressional Budget Office, and the National Bureau of Economic Research.

The most recent business cycle peak was in the fourth quarter of 2007 and the trough was in the second quarter of 2009 after which a new expansion began. Between the peak and the trough, the economy was in a recession. The recession was extremely deep and the expansion that followed was extremely weak—real GDP remained a long way below potential GDP.

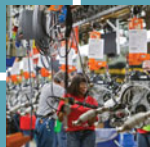
six months to a year, and marked by contractions in many sectors of the economy.” This definition means that sometimes the NBER declares a recession even though real GDP has not decreased for two successive quarters. A recession in 2001 was such a recession. An expansion ends and a recession begins at a business cycle peak. A peak is the highest level of real GDP that has been attained up to that time. A recession ends at a trough when real GDP reaches a low point and from which a new expansion begins.

The shaded bar in Figure 14.4 highlights the 2008–2009 recession. This recession was unusually severe. It lowered real GDP to its level of 2005. The end of a recession isn’t the end of pain. When an expansion begins, real GDP is below potential GDP. And even after two years into the expansion that followed the 2008–2009 recession, real GDP had not returned to its previous peak level and the gap between real GDP and potential GDP was wide.

The period that began in 1991 following a severe recession and that ended with the global financial crisis of 2008 was so free from serious downturns in real GDP and other indicators of economic activity that it was called the *Great Moderation*, a name that contrasts it with the Great Depression. Some starry-eyed optimists even began to declare that the business cycle was dead. This long period of expansion also turned the attention of macroeconomists away from the business cycle and toward a focus on economic growth and the possibility of achieving faster growth.

But the 2008–2009 recession put the business cycle back on the agenda. Economists were criticized for not predicting it, and old divisions among economists that many thought were healed erupted in the pages of *The Economist* and *The New York Times* and online on a host of blogs.

We’ll be examining the causes of recession and the alternative views among economists in greater detail as you progress through the rest of your study of macroeconomics.



EYE on the BOOMS AND BUSTS

How Do We Track the Booms and Busts of our Economy?

The National Bureau of Economic Research (NBER) Business Cycle Dating Committee determines the dates of U.S. business cycle turning points.

To identify the date of a business cycle peak, the NBER committee looks at data on industrial production, total employment, real GDP, and wholesale and retail sales.

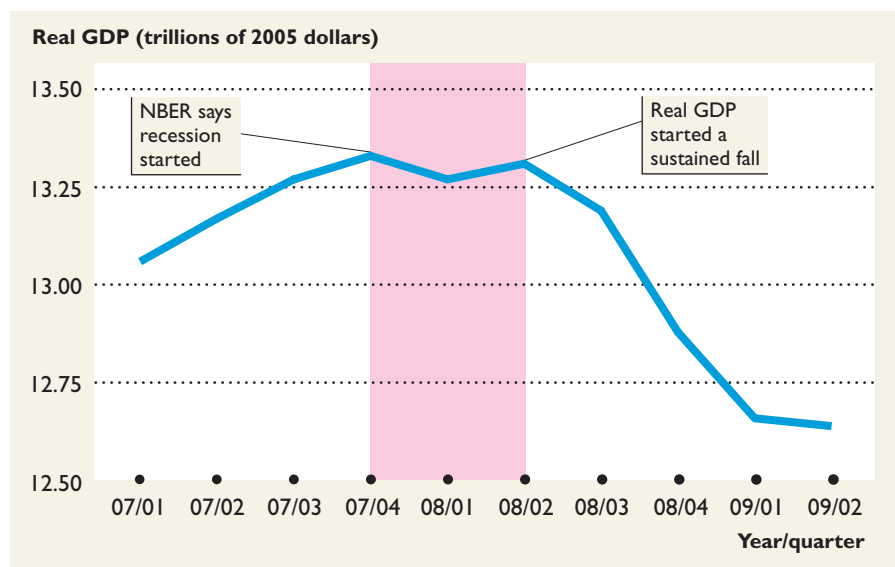
The NBER committee met in November 2008 to determine when the economy went into recession.

The committee reported that the two most reliable measures of aggregate domestic production are real GDP measured using the expenditure approach and the income approach.

Because of a statistical discrepancy, these two estimates of aggregate production differ and for a few quarters in 2007 and 2008 they told conflicting stories. As the committee noted, these estimates did “not speak clearly about the date of a peak in activity.”

The NBER examined other data on real personal income, real manufacturing, wholesale and retail sales, industrial production, and employment. All of these data peaked between November

2007 and June 2008 and on balance, the committee decided that November 2007 was the peak. But as the figure shows, real GDP didn’t begin a sustained fall until two quarters later.



SOURCES OF DATA: Bureau of Economic Analysis and the National Bureau of Economic Research.

Let’s now leave comparisons of the standard of living over time and business cycles and briefly see how we compare the standard of living among countries.

■ The Standard of Living Among Countries

To use real GDP per person to compare the standard of living among countries, we must convert the numbers for other countries into U.S. dollars. To calculate real GDP, we must also use a common set of prices—called *purchasing power parity prices*—for all countries. The International Monetary Fund performs these calculations and if you turn back to Figure 2.4 on p. 44 you can see some comparisons based on these data. They tell, for example, that an average American has a standard of living (income per person) almost 8 times that of an average person in China.

Real GDP provides an easy way of comparing living standards. But real GDP doesn’t include *all* the goods and services produced. Also, real GDP has nothing to say about factors other than the goods and services that affect the standard of living. Let’s explore these limitations of real GDP.

■ Goods and Services Omitted from GDP

GDP measures the value of goods and services that are bought in markets. GDP excludes

- Household production
- Underground production
- Leisure time
- Environment quality

Household Production

Household production is the production of goods and services (mainly services) in the home. Examples of this production are preparing meals, changing a light bulb, cutting grass, washing a car, and helping a student with homework. Because we don't buy these services in markets, they are not counted as part of GDP. The result is that GDP *underestimates* the value of the production.

Many items that were traditionally produced at home are now bought in the market. For example, more families now eat in fast-food restaurants—one of the fastest-growing industries in the United States—and use day-care services. These trends mean that food preparation and child-care services that were once part of household production are now measured as part of GDP. So real GDP grows more rapidly than does real GDP plus home production.

Household production

The production of goods and services in the home.

Underground Production

Underground production is the production of goods and services hidden from the view of government because people want to avoid taxes and regulations or their actions are illegal. Because underground production is unreported, it is omitted from GDP.

Examples of underground production are the distribution of illegal drugs, farm work that uses illegal workers who are paid less than the minimum wage, and jobs that are done for cash to avoid paying income taxes. This last category might be quite large and includes tips earned by cab drivers, hairdressers, and hotel and restaurant workers.

Edgar L. Feige, an economist at the University of Wisconsin, estimates that U.S. underground production was about 16 percent of GDP during the early 1990s. Underground production in many countries, especially in most developing countries, is estimated to be larger than that in the United States.

Underground production

The production of goods and services hidden from the view of government.

Leisure Time

Leisure time is an economic good that is not valued as part of GDP. Yet the marginal hour of leisure time must be at least as valuable to us as the wage we earn for working. If it were not, we would work instead. Over the years, leisure time has steadily increased as the workweek gets shorter, more people take early retirement, and the number of vacation days increases. These improvements in our standard of living are not measured in real GDP.

Environment Quality

Pollution is an economic *bad* (the opposite of a *good*). The more we pollute our environment, other things remaining the same, the lower is our standard of living. This lowering of our standard of living is not measured by real GDP.

■ Other Influences on the Standard of Living

The quantity of goods and services consumed is a major influence on the standard of living. But other influences are

- Health and life expectancy
- Political freedom and social justice

Health and Life Expectancy

Good health and a long life—the hopes of everyone—do not show up directly in real GDP. A higher real GDP enables us to spend more on medical research, health care, a good diet, and exercise equipment. As real GDP has increased, our life expectancy has lengthened. But we face new health and life expectancy problems every year. Diseases, such as AIDS, and drug abuse are taking young lives at a rate that causes serious concern. When we take these negative influences into account, real GDP growth might overstate the improvements in the standard of living.

Political Freedom and Social Justice

A country might have a very large real GDP per person but have limited political freedom and social justice. For example, a small elite might enjoy political liberty and extreme wealth while the majority of people have limited freedom and live in poverty. Such an economy would generally be regarded as having a lower standard of living than one that had the same amount of real GDP but in which everyone enjoyed political freedom.



EYE on YOUR LIFE

Making GDP Personal

As you read a newspaper or business magazine, watch a TV news show, or browse a news Web site, you often come across reports about GDP.

What do these reports mean for you? Where in the National Income and Product Accounts do *your* transactions appear? How can you use information about GDP in your life?

Your Contribution to GDP

Your own economic transactions show up in the National Income and Product Accounts on both the expenditure side and the income side—as part of the expenditure approach and part of the

income approach to measuring GDP.

Most of your expenditure is part of Consumption Expenditure. If you were to buy a new home, that item would appear as part of Investment. Because much of what you buy is produced in another country, expenditure on these goods shows up as part of Imports.

If you have a job, your income appears in Compensation of Employees.

Because the GDP measure of the value of production includes only market transactions, some of your own production of goods and services is most likely not counted in GDP.

What are the nonmarket goods and services that you produce? How would you go about valuing them?

Making Sense of the Numbers

To use the GDP numbers in a news report, you must first check whether the reporter is referring to *nominal* GDP or *real* GDP.

Using U.S. real GDP per person, check how your income compares with the average income in the United States. When you see GDP numbers for other countries, compare your income with that of a person in France, or Canada, or China.



EYE on the GLOBAL ECONOMY

Which Country Has the Highest Standard of Living?

You've seen that as a measure of the standard of living, GDP has limitations. To compare the standard of living across countries, we must consider other factors in addition to GDP.

GDP measures only the market value of all the final goods and services produced and bought in markets. GDP omits some goods and services (those produced in the home and in the hidden economy). It omits the value of leisure time, of good health and long life expectancy, as well as of political freedom and social justice. It also omits the damage (negative value) that pollution does to the environment.

These limitations of GDP as a measure of the standard of living apply in every country. So to make international comparisons of the standard of living, we must look at real GDP and other indicators. Nonetheless, real GDP per person is a major component of international comparisons.

Many alternatives to GDP have been proposed. One, called Green GDP, subtracts from GDP an estimate of the cost of greenhouse gas emissions and other negative influences on the environment. Another measure, called the Happy Planet Index, or HPI, goes further and subtracts from GDP an estimate of the cost of depleting nonrenewable resources.

Neither the Green GDP nor the HPI are reliable measures because they rely on guesses about the costs of pollution and resource depletion that are subjective and unreliable.

Taking an approach that focuses on the quality of life factors, the United Nations (UN) has constructed a Human Development Index (HDI), which combines real GDP, life expectancy and health, and education.

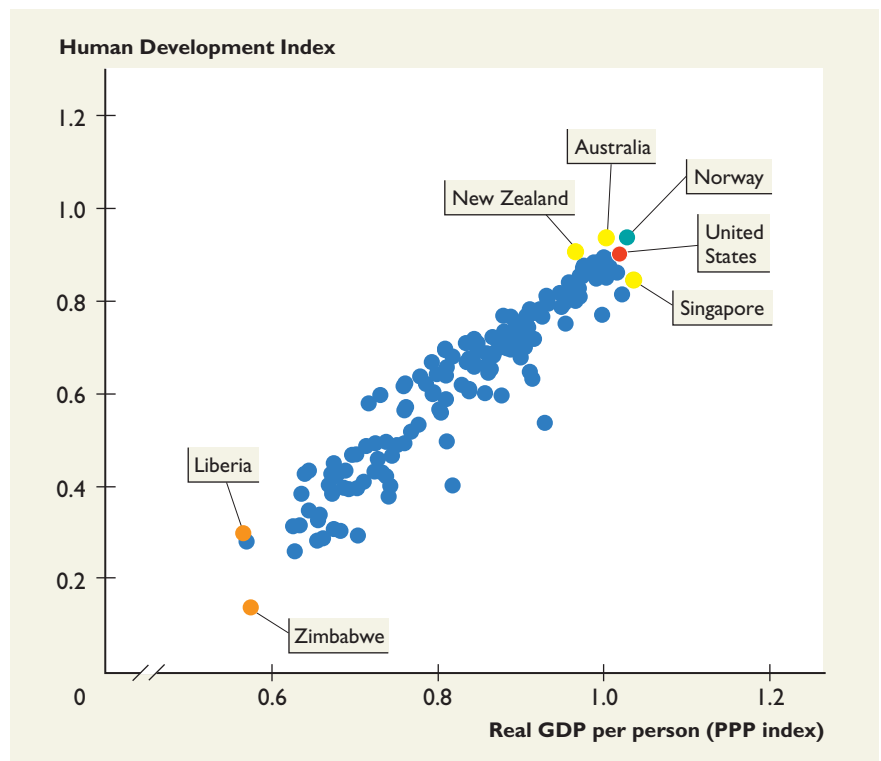
The figure shows the relationship between the HDI and GDP in 2010. (In the figure, each dot represents a country.) These two measures of the standard of living tell a similar but not identical story.

The United States has the 3rd highest GDP per person and the 4th highest HDI. Why does the United States not have a higher HDI?

The UN says that the people who live in the three countries with higher HDIs live longer, have access to universal health care, and have better schools than do people in the United States. The HDI emphasized equality of access to these services.

The HDI doesn't include political freedom and social justice. If it did, the United States would score highly on that component of the index.

The bottom line is that we don't know which country has the highest standard of living. We do know that GDP per person alone does not provide the complete answer.



SOURCE OF DATA: *United Nations Human Development Report, 2011*, <http://hdr.undp.org/>.

MyEconLab

You can work these problems in Study Plan 14.3 and get instant feedback.

TABLE 1

| Country | Real GDP per person |
|---------------|---------------------|
| China | \$4,833 |
| Russia | \$13,543 |
| United States | \$48,666 |
| Canada | \$50,265 |

CHECKPOINT 14.3

Describe the uses of real GDP and explain its limitations as a measure of the standard of living.

Practice Problems

The United Nations Human Development Report gives the data for 2011 in Table 1. Other information suggests that household production is similar in Canada and the United States and smaller than in China and Russia. The underground economy is largest in Russia and China and a similar proportion of these economies. Canadians and Americans enjoy more leisure hours than do the Chinese and Russians. Canada and the United States spend significantly more on the environment than do China and Russia. Use this information and ignore any other influences to work Problems 1 and 2.

1. In which pair (or pairs) of countries is it easiest to compare the standard of living? And in which pair (or pairs) is it most difficult? Explain why.
2. Do the differences in real GDP per person correctly rank the standard of living in these four countries? What additional information would we need to be able to make an accurate assessment of the relative standard of living in these four countries?

In the News

Economists look to expand GDP to include the quality of life

Robert Kennedy, when seeking the Democratic presidential nomination in 1968, remarked that GDP measures everything except that which makes life worthwhile.

Source: *The New York Times*, September 1, 2008

Which items did Robert Kennedy probably think were missing?

Solutions to Practice Problems

1. Two pairs—Canada and the United States, and China and Russia—are easy to compare because household production, the underground economy, leisure hours, and the environment are similar in the countries in each pair. The most difficult comparison is Canada and the United States with either China or Russia. Household production and the underground economy narrow the differences but leisure hours and the environment widen them.
2. Differences in real GDP per person probably correctly rank the standard of living because where the gap is small (Canada and the United States), other factors are similar, and where other factors differ, the gaps are huge. More information on the value of household production, the underground economy, the value of leisure, and the value of environmental differences is required to make an accurate assessment of relative living standards.

Solution to In the News

GDP measures production that is traded in markets. GDP does not include household production, leisure time, health and life expectancy, political freedom, and social justice. These items are probably the ones that Kennedy believed were missing from GDP as a measure of the quality of life.

CHAPTER SUMMARY

Key Points

- 1 Define GDP and explain why the value of production, income, and expenditure are the same for an economy.**
 - GDP is the market value of all final goods and services produced within a country in a given time period.
 - We can value goods and services either by what they cost to produce (incomes) or by what people are willing to pay (expenditures).
 - The value of production equals income equals expenditure.
- 2 Describe how economic statisticians measure GDP and distinguish between nominal GDP and real GDP.**
 - BEA measures GDP by summing expenditures and by summing incomes. With no errors of measurement the two totals are the same, but in practice, a small statistical discrepancy arises.
 - A country's GNP is similar to its GDP, but GNP is the value of production by factors of production supplied by the residents of a country.
 - Nominal GDP is the value of production using the prices of the current year and the quantities produced in the current year.
 - Real GDP is the value of production using the prices of a base year and the quantities produced in the current year.
- 3 Describe the uses of real GDP and explain its limitations as a measure of the standard of living.**
 - We use real GDP per person to compare the standard of living over time.
 - We use real GDP to determine when the economy has reached a business cycle peak or trough.
 - We use real GDP per person expressed in purchasing power parity dollars to compare the standard of living among countries.
 - Real GDP omits some goods and services and ignores some factors that influence the standard of living.
 - The Human Development Index takes some other factors into account.

Key Terms

| | | |
|---|--|------------------------------|
| Business cycle, 382 | Household production, 385 | Potential GDP, 381 |
| Consumption expenditure, 369 | Imports of goods and services, 370 | Real GDP, 378 |
| Depreciation, 376 | Intermediate good or service, 368 | Real GDP per person, 381 |
| Disposable personal income, 377 | Investment, 369 | Recession, 382 |
| Exports of goods and services, 370 | Net domestic product at factor cost, 375 | Saving, 370 |
| Final good or service, 368 | Net exports of goods and services, 370 | Standard of living, 381 |
| Government expenditure on goods and services, 370 | Net taxes, 370 | Statistical discrepancy, 376 |
| Gross domestic product (GDP), 368 | Nominal GDP, 378 | Underground production, 385 |
| Gross national product (GNP), 377 | | |

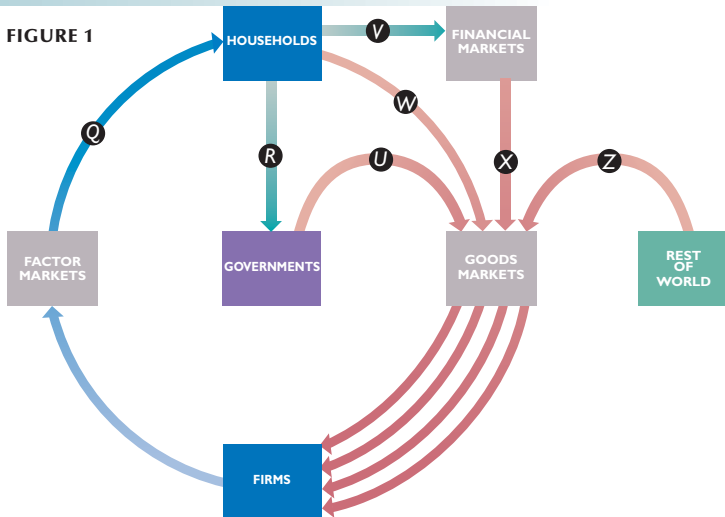
MyEconLab

You can work these problems in Chapter 14 Study Plan and get instant feedback.



CHAPTER CHECKPOINT

Study Plan Problems and Applications



1. Figure 1 shows the flows of income and expenditure in an economy. In 2009, *U* was \$2 trillion, *V* was \$1.5 trillion, *W* was \$7 trillion, *X* was \$1.5 trillion, and *Z* was zero. Calculate total income, net taxes, and GDP.

Use the following information to work Problems 2 and 3.

The national accounts of Parchment Paradise are kept on (you guessed it) parchment. A fire destroys the statistics office. The accounts are now incomplete but they contain the following data:

- GDP (income approach) \$2,900
- Consumption expenditure \$2,000
- Indirect taxes less subsidies \$100
- Interest, rent, and profit \$500
- Investment \$800
- Government expenditure \$400
- Wages \$2,000
- Net factor income from abroad \$50
- Net exports -\$200

2. Calculate GDP (expenditure approach) and depreciation.
3. Calculate net domestic product at factor cost, the statistical discrepancy, and GNP.

Use the following information to work Problems 4 to 6.

An economy produces only fun and food. Table 1 shows the prices and the quantities of fun and food produced in 2009 and 2010. The base year is 2009.

TABLE 1

| (a) In 2009: | | |
|--------------|----------|-------|
| Item | Quantity | Price |
| Fun | 40 | \$2 |
| Food | 60 | \$3 |
| (b) In 2010: | | |
| Item | Quantity | Price |
| Fun | 35 | \$3 |
| Food | 65 | \$2 |

4. Calculate nominal GDP in 2009 and 2010.
5. Calculate the percentage increase in production in 2010.
6. If potential GDP was \$270 in 2009 and it grew by 1 percent in 2010, in which phase of the business cycle is the economy? Explain.

Use the following information to work Problems 7 to 9.

Higher prices pushed up consumer spending for June

The Commerce Department reported that retail sales increased 0.8 percent in June. But net exports were down 0.3 percent in the second quarter of 2009 and inventories held by business fell by 1.1 percent in June, while sales at all levels of production were up 0.9 percent.

Source: Commerce Department, August 13, 2009

7. Which component of GDP changed because retail sales increased? Which component of GDP changed because inventories held by businesses fell?
8. Explain the effect of the fall in net exports on GDP.
9. Does the statement that sales at all levels of production were up 0.9 percent mean that GDP increased by 0.9 percent? Explain your answer.

Instructor Assignable Problems and Applications

Your instructor can assign these problems as homework, a quiz, or a test in [MyEconLab](#).

1. In 2008, the population of China was 1.3 billion and real GDP (in purchasing power parity prices) was \$4.4 trillion. In the same year, the population of India was 1.2 billion and real GDP (in purchasing power parity prices) was \$1.2 trillion. In 2005, the most recent year for which we have the data, China's HDI was 0.777 and India's was 0.619.

Based on this information, which country has the higher standard of living? What features of the information provided lead you to your conclusion?

2. Classify each of the items in List 1 as a final good or service or an intermediate good or service and identify which is a component of consumption expenditure, investment, or government expenditure on goods and services.

Use the following information to work Problems 3 and 4.

Mitsubishi Heavy Industries makes the wings of the new Boeing 787 Dreamliner in Japan. Toyota assembles cars for the U.S. market in Kentucky.

3. Explain where these activities appear in the National Income and Product Accounts of the United States.
4. Explain where these activities appear in the National Income and Product Accounts of Japan.

Use the data on the economy of Iberia in Table 1 to work Problems 5 and 6.

5. Calculate Iberia's GDP.
6. Calculate Iberia's imports of goods and services.

Use Table 2, which shows an economy's total production and the prices of the final goods it produced in 2009 and 2010, to work Problems 7 to 9.

7. Calculate nominal GDP in 2009 and 2010.
8. The base year is 2009. Calculate real GDP in 2009 and 2010.
9. Calculate the percentage increase in production in 2010.

Use the following information to work Problems 10 and 11.

Cash-paying vultures pick bones of U.S. housing market as mortgages dry up
New-home sales fell to an annual pace of 250,000 in February, an all-time low in records dating to 1963, the Commerce Department reported March 23. Existing-home sales dropped to a 4.88 million annualized pace in February, down 2.8 percent from a year earlier, the National Association of Realtors said, while the median price of existing homes fell to \$156,100, the lowest since February 2002.

Source: Bloomberg, March 29, 2011

10. Where do new-home sales appear in the circular flow of expenditure and income? Explain how a fall in new home sales affects real GDP.
11. Where do sales of previously owned homes appear in the circular flow of expenditure and income? Explain how a fall in sales of previously owned homes affects real GDP.
12. **A bit more bounce in the global economy**

The global economy is in the early stages of an upturn that will deliver more GDP growth than is expected but less than is needed. The latest economic news points to sustained above-trend global growth.

Source: J.P. Morgan Global Data Watch, September, 2009

Does this news mean that the 2008–2009 recession had ended by September 2009? Does recession end only when real GDP returns to potential GDP?

LIST 1

- Banking services bought by Target
- Security system bought by the White House
- Coffee beans bought by Starbucks
- New coffee machines bought by Starbucks
- Starbucks grande mocha frappuccino bought by a student
- New battle ship bought by the U.S. navy

TABLE 1

| Item | Amount |
|-------------------------|---------------|
| Net taxes | \$18 billion |
| Government expenditure | \$20 billion |
| Saving | \$15 billion |
| Consumption expenditure | \$67 billion |
| Investment | \$21 billion |
| Exports | \$30 billion. |

TABLE 2

(a) In 2009:

| Item | Quantity | Price |
|---------|----------|-------|
| Fish | 100 | \$2 |
| Berries | 50 | \$6 |

(b) In 2010:

| Item | Quantity | Price |
|---------|----------|-------|
| Fish | 75 | \$5 |
| Berries | 65 | \$10 |

MyEconLab

You can work this quiz in Chapter 14 Study Plan and get instant feedback.

Multiple Choice Quiz

1. Gross domestic product is the market value of all the _____ in a given time period.
 - A. goods and services bought by Americans
 - B. goods and services produced by American companies in all countries
 - C. final goods and services produced by all firms located in the United States
 - D. U.S.-produced goods and services bought in the United States
2. A _____ is a final good and _____ is an intermediate good.
 - A. new car bought by a student; a used SUV bought by a dealer
 - B. new textbook; used textbook
 - C. new iPhone bought by a student; new computer bought by Wal-Mart
 - D. gasoline bought by you; jet fuel bought by Southwest Airlines
3. Saving equals _____.
 - A. income minus consumption expenditure minus net taxes
 - B. income minus net taxes
 - C. total income minus total expenditure
 - D. net taxes minus government expenditure
4. The expenditure approach to measuring U.S. GDP equals _____.
 - A. the sum of U.S. consumption expenditure and U.S. investment
 - B. U.S. government expenditure minus taxes paid by Americans
 - C. all expenditure on final goods and services produced in the United States in a given time period
 - D. all expenditure by Americans on goods and services produced in the United States in a given time period
5. When using the income approach to measure GDP at market prices, in addition to summing all factor incomes it is necessary to _____.
 - A. subtract depreciation because profit is not reported as net profit
 - B. add depreciation because capital depreciates when goods are manufactured
 - C. add indirect taxes less subsidies to convert aggregate income from factor cost to market prices
 - D. add a statistical discrepancy which is the sum of depreciation and indirect taxes less subsidies
6. The following statements about the business cycle are correct *except* _____.
 - A. it is a regular predictable cycle in real GDP around potential GDP
 - B. from the peak to the trough, the economy is in a recession
 - C. from the trough to the peak, the economy is in an expansion
 - D. it is a periodic movement in economic activity including employment
7. Real GDP per person is not an accurate measure of the standard of living because it _____.
 - A. includes the goods and services that governments buy
 - B. omits the goods and services that people produce for themselves
 - C. includes goods and services bought by firms
 - D. omits the goods and services imported from other countries

APPENDIX: MEASURING REAL GDP

This appendix explains the principles used by the Bureau of Economic Analysis (BEA) to calculate real GDP using a measure called **chained-dollar real GDP**. We begin by explaining the problem that arises from using the prices of the base year (the method on pp. 378–379) and how the problem can be overcome.

Chained-dollar real GDP
The measure of real GDP calculated by the Bureau of Economic Analysis.

■ The Problem With Base-Year Prices

When we calculated real GDP on pp. 378–379, we found that real GDP in 2011 was 60 percent greater than it was in 2005. But instead of using the prices of 2005 as the constant prices, we could have used the prices of 2011. In this case, we would have valued the quantities produced in 2005 at the prices of 2011. By comparing the values of real GDP in 2005 and 2011 at the constant prices of 2011, we get a different number for the percentage increase in production. If you use the numbers in Table 14.3 on p. 379 to value 2005 production at 2011 prices, you will get a real GDP in 2005 of \$150 million (2011 dollars). Real GDP in 2011 at 2011 prices is \$300 million. So by using the prices of 2011, production doubled—a 100 percent increase—from 2005 to 2011. Did production in fact increase by 60 percent or 100 percent?

The problem arises because to calculate real GDP, we weight the quantity of each item produced by its price. If all prices change by the same percentage, then the *relative* weight on each good or service doesn't change and the percentage change in real GDP from the first year to the second is the same regardless of which year's prices we use. But if prices change by different percentages, then the *relative* weight on each good or service *does* change and the percentage change in real GDP from the first year to the second depends on which prices we use. So which year's prices should we use: those of the first year or those of the second?

The answer given by the BEA method is to use the prices of both years. If we calculate the percentage change in real GDP twice, once using the prices of the first year and again using the prices of the second year, and then take the average of those two percentage changes, we get a unique measure of the change in real GDP and one that gives equal importance to the *relative* prices of both years.

To illustrate the calculation of the BEA measure of real GDP, we'll work through an example. The method has three steps:

- Value production in the prices of adjacent years.
- Find the average of two percentage changes.
- Link (chain) to the base year.

■ Value Production in the Prices of Adjacent Years

The first step is to value production in *adjacent* years at the prices of both years. We'll make these calculations for 2012, and its preceding year, 2011.

Table A14.1 shows the quantities produced and prices in the two years. Part (a) shows the nominal GDP calculation for 2011—the quantities produced in 2011 valued at the prices of 2011. Nominal GDP in 2011 is \$145 million. Part (b) shows the nominal GDP calculation for 2012—the quantities produced in 2012 valued at the prices of 2012. Nominal GDP in 2012 is \$172 million. Part (c) shows the value of the quantities produced in 2012 at the prices of 2011. This total is \$160 million. Finally, part (d) shows the value of the quantities produced in 2011 at the prices of 2012. This total is \$158 million.

TABLE A14.1

Real GDP Calculation Step 1: Value Production in Adjacent Years at Prices of Both Years

Step 1 is to value the production of adjacent years at the prices of both years.

Here, we value the production of 2011 and 2012 at the prices of both 2011 and 2012.

The value of 2011 production at 2011 prices, in part (a), is nominal GDP in 2011.

The value of 2012 production at 2012 prices, in part (b), is nominal GDP in 2012.

Part (c) calculates the value of 2012 production at 2011 prices, and part (d) calculates the value of 2011 production at 2012 prices.

We use these numbers in Step 2.

| | Item | Quantity (millions of units) | Price (dollars per unit) | Expenditure (millions of dollars) |
|--|--------------------------------|---------------------------------|-----------------------------|--------------------------------------|
| (a) In 2011 | | | | |
| C | T-shirts | 3 | 5 | 15 |
| I | Computer chips | 3 | 10 | 30 |
| G | Security services | 5 | 20 | 100 |
| Y | Nominal GDP in 2011 | | | <u>145</u> |
| (b) In 2012 | | | | |
| C | T-shirts | 4 | 4 | 16 |
| I | Computer chips | 2 | 12 | 24 |
| G | Security services | 6 | 22 | 132 |
| Y | Nominal GDP in 2012 | | | <u>172</u> |
| (c) Quantities of 2012 valued at prices of 2011 | | | | |
| C | T-shirts | 4 | 5 | 20 |
| I | Computer chips | 2 | 10 | 20 |
| G | Security services | 6 | 20 | 120 |
| Y | 2012 production at 2011 prices | | | <u>160</u> |
| (d) Quantities of 2011 valued at prices of 2012 | | | | |
| C | T-shirts | 3 | 4 | 12 |
| I | Computer chips | 3 | 12 | 36 |
| G | Security services | 5 | 22 | 110 |
| Y | 2011 production at 2012 prices | | | <u>158</u> |

Find the Average of Two Percentage Changes

The second step is to find the percentage change in the value of production based on the prices in the two adjacent years. Table A14.2 summarizes these calculations.

Valued at the prices of 2011, production increased from \$145 million in 2011 to \$160 million in 2012, an increase of 10.3 percent. Valued at the prices of 2012, production increased from \$158 million in 2011 to \$172 million in 2012, an increase of 8.9 percent. The average of these two percentage changes in the value of production is 9.6. That is, $(10.3 + 8.9) \div 2 = 9.6$.

By applying this percentage change to real GDP, we can find the value of real GDP in 2012. Because real GDP in 2011 is in 2011 dollars, real GDP in 2012 is also in 2011 dollars. GDP in 2011 is \$145 million, so a 9.6 percent increase is \$14 million. Real GDP in 2012, expressed in 2011 dollars, is \$145 million plus \$14 million, which equals \$159 million.

Although the real GDP of \$159 million is expressed in 2011 dollars, the calculation uses the average of the *relative prices* of the final goods and services that make up GDP in 2011 and 2012.

TABLE A14.2

Real GDP Calculation Step 2: Find Average of Two Percentage Changes

| Value of Production in Adjacent Years | | Millions of dollars | |
|---|------|---------------------|---|
| 2011 production at 2011 prices | | 145 | Using the numbers calculated in Step 1, we find the percentage change in production from 2011 to 2012 valued at 2011 prices, which is 10.3 percent. |
| 2012 production at 2011 prices | | 160 | |
| Percentage change in production at 2011 prices | 10.3 | | |
| 2011 production at 2012 prices | | 158 | We also find the percentage change in production from 2011 to 2012 valued at 2012 prices, which is 8.9 percent. |
| 2012 production at 2012 prices | | 172 | |
| Percentage change in production at 2012 prices | 8.9 | | |
| Average of two percentage changes in production | 9.6 | | We then find the average of these two percentage changes, which is 9.6 percent. |

Link (Chain) to the Base Year

The final step repeats the calculation that we've just described to obtain the real GDP growth rate each year. In the base year, which currently is 2005, real GDP equals nominal GDP. By applying the calculated growth rates to each successive year, we obtain *chained-dollar real GDP* in 2005 dollars.

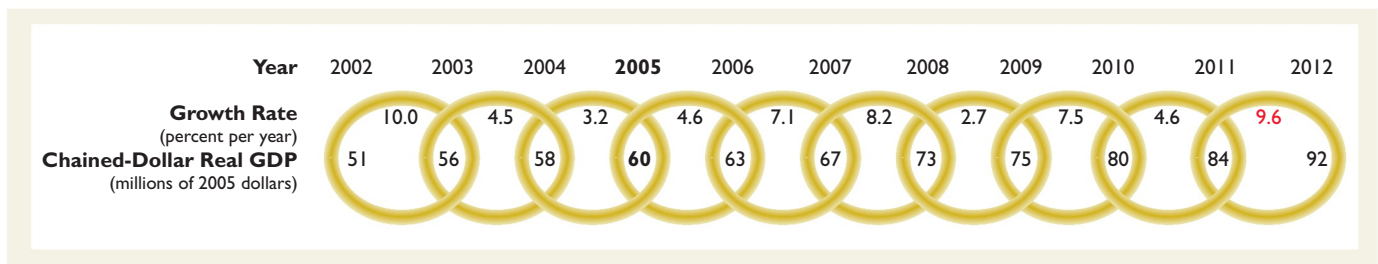
Figure A14.1 shows an example. In the base year, 2005, real GDP equals nominal GDP, which is \$60 million. The figure shows the growth rate of real GDP for each year between 2002 and 2012, the final one of which is the 9.6 percent that we calculated in Table A14.2 above.

Starting with real GDP in the base year, we apply the calculated percentage changes to find real GDP in other years. For example, in 2006, the growth rate was 4.6 percent, so real GDP in 2006 was 4.6 percent higher than \$60 million, which is \$63 million. In 2005, the growth rate was 3.2 percent, so real GDP in 2005 was 3.2 percent higher than real GDP in 2004, which was \$58 million. By repeating the calculations through to 2011, real GDP in 2011 was \$84 million. In 2012, real GDP grew by 9.6 percent of \$84 million, which is \$8 million, so real GDP in 2012 was \$92 million.

FIGURE A14.1

Real GDP Calculation Step 3: Link (Chain) to the Base Year

MyEconLab Animation



The growth rate of real GDP from one year to the next is calculated for every pair of years and then linked to the base year. Suppose that real GDP was \$60 million in the base year, 2005. By applying the growth rate between each pair of years, we find the

chained-dollar real GDP for each year, expressed in terms of the value of the dollar in the base year. Here, the percentages for 2002 through to 2012 are assumed. By 2012, the chained-dollar real GDP has increased to \$92 million in 2005 dollars.

MyEconLab

You can work these problems in Chapter 14 Study Plan and get instant feedback.

TABLE 1

(a) In 2010:

| Item | Quantity | Price |
|----------|----------|-------|
| Bananas | 100 | \$10 |
| Coconuts | 50 | \$12 |

(b) In 2011:

| Item | Quantity | Price |
|----------|----------|-------|
| Bananas | 110 | \$15 |
| Coconuts | 60 | \$10 |

Your instructor can assign these problems as homework, a quiz, or a test in **MyEconLab**.

TABLE 2

(a) In 2010:

| Item | Quantity | Price |
|------|----------|-------|
| Food | 100 | \$2 |
| Fun | 50 | \$6 |

(b) In 2011:

| Item | Quantity | Price |
|------|----------|-------|
| Food | 75 | \$5 |
| Fun | 65 | \$10 |

APPENDIX CHECKPOINT

Study Plan Problems

An island economy produces only bananas and coconuts. Table 1 gives the quantities produced and prices in 2010 and in 2011.

1. Calculate nominal GDP in 2010 and nominal GDP in 2011.
2. Calculate the value of 2011 production in 2010 prices and the percentage increase in production when valued at 2010 prices.
3. Calculate the value of 2010 production in 2011 prices and the percentage increase in production when valued at 2011 prices.
4. The base year is 2010. Use the chained-dollar method to calculate real GDP in 2010 and 2011. In terms of what dollars is each of these two real GDPs measured?
5. The base year is 2010. Using the chained-dollar method, compare the growth rates of nominal GDP and real GDP in 2011.
6. The base year is 2011. Use the chained-dollar method to calculate real GDP in 2010 and 2011. In terms of what dollars is each of these two real GDPs measured?
7. Compare the growth rates of nominal GDP and real GDP in 2011 dollars in 2011.

Instructor Assignable Problems

An economy produces only food and fun. Table 2 shows the quantities produced and prices in 2010 and 2011.

1. Calculate nominal GDP in 2010 and nominal GDP in 2011.
2. Calculate the value of 2011 production in 2010 prices and the percentage increase in production when valued at 2010 prices.
3. Calculate the value of 2010 production in 2011 prices and the percentage increase in production when valued at 2011 prices.
4. Using the chained-dollar method, calculate real GDP in 2010 and 2011 if the base year is 2011. In terms of what dollars is each of these two real GDPs measured?
5. The base year is 2011. Using the chained-dollar method, compare the growth rates of nominal GDP and real GDP in 2011.
6. The base year is 2010. Use the chained-dollar method to calculate real GDP in 2010 and 2011. In terms of what dollars is each of these two real GDPs measured?
7. Compare the growth rates of nominal GDP and real GDP in 2010 dollars in 2011.



How long does it take to find a job?

Jobs and Unemployment



CHAPTER CHECKLIST

When you have completed your study of this chapter, you will be able to

- 1 Define the unemployment rate and other labor market indicators.
- 2 Describe the trends and fluctuations in the indicators of labor market performance in the United States.
- 3 Describe the types of unemployment, define full employment, and explain the link between unemployment and real GDP.

15.1 LABOR MARKET INDICATORS

Every month, 1,600 field interviewers and supervisors working on a joint project between the Bureau of Labor Statistics (or BLS) and the Bureau of the Census survey 60,000 households and ask a series of questions about the age and labor market status of their members. This survey is called the *Current Population Survey*. Let's look at the types of data collected by this survey.

■ Current Population Survey

Figure 15.1 shows the categories into which the BLS divides the population. It also shows the relationships among the categories. The first category divides the population into two groups: the working-age civilian population and others. The **working-age population** is the total number of people aged 16 years and over who are not in jail, hospital, or some other form of institutional care or in the U.S. Armed Forces. In August 2011, the estimated population of the United States was 312.1 million, the working-age population was 239.9 million, and 72.2 million people were under 16 years of age, in the military, or living in institutions.

The second category divides the working-age population into two groups: those in the labor force and those not in the labor force. The **labor force** is the number of people employed plus the number unemployed. In August 2011, the U.S. labor force was 153.6 million and 86.3 million people were not in the labor force. Most of those not in the labor force were in school full time or had retired from work.

The third category divides the labor force into two groups: the employed and the unemployed. In August 2011 in the United States, 139.6 million people were employed and 14.0 million people were unemployed.

■ Population Survey Criteria

The survey counts as *employed* all persons who, during the week before the survey, either

1. Worked at least 1 hour as paid employees or worked 15 hours or more as unpaid workers in their family business or
2. Were not working but had jobs or businesses from which they were temporarily absent.

The survey counts as *unemployed* all persons who, during the week before the survey,

1. Had no employment,
2. Were available for work,

and either

1. Had made specific efforts to find employment during the previous four weeks or
2. Were waiting to be recalled to a job from which they had been laid off.

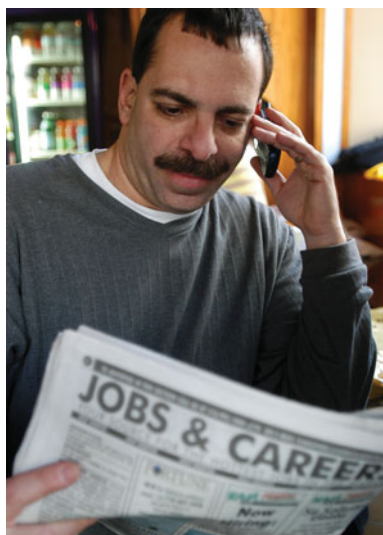
People in the working-age population who by the above criteria are neither employed nor unemployed are classified as not in the labor force.

Working-age population

The total number of people aged 16 years and over who are not in jail, hospital, or some other form of institutional care or in the U.S. Armed Forces.

Labor force

The number of people employed plus the number unemployed.

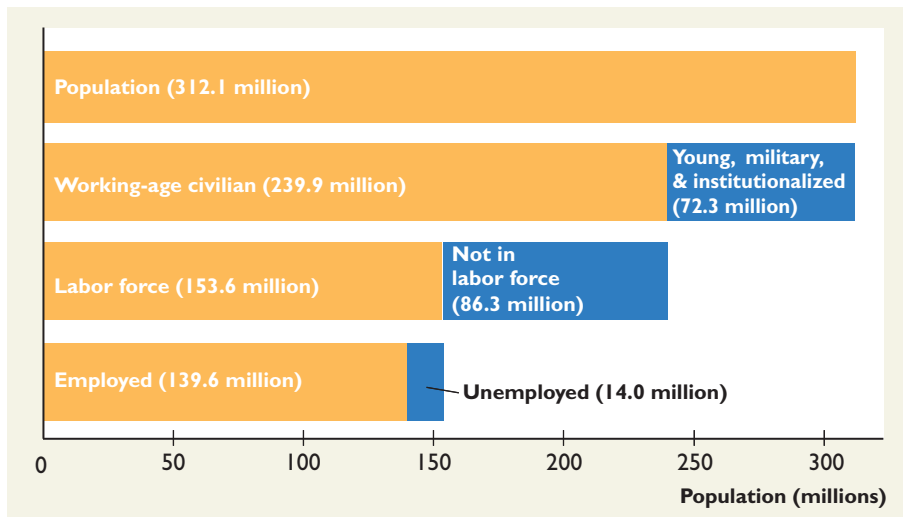


To be counted as unemployed, a person must not only want a job but also have tried to find one.

FIGURE 15.1

Population Labor Force Categories

MyEconLab Real-time data



SOURCE OF DATA: Bureau of Labor Statistics.

The U.S. population is divided into the working-age population and the young, military, and institutionalized. The working-age population is divided into the labor force and those not in the labor force. The labor force is divided into those employed and those unemployed. The figure shows the data for August 2011.

Two Main Labor Market Indicators

Using the numbers from the Current Population Survey, the BLS calculates several indicators of the state of the labor market. The two main labor market indicators are

- The unemployment rate
- The labor force participation rate

The Unemployment Rate

The amount of unemployment is an indicator of the extent to which people who want jobs can't find them. It tells us the amount of slack in the labor market. The **unemployment rate** is the percentage of the people in the labor force who are unemployed. That is,

$$\text{Unemployment rate} = \frac{\text{Number of people unemployed}}{\text{Labor force}} \times 100.$$

In August 2011, the number of people unemployed was 14.0 million and the labor force was 153.6 million. We can use these numbers to calculate the unemployment rate in August 2011, which is

$$\begin{aligned} \text{Unemployment rate} &= \frac{14.0 \text{ million}}{153.6 \text{ million}} \times 100 \\ &= 9.1 \text{ percent.} \end{aligned}$$

Unemployment rate

The percentage of the people in the labor force who are unemployed.

Labor force participation rate

The percentage of the working-age population who are members of the labor force.

The Labor Force Participation Rate

The number of people in the labor force is an indicator of the willingness of people of working age to take jobs. The **labor force participation rate** is the percentage of the working-age population who are members of the labor force. That is,

$$\text{Labor force participation rate} = \frac{\text{Labor force}}{\text{Working-age population}} \times 100.$$

In August 2011, the labor force was 153.6 million and the working-age population was 239.9 million. We can use these numbers to calculate the labor force participation rate in August 2011, which is

$$\begin{aligned} \text{Labor force participation rate} &= \frac{153.6 \text{ million}}{239.9 \text{ million}} \times 100. \\ &= 64.0 \text{ percent.} \end{aligned}$$

Alternative Measures of Unemployment

The unemployment rate based on the official definition of unemployment omits some types of underutilization of labor. The omissions are

- Marginally attached workers
- Part-time workers

Marginally Attached Workers**Marginally attached worker**

A person who does not have a job, is available and willing to work, has not made specific efforts to find a job within the previous four weeks, but has looked for work sometime in the recent past.

Discouraged worker

A marginally attached worker who has not made specific efforts to find a job within the past four weeks because previous unsuccessful attempts to find a job were discouraging.

Some people who think of themselves as being in the labor force and unemployed are not counted in the official labor force numbers. They are marginally attached workers. A **marginally attached worker** is a person who does not have a job, is available and willing to work, has not made specific efforts to find a job within the previous four weeks, but has looked for work sometime in the recent past. A **discouraged worker** is a marginally attached worker who has not made specific efforts to find a job within the previous four weeks because previous unsuccessful attempts were discouraging.

Other marginally attached workers differ from discouraged workers only in their reasons for not having looked for a job during the previous four weeks. For example, Martin doesn't have a job and is available for work, but he has not looked for work in the past four weeks because he was busy cleaning his home after a flood. He is a marginally attached worker but not a discouraged worker. Lena, Martin's wife, doesn't have a job and is available for work, but she hasn't looked for work in the past four weeks because she's been looking for six months and hasn't had a single job offer. She is a discouraged worker.

Neither the unemployment rate nor the labor force participation rate includes marginally attached workers. In August 2011, 988,000 people were discouraged workers. If we add them to both the number unemployed and the labor force, the unemployment rate becomes 9.7 percent—only slightly higher than the standard definition of the unemployment rate. Also in August 2011, 1,432,000 people were other marginally attached workers. If we add them and the discouraged workers to both the number unemployed and the labor force, the unemployment rate becomes 10.5 percent—1.4 percentage points higher than the standard definition.



EYE on the U.S. ECONOMY

The Current Population Survey

The Bureau of Labor Statistics and the Bureau of the Census go to great lengths to collect accurate labor force data. They constantly train and retrain around 1,600 field interviewers and supervisors. Each month, each field interviewer contacts 37 households and asks basic demographic questions about everyone living at the address and detailed labor force questions about those aged 16 or over.

Once a household has been selected for the survey, it is questioned for four consecutive months and then again for the same four months a year later. Each month, the addresses that have been in the panel eight times are removed and 6,250 new addresses are added. The rotation and overlap of households provide

very reliable information about month-to-month and year-to-year changes in the labor market.

The first time that a household is in the panel, an interviewer, armed with a hand-held computer, visits it. If the household has a telephone, most of the subsequent interviews are con-

ducted by phone, many of them from one of the three telephone interviewing centers in Hagerstown, Maryland; Jeffersonville, Indiana; and Tucson, Arizona.

For more information about the Current Population Survey, visit www.bls.gov/cps/cps_faq.htm.



Part-Time Workers

The Current Population Survey measures the number of full-time workers and part-time workers. **Full-time workers** are those who usually work 35 hours or more a week. **Part-time workers** are those who usually work less than 35 hours a week. Part-time workers are divided into two groups: part time for economic reasons and part time for noneconomic reasons.

People who work **part time for economic reasons** (also called *involuntary part-time workers*) are people who work 1 to 34 hours but are looking for full-time work. These people are unable to find full-time work because of unfavorable business conditions or seasonal decreases in the availability of full-time work.

People who work part time for noneconomic reasons do not want full-time work and are not available for such work. This group includes people with health problems, family or personal responsibilities, or education commitments that limit their availability for work.

The Bureau of Labor Statistics uses the data on full-time and part-time status to measure the slack in the labor market that results from people being underemployed—employed but not able to find as much employment as they would like.

In August 2011, when employment was 139.6 million, full-time employment was 112.6 million and part-time employment was 27.0 million. An estimated 8.8 million people worked part time for economic reasons. When this number, along with marginally attached workers, is added to the number unemployed, the unemployment rate becomes 16.2 percent.

Full-time workers

People who usually work 35 hours or more a week.

Part-time workers

People who usually work less than 35 hours a week.

Part time for economic reasons

People who work 1 to 34 hours per week but are looking for full-time work and cannot find it because of unfavorable business conditions.

MyEconLab

You can work these problems in Study Plan 15.1 and get instant feedback.

CHECKPOINT 15.1

Define the unemployment rate and other labor market indicators.

Practice Problems

The BLS reported that in July 2009, the labor force was 154.5 million, employment was 140.0 million, and the working-age population was 235.9 million.

1. Calculate the unemployment rate and the labor force participation rate.
2. The BLS also reported that 24 percent of all employment in July 2009 was part time and that 9.1 million people worked part time for economic reasons. How many people worked part time for noneconomic reasons?

In the News**Summer 2011 youth labor market**

From April to July 2011, the number of employed youth 16 to 24 years old rose by 1.7 million to 18.6 million. Unemployment of youth increased from 3.4 million to 4.1 million. In July, the youth labor force grew by 2.4 million to a total of 22.7 million and the youth population was 38 million.

Source: BLS Press Release, August 24, 2011

How did the youth unemployment rate change from April to July? Calculate the youth labor force participation rate in July.

Solutions to Practice Problems

1. The unemployment rate is 9.4 percent. The labor force is the sum of the number employed plus the number unemployed. So the number unemployed equals the labor force minus the number employed, which equals 154.5 million minus 140.0 million, or 14.5 million. The unemployment rate is the number unemployed as a percentage of the labor force. The unemployment rate = $(14.5 \text{ million} \div 154.5 \text{ million}) \times 100$, or 9.4 percent. The labor force participation rate is 65.5 percent. The labor force participation rate is the percentage of the working-age population who are in the labor force. Labor force participation rate = $(154.5 \div 235.9) \times 100$, or 65.5 percent.
2. 24.5 million people worked part time for noneconomic reasons. Employment was 140 million. Part-time employment was 24 percent of 140 million, which equals 33.6 million. Given that 9.1 million worked part time for economic reasons, 33.6 million minus 9.1 million, or 24.5 million worked part time for noneconomic reasons.

Solution to In the News

The unemployment rate is the number unemployed as a percentage of the labor force. The April labor force equals the July labor force (22.7 million) minus the growth of 2.4 million from April to July. That is, the April labor force was 20.3 million. In April, 3.4 million youths were unemployed, so the April unemployment rate was $(3.4 \div 20.3) \times 100$, or 16.7 percent. In July, 4.1 million youths were unemployed and the labor force was 22.7 million, so the unemployment rate was 18.1 percent. From April to July, the unemployment rate rose from 16.7 percent to 18.1 percent. The labor force participation rate equals the labor force (22.7 million) as a percentage of the population (38 million), which was 59.7 percent.

15.2 LABOR MARKET TRENDS AND FLUCTUATIONS

What do we learn about the U.S. labor market from changes in the unemployment rate, the labor force participation rate, and the alternative measures of unemployment? Let's explore the trends and fluctuations in these indicators.

■ Unemployment Rate

Figure 15.2 shows the U.S. unemployment rate over the 82 years from 1929 to 2011. Over these years, the average U.S. unemployment rate was 7.2 percent, but from 1948 to 2011, the long-term average was 5.8 percent. The unemployment rate was below this long-term average during the 1940s through the 1960s and during the late 1990s and early 2000s. It was above the long-term average during the 1970s to the mid 1990s and 2009–2011.

During the 1960s, the unemployment rate gradually fell to 3.5 percent. These years saw a rapid rate of job creation, partly from the demands placed on the economy by the growth of defense production during the Vietnam War and partly from an expansion of consumer spending encouraged by an expansion of social programs. Another burst of rapid job creation driven by the “new economy”—the high-technology sector driven by the expansion of the Internet—lowered the unemployment rate from 1995 through most of the 2000s to below average.

The most striking event visible in Figure 15.2 is the **Great Depression**, a period of high unemployment, low incomes, and extreme economic hardship that lasted from 1929 to 1939. By 1933, the worst of the Great Depression years, real GDP had fallen by a huge 30 percent and as the figure shows, one in four of the people who wanted jobs couldn't find them. The horrors of the Great Depression led to the New Deal and shaped political attitudes that persist today.

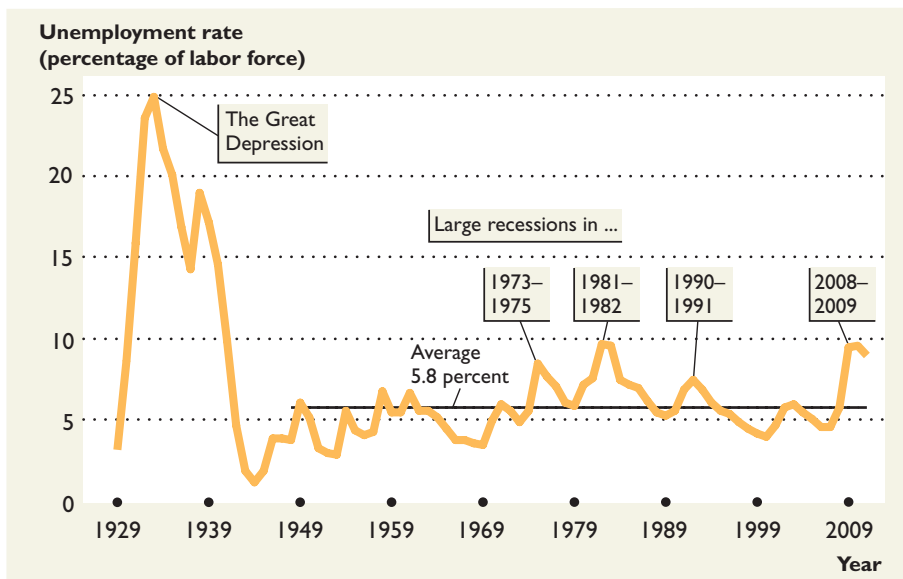
Great Depression

A period of high unemployment, low incomes, and extreme economic hardship that lasted from 1929 to 1939.

■ FIGURE 15.2

The U.S. Unemployment Rate: 1929–2011

MvEconLab Real-time data



The average unemployment rate from 1948 to 2011 was 5.8 percent. The unemployment rate increases in recessions and decreases in expansions. Unemployment was at its lowest during World War II and the expansions of the 1950s, 1960s, and the 1990s and at its highest during the Great Depression and the recessions of 1981–1982 and 2008–2009.

SOURCE OF DATA: Bureau of Labor Statistics.



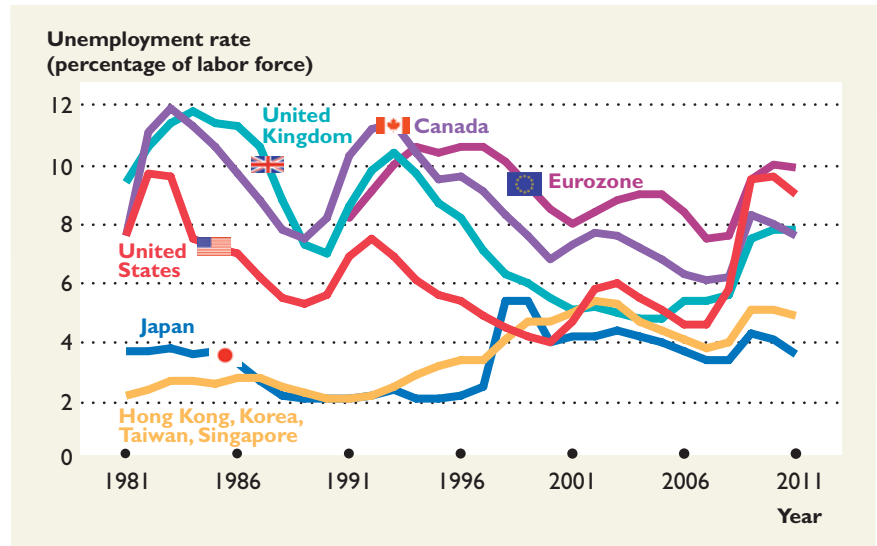
EYE on the GLOBAL ECONOMY

Unemployment Around the World

Before the 2008–2009 recession, the U.S. unemployment rate fell in the middle of the range experienced by other countries. The highest unemployment rates have been in Europe, Canada, and the United Kingdom and the lowest unemployment rates have been in Japan and the newly industrializing countries of Asia.

Differences in unemployment rates were much greater during the 1980s and 1990s than in the 2000s.

All of the countries with higher average unemployment rates than the United States also have higher unemployment benefits and more regulated labor markets.



SOURCE OF DATA: International Monetary Fund, *World Economic Outlook*, April 2011.

During the recessions of 1973–1975, 1981–1982, 1990–1991, and 2008–2009, the unemployment rate increased. During the post-war years, the unemployment rate peaked in November–December 1982, when 10.8 percent of the labor force were unemployed. By mid-2011, although the economy had come out of recession and entered into a slow expansion, the unemployment rate stood at 9.1 percent. While the popular representation of the 2008–2009 recession compares it with the Great Depression, you can see in Figure 15.2 that 2010 is strikingly different from 1933, the year in which the unemployment rate peaked during the Great Depression.

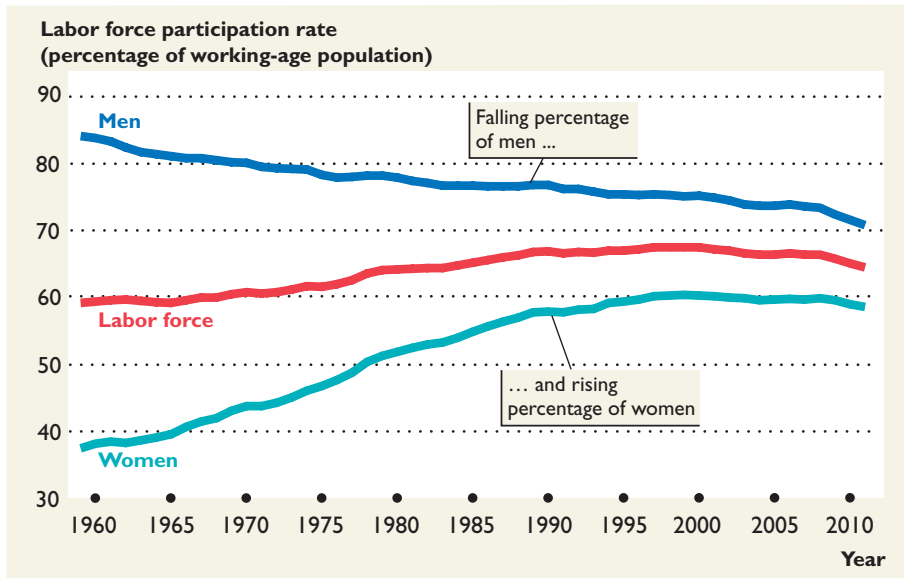
■ The Participation Rate

Figure 15.3 shows the labor force participation rate, which increased from 59 percent in 1960 to 67 percent at its peak in the late 1990s. Why has the labor force participation rate increased? The main reason is an increase in the number of women who have entered the labor force.

Figure 15.3 shows that in the 40 years from 1960 to 2000, the participation rate of women increased from 37 percent to 60 percent. This increase is spread across women of all age groups and occurred for four main reasons. First, more women pursued a college education and so increased their earning power. Second, technological change in the workplace created a large number of white-collar jobs with flexible work hours that many women found attractive. Third, technological change in the home increased the time available for paid employment. And fourth, families looked increasingly to a second income to balance tight budgets.

FIGURE 15.3
The Changing Face of the Labor Market: 1960–2011

MyEconLab Real-time data



During the past 51 years, the labor force participation rate has increased. The labor force participation rate of men has decreased, and that of women has increased.

SOURCE OF DATA: Bureau of Labor Statistics.

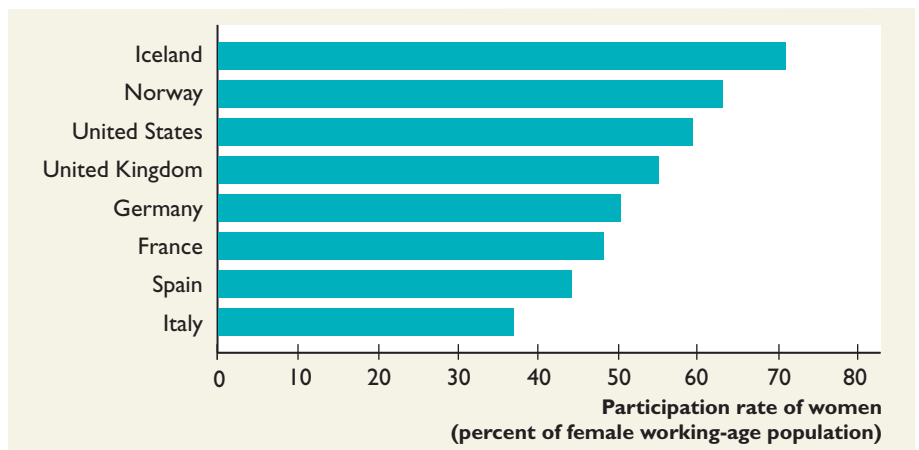


EYE on the GLOBAL ECONOMY

Women in the Labor Force

The labor force participation rate of women has increased in most advanced nations. But the participation rate of women in the labor force varies a great deal around the world. The figure compares seven other countries with the United States.

Cultural factors play a role in determining national differences in women's work choices. But economic factors such as the percentage of women with a college degree will ultimately dominate cultural influences and bring a convergence.



SOURCE OF DATA: OECD.

Figure 15.3 also shows another remarkable trend in the U.S. labor force: The participation rate of men *decreased* from 83 percent in 1960 to 70 percent in 2010. As in the case of women, this decrease is spread across all age groups. Some of the decrease occurred because older men chose to retire earlier. During the 1990s, some of this earlier retirement was made possible by an increase in wealth. But some arose from job loss at an age at which finding a new job is difficult. For other men, mainly those in their teens and twenties, decreased labor force participation occurred because more chose to remain in full-time education.

Alternative Measures of Unemployment

You've seen that the official measure of unemployment does not include marginally attached workers and people who work part time for economic reasons. The Bureau of Labor Statistics (BLS) now provides three broader measures of the unemployment rate, known as U-4, U-5, and U-6, that include these wider groups of the jobless. The official unemployment rate (based on the standard definition of unemployment) is called U-3 and as these names imply, there is also a U-1 and U-2 measure. The U-1 and U-2 measures of the unemployment rate are narrower than the official measure. U-1 is the percentage of the labor force that has been unemployed for 15 weeks or more and is a measure of long-term involuntary unemployment. U-2 is the percentage of the labor force who are laid off and is another measure of involuntary unemployment.

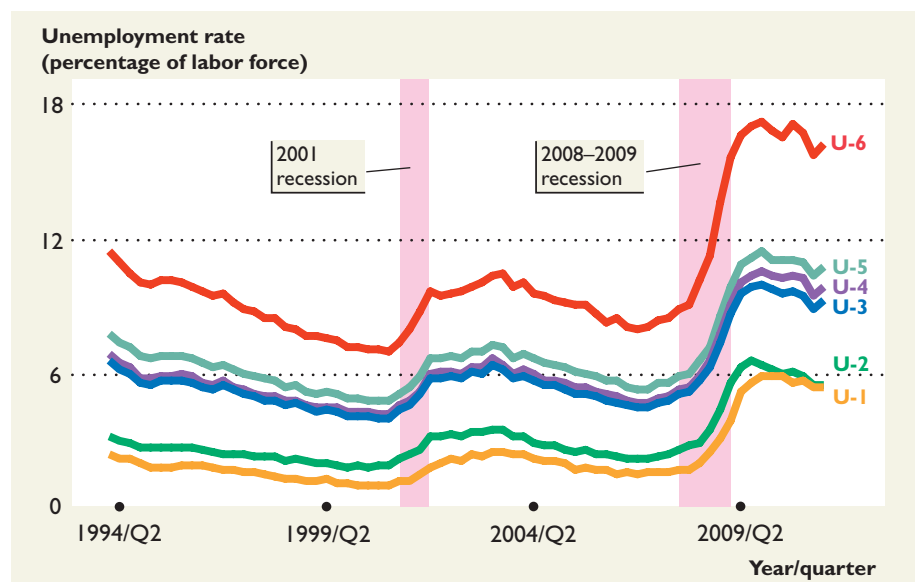
Figure 15.4 shows the history of these six measures of unemployment since 1994 (the year in which the BLS started to measure them). The relative magnitudes of the six measures are explained by what they include—the broader the measure, the higher the average. The six measures follow similar but not identical tracks,

FIGURE 15.4

Alternative Measures of Unemployment: 1994–2011

MyEconLab Real-time data

- The alternative measures of unemployment are:
- U-1 People unemployed 15 weeks or longer
 - U-2 People laid off and others who completed a temporary job
 - U-3 Total unemployed (official measure)
 - U-4 Total unemployed plus discouraged workers
 - U-5 U-4 plus other marginally attached workers
 - U-6 U-5 plus employed part time for economic reasons
- U-1, U-2, and U-3 are percentages of the labor force.
- U-4, U-5, and U-6 are percentages of the labor force plus the unemployed in the added category.



SOURCE OF DATA: Bureau of Labor Statistics.

rising during the recessions and falling in the expansions between the recessions. But during the 2001 recession, U-1 barely changed while during the 2008–2009 recession, it more than doubled in less than a year.

■ A Closer Look at Part-Time Employment

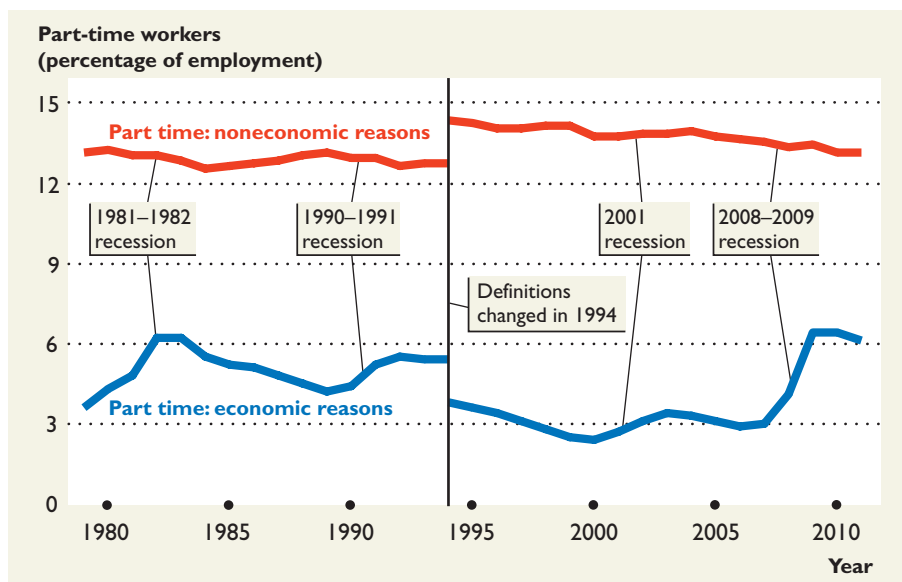
The broadest measure of the unemployment rate, U-6, includes people who work part time for economic reasons. Let's take a closer look at part-time employment.

A part-time job is attractive to many workers because it enables them to balance family and other commitments with work. Part-time jobs are attractive to employers because they don't have to pay benefits to part-time workers and are less constrained by government regulations. People who choose part-time jobs are part time for noneconomic reasons. People who take a part-time job because they can't find a full-time job are part time for economic reasons. The BLS measures these two groups and Figure 15.5 shows the data since 1980 (but with a change in the definitions in 1994).

The number of people who work part time for noneconomic reasons is double the number who work part time for economic reasons. Also, the percentage of the labor force who are part time for noneconomic reasons is remarkably steady at an average of 13 percent (old definition) and 14 percent (new definition) of the labor force, and that percentage barely fluctuates with the business cycle.

The percentage of the labor force who work part-time for economic reasons experiences large swings. In the 1981–1982 recession, it climbed to 6.2 percent and in the 2008–2009 recession, it climbed to 6.4 percent.

■ **FIGURE 15.5**
Part-Time Workers: 1980–2011



SOURCE OF DATA: Bureau of Labor Statistics.

MyEconLab Real-time data

The annual average percentage of all employed workers who are part time for noneconomic reasons is a steady 13 percent (old definition) and 14 percent (new definition) and this percentage barely fluctuates with the business cycle.

But the percentage of all employed workers who are part time for economic reasons fluctuates with the business cycle. It increases in a recession and decreases in an expansion.

MyEconLab

You can work these problems in Study Plan 15.2 and get instant feedback.

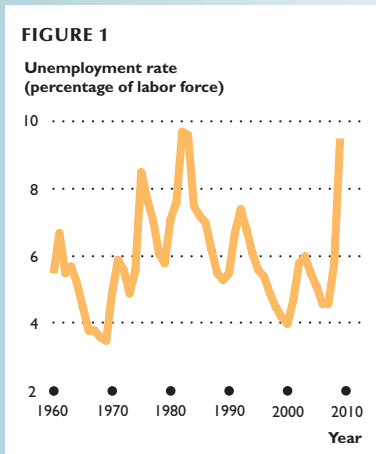


TABLE 1

| Recession years | Participation rate | Unemployment rate |
|-----------------|--------------------|-------------------|
| | (percent in July) | |
| 1973 | 71.9 | 11.1 |
| 1974 | 73.2 | 12.4 |
| 1975 | 73.0 | 16.3 |
| 1981 | 75.3 | 16.2 |
| 1982 | 74.7 | 18.6 |
| 1990 | 75.1 | 10.9 |
| 1991 | 73.6 | 13.7 |
| 2008 | 65.1 | 14.0 |
| 2009 | 63.0 | 18.5 |

CHECKPOINT 15.2

Describe the trends and fluctuations in the indicators of labor market performance in the United States.

Practice Problems

- Figure 1 shows the unemployment rate in the United States from 1960 to 2010. In which decade—the 1960s, 1970s, 1980s, 1990s, or 2000s—was the average unemployment rate the lowest and what brought low unemployment in that decade? In which decade was the average unemployment rate the highest and what brought high unemployment in that decade?
- Describe the trends in the participation rates of men and women and of all workers.

In the News

For young people, a jobless summer

In July 2009, the youth unemployment rate hit 18.5 percent—the highest level since the BLS started recording youth labor statistics. The proportion of young people working was 51.4 percent, another historic low for the month of July.

Source: *The Wall Street Journal*, August 27, 2009

In addition, Table 1 sets out data for the youth labor force participation rate and unemployment rate during four major recent U.S. recessions.

- Compare the changes in the labor force participation rate during the recessions in Table 1. During which recession did the labor force participation rate drop the most?
- Compare the changes in the unemployment rate during the recessions in Table 1. During which recession did the unemployment rate rise the most?

Solutions to Practice Problems

- Figure 1 shows that the unemployment rate was lowest during the 1960s when defense spending on the Vietnam War and expansion of social programs brought rapid expansions and lowered the unemployment rate. Figure 1 shows that the unemployment rate was highest during the 1980s. During the 1981–1982 recession it increased to almost 10 percent.
- The participation rate of women increased because (1) better-educated women earn more, (2) more white-collar jobs with flexible work hours were created, (3) people have more time for paid employment, and (4) families increasingly needed two incomes to balance their budgets. The participation rate of men decreased because more men remained in school and some men took early retirement. The overall participation rate increased.

Solutions to In the News

- As each recession progressed, the participation rate dropped, except during the 1973–1975 recession. The biggest drop occurred during the 2008–2009 recession.
- As each recession progressed, the unemployment rate rose. The biggest rise occurred during the 1973–1975 recession when it rose from 11.1 percent to 16.3 percent—a 5.2 percentage point rise.

15.3 UNEMPLOYMENT AND FULL EMPLOYMENT

There is always someone without a job who is searching for one, so there is always some unemployment. The key reason is that the labor market is constantly churning. New jobs are created and old jobs die; and some people move into the labor force and some move out of it. This churning creates unemployment.

We distinguish among three types of unemployment:

- Frictional unemployment
- Structural unemployment
- Cyclical unemployment

■ Frictional Unemployment

Frictional unemployment is the unemployment that arises from people entering and leaving the labor force, from quitting jobs to find better ones, and from the ongoing creation and destruction of jobs—from normal labor turnover. Frictional unemployment is a permanent and healthy phenomenon in a dynamic, growing economy.

There is an unending flow of people into and out of the labor force as people move through the stages of life—from being in school to finding a job, to working, perhaps to becoming unhappy with a job and looking for a new one, and finally, to retiring from full-time work.

There is also an unending process of job creation and job destruction as new firms are born, firms expand or contract, and some firms fail and go out of business.

The flows into and out of the labor force and the processes of job creation and job destruction create the need for people to search for jobs and for businesses to search for workers. Businesses don't usually hire the first person who applies for a job, and unemployed people don't usually take the first job that comes their way. Instead, both firms and workers spend time searching for what they believe will be the best available match. By this process of search, people can match their own skills and interests with the available jobs and find a satisfying job and a good income.

■ Structural Unemployment

Structural unemployment is the unemployment that arises when changes in technology or international competition change the skills needed to perform jobs or change the locations of jobs. Structural unemployment usually lasts longer than frictional unemployment because workers must retrain and possibly relocate to find a job. For example, when a telephone exchange in Gary, Indiana, is automated, some jobs in that city are destroyed. Meanwhile, new jobs for life-insurance salespeople and retail clerks are created in Chicago, Indianapolis, and other cities. The former telephone operators remain unemployed for several months until they move, retrain, and get one of these jobs. Structural unemployment is painful, especially for older workers for whom the best available option might be to retire early but with a lower income than they had expected.

Sometimes, the amount of structural unemployment is small. At other times, it is large, and at such times, structural unemployment can become a serious long-term problem. It was especially large during the late 1970s and early 1980s.

Frictional unemployment

The unemployment that arises from people entering and leaving the labor force, from quitting jobs to find better ones, and from the ongoing creation and destruction of jobs—from normal labor turnover.



A new graduate interviews for a job.

Structural unemployment

The unemployment that arises when changes in technology or international competition change the skills needed to perform jobs or change the locations of jobs.



A job lost to computer technology.

Cyclical unemployment

The fluctuating unemployment over the business cycle that increases during a recession and decreases during an expansion.

Natural unemployment rate

The unemployment rate when the economy is at full employment.

Full employment

When there is no cyclical unemployment or, equivalently, when *all* the unemployment is frictional or structural.

■ Cyclical Unemployment

The higher than normal unemployment at a business cycle trough and the lower than normal unemployment at a business cycle peak is called **cyclical unemployment**. A worker who is laid off because the economy is in a recession and who gets rehired some months later when the expansion begins has experienced cyclical unemployment.

■ “Natural” Unemployment

Natural unemployment is the unemployment that arises from frictions and structural change when there is no cyclical unemployment—when all the unemployment is frictional and structural. Natural unemployment as a percentage of the labor force is called the **natural unemployment rate**.

Full employment is defined as a situation in which the unemployment rate equals the natural unemployment rate.

What determines the natural unemployment rate? Is it constant or does it change over time?

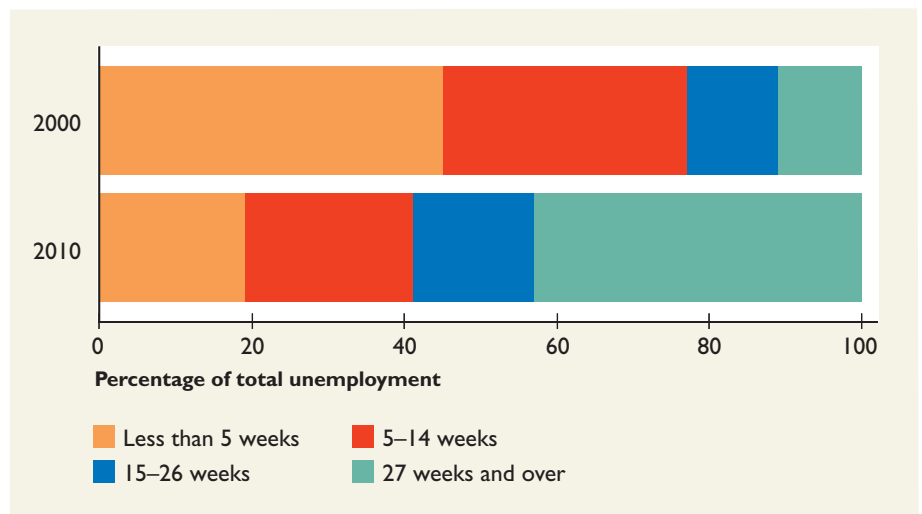
The natural unemployment rate is influenced by many factors but the most important ones are

- The age distribution of the population
- The pace of structural change
- The real wage rate
- Unemployment benefits

**EYE on the UNEMPLOYED****How Long Does it Take to Find a Job?**

The average duration of unemployment spells varies over the business cycle. In 2000, at a cycle peak when the unemployment rate was below the natural rate at 4 percent, the median time to find a job was 6 weeks. In 2010, just after a cycle trough when the unemployment rate was above the natural rate at 9.6 percent, the median time to find a job was 22 weeks.

The figure provides more information: It shows the percentage of the unemployed at four unemployment durations. You can see that long-term unemployment (27 weeks and over) barely exists at a cycle peak but is a huge problem at a cycle trough.



SOURCE OF DATA: Bureau of Labor Statistics.

The Age Distribution of the Population

An economy with a young population has a large number of new job seekers every year and has a high level of frictional unemployment. An economy with an aging population has fewer new job seekers and a low level of frictional unemployment.

The Pace of Structural Change

The pace of structural change is sometimes low. The same jobs using the same machines remain in place for many years. But sometimes there is a technological upheaval. The old ways are swept aside and millions of jobs are lost and the skill to perform them loses value. The amount of structural unemployment fluctuates with the pace of technological change and the change driven by fierce international competition, especially from fast-changing Asian economies. A high level of structural unemployment is present in many parts of the United States today.

The Real Wage Rate

The natural unemployment rate is influenced by the level of the real wage rate. Anything that raises the real wage rate above the market equilibrium level creates a surplus of labor and increases the natural unemployment rate. The real wage rate might exceed the market equilibrium level for two reasons: a minimum wage and an efficiency wage. The federal minimum wage creates unemployment because it is set above the equilibrium wage rate of low-skilled young workers. An efficiency wage is a wage set above the going market wage to enable firms to attract the most productive workers, get them to work hard, and discourage them from quitting. When firms set their wage above the going market wage, some workers would like to work for these firms but can't get jobs.

Unemployment Benefits

Unemployment benefits increase the natural unemployment rate by lowering the opportunity cost of job search. European countries have more generous unemployment benefits and higher natural unemployment rates than the United States. Extending unemployment benefits increases the natural unemployment rate.

There is no controversy about the existence of a natural unemployment rate. Nor is there disagreement that the natural unemployment rate changes. But economists don't know its exact size or the extent to which it fluctuates. The Congressional Budget Office estimates the natural unemployment rate and its estimate for 2010 was 5.2 percent—a bit more than a half of the actual unemployment rate in that year.

■ Unemployment and Real GDP

Cyclical unemployment is the fluctuating unemployment over the business cycle—unemployment that increases during a recession and decreases during an expansion. At full employment, there is *no* cyclical unemployment. At a business cycle trough, cyclical unemployment is *positive* and at a business cycle peak, cyclical unemployment is *negative*.

Figure 15.6(a) shows the unemployment rate in the United States between 1980 and 2011. It also shows the natural unemployment rate and cyclical unemployment.

The natural unemployment rate in this figure was estimated by the Congressional Budget Office (CBO).

In Figure 15.6(a), you can see that during most of the 1980s, the early 1990s, early 2000s, and during 2008–2009, unemployment was above the natural unemployment rate, so cyclical unemployment was positive (the red sections of the line). You can also see that during the late 1980s, from 1997 to 2001, and during 2005–2008 unemployment was below the natural unemployment rate, so cyclical unemployment was negative (the blue sections of the line).

As the unemployment rate fluctuates around the natural unemployment rate, real GDP fluctuates around potential GDP. **Potential GDP** is the value of real GDP when the economy is at full employment—all the economy's factors of production (labor, capital, land, and entrepreneurial ability) are employed. Real GDP equals potential GDP when the economy is at full employment. Real GDP minus potential GDP expressed as a percentage of potential GDP is called the **output gap**.

Figure 15.6(b) shows the U.S. *output gap* from 1980 to 2011. You can see that as the unemployment rate fluctuates around the natural unemployment rate, the output gap also fluctuates. When the unemployment rate is above the natural unemployment rate, in part (a), the output gap is negative (real GDP is below potential GDP), in part (b); when the unemployment rate is below the natural unemployment rate, the output gap is positive (real GDP is above potential GDP); and when the unemployment rate equals the natural unemployment rate, the output gap is zero (real GDP equals potential GDP).

You can also see in Figure 15.6 that the unemployment rate is a lagging indicator of the business cycle. Long after a recession is over, the unemployment rate is still rising.

Potential GDP

The value of real GDP when the economy is at full employment—all the economy's factors of production (labor, capital, land, and entrepreneurial ability) are employed.

Output gap

Real GDP minus potential GDP expressed as a percentage of potential GDP.



EYE on YOUR LIFE

Your Labor Market Status and Activity

You are going to spend a lot of your life in the labor market. Most of the time, you'll be supplying labor services. But first, you must find a job. Most likely, one job will not last your entire working life. You will want to find a new job when you decide to quit or when changing economic conditions destroy your current job.

As you look for a job, get a job, quit a job or get laid off and look for a new job, you will pass through many and possibly all of the population categories used in the Current Population Survey that you've learned about in this chapter.

Think about your current labor

market status while you are studying economics.

- Are you in the labor force or not?
- If you are in the labor force, are you employed or unemployed?
- If you are employed, are you a part-time or a full-time worker?

Now think about someone you know who is unemployed or has been unemployed. Classify the unemployment experienced by this person as

- frictional,
- structural, or
- cyclical.

How can you tell the type of unemployment experienced by this person?

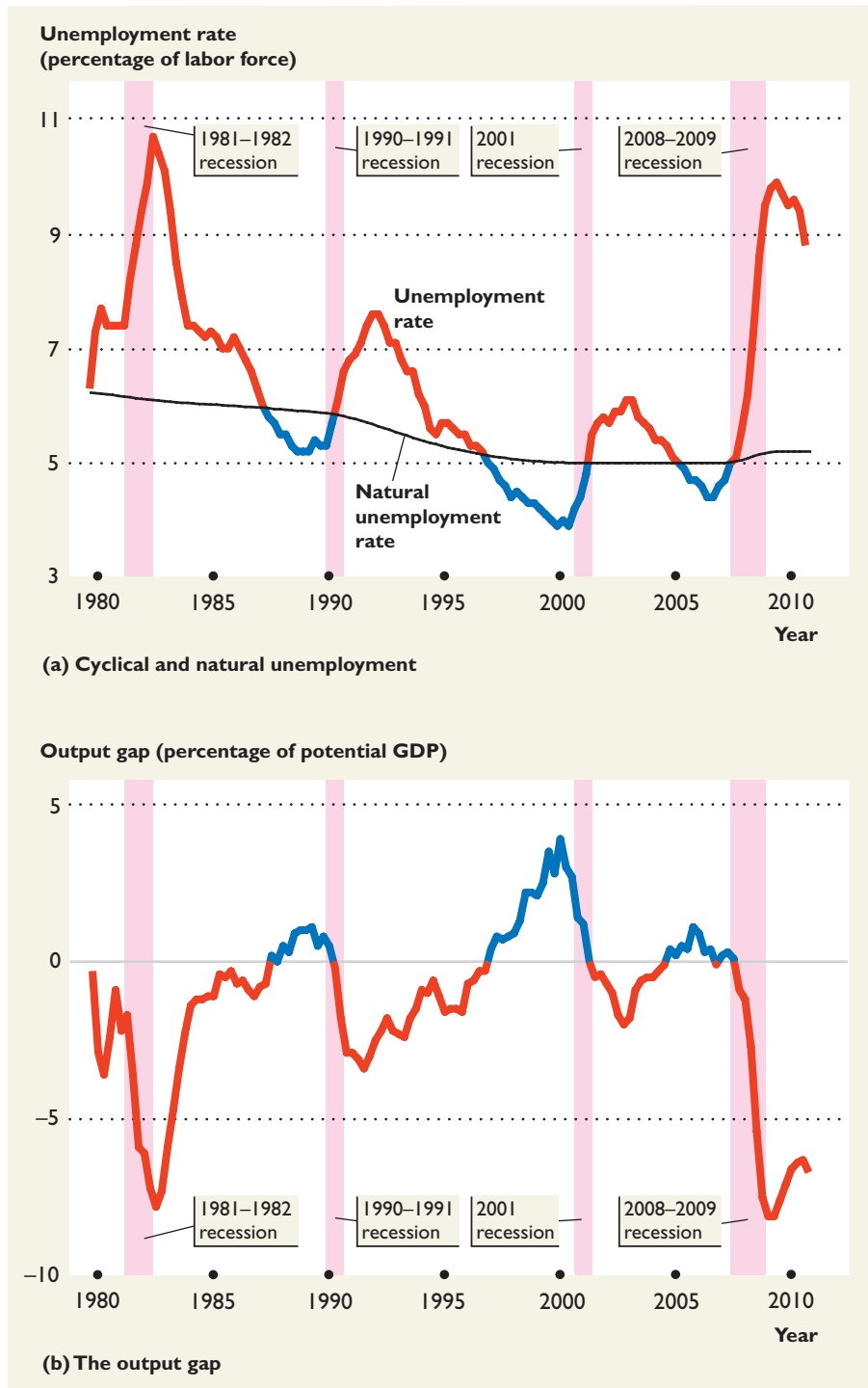
The labor market conditions that you face today or when you graduate and look for a job depend partly on general national economic conditions—on whether the economy is in recession or booming.

Labor market conditions also depend on where you live. Visit the Bureau of Labor Statistics' web site at www.bls.gov/sae/sm_mrs.htm. There you can find information on employment and unemployment for your state and metropolitan area or county. By comparing the labor market conditions in your own region with those in other areas, you can figure out where it might be easier to find work.

FIGURE 15.6

The Relationship Between Unemployment and the Output Gap

MyEconLab Real-time data



As the unemployment rate fluctuates around the natural unemployment rate in part (a), the output gap—real GDP minus potential GDP expressed as a percentage of potential GDP—fluctuates around a zero output gap in part (b).

When the unemployment rate exceeds the natural unemployment rate, real GDP is below potential GDP and the output gap is negative (red sections in both parts).

When the unemployment rate is below the natural unemployment rate, real GDP is above potential GDP and the output gap is positive (blue sections in both parts).

The natural unemployment rate shown in the graph is the Congressional Budget Office's estimate. It might turn out to be a substantial underestimate for the years since 2008.

SOURCES OF DATA: Bureau of Economic Analysis, Bureau of Labor Statistics, and Congressional Budget Office.

MyEconLab

You can work these problems in Study Plan 15.3 and get instant feedback.

CHECKPOINT 15.3

Describe the types of unemployment, define full employment, and explain the link between unemployment and real GDP.

Practice Problems

Recovery won't improve unemployment

Despite some optimism about the seeds of recovery, the Congressional Budget Office (CBO) sees joblessness rising. The CBO sees unemployment peaking at 10.4% next year from an average of 9.3% this year, before it falls to 9.1% in 2011.

Source: *Fortune*, August 25, 2009

Before the recession began, the U.S. unemployment rate was about 6 percent.

1. As a recession begins, firms quickly make layoffs. Is this rise in unemployment mostly a rise in frictional, structural, or cyclical unemployment?
2. Why does unemployment continue to rise as an expansion begins?

In the News

BofA cutbacks may hit 40,000

Bank of America officials have discussed eliminating about 40,000 positions during the first wave of a restructuring. The numbers could change, but the restructuring would reduce the bank's workforce over a period of years.

Source: *The Wall Street Journal*, September 9, 2011

Postal Service targets 220,000 job cuts

The U.S. Postal Service plans to reduce its workforce by 220,000 jobs to remedy its dire financial situation. The Postal Service, financed mostly by postage, has been struggling as a result of the economic slowdown.

Source: *The Wall Street Journal*, August 12, 2011

What type of unemployment will arise from the cut in employment in each of these cases? Explain your answer.

Solutions to Practice Problems

1. When a recession starts, firms are quick to lay off workers. Most of the rise in unemployment is cyclical—related to the state of the economy. The unemployment rate rises quickly as the number of layoffs increases.
2. The unemployment rate is a lagging indicator of the business cycle. When an expansion begins, firms start hiring. Unemployed workers get jobs, but the labor force increases as marginally attached workers start to look for jobs. In the early stages of an expansion, the number of marginally attached workers looking for jobs exceeds the number of people hired and unemployment increases.

Solution to In the News

Bank of America is reducing its workforce as it restructures its organization in response to changing technology. Because online banking has grown, the bank will close many branches. Cuts in its workforce will create structural unemployment. The U.S. Postal Service is cutting its workforce in response to a downturn in economic activity. Cuts in its workforce will create cyclical unemployment.

CHAPTER SUMMARY

Key Points

- 1 Define the unemployment rate and other labor market indicators.**
 - The unemployment rate is the number of people unemployed as a percentage of the labor force, and the labor force is the sum of the number of people employed and the number unemployed.
 - The labor force participation rate is the labor force as a percentage of the working-age population.
- 2 Describe the trends and fluctuations in the indicators of labor market performance in the United States.**
 - The unemployment rate fluctuates with the business cycle, increasing in recessions and decreasing in expansions.
 - The labor force participation rate of women has increased, and the labor force participation rate of men has decreased.
- 3 Describe the types of unemployment, define full employment, and explain the link between unemployment and real GDP.**
 - Unemployment can be frictional, structural, or cyclical.
 - Full employment occurs when there is no cyclical unemployment and at full employment, the unemployment rate equals the natural unemployment rate.
 - Potential GDP is the real GDP produced when the economy is at full employment.
 - As the unemployment rate fluctuates around the natural unemployment rate, real GDP fluctuates around potential GDP and the output gap fluctuates between negative and positive values.

Key Terms

| | |
|-------------------------------------|-------------------------------------|
| Cyclical unemployment, 410 | Natural unemployment rate, 410 |
| Discouraged worker, 400 | Output gap, 412 |
| Frictional unemployment, 409 | Part time for economic reasons, 401 |
| Full employment, 410 | Part-time workers, 401 |
| Full-time workers, 401 | Potential GDP, 412 |
| Great Depression, 403 | Structural unemployment, 409 |
| Labor force, 398 | Unemployment rate, 399 |
| Labor force participation rate, 400 | Working-age population, 398 |
| Marginally attached worker, 400 | |

MyEconLab

You can work these problems in Chapter 15 Study Plan and get instant feedback.

CHAPTER CHECKPOINT

Study Plan Problems and Applications

Use the following information gathered by a BLS labor market survey of four households to work Problems 1 and 2.

- Household 1: Candy worked 20 hours last week setting up her Internet shopping business. The rest of the week, she completed application forms and attended two job interviews. Husband Jerry worked 40 hours at his job at GM. Daughter Meg, a student, worked 10 hours at her weekend job at Starbucks.
- Household 2: Joey, a full-time bank clerk, was on vacation. Wife, Serena, who wants a full-time job, worked 10 hours as a part-time checkout clerk.
- Household 3: Ari had no work last week but was going to be recalled to his regular job in two weeks. Partner Kosta, after months of searching for a job and not being able to find one, has stopped looking and will go back to school.
- Household 4: Mimi and Henry are retired. Son Hank is a professional artist, who painted for 12 hours last week and sold one picture.

1. Classify each of the 10 people into the labor market category used by the BLS. Who are part-time workers and who are full-time workers? Of the part-time workers, who works part time for economic reasons?
2. Calculate the unemployment rate and the labor force participation rate, and compare these rates with those in the United States in 2011.
3. Give two examples of people who work part time for economic reasons and two examples of people who work part time for noneconomic reasons.
4. Explain the relationship between the percentage of employed workers who have part-time jobs and the business cycle.
5. Distinguish among the three types of unemployment: frictional, structural, and cyclical. Provide an example of each type of unemployment in the United States today.
6. Describe the relationship between the unemployment rate and the natural unemployment rate as the output gap fluctuates between being positive and being negative.

Use the following information to work Problems 7 and 8.

July unemployment dips in 17 states, rises in 26

The Labor Department said that the largest job gains occurred in New York, which added 62,100 jobs, while Minnesota added 10,300 jobs, its first gains in almost a year. Vermont added 900 jobs but its unemployment rate fell from 7.3% to 6.8%—the biggest drop of all states.

Source: The Associated Press, August 21, 2009

7. Explain how, other things remaining the same, the increase of 62,100 jobs in New York and of 10,300 in Minnesota changed the number of people employed, the labor force, and the unemployment rate.
8. Explain why when Vermont added only 900 jobs, its unemployment fell by more than any other state.

Instructor Assignable Problems and Applications

Your instructor can assign these problems as homework, a quiz, or a test in [MyEconLab](#).

1. In the United States,
 - Compare the duration of unemployment in 2010 with that in 2000 and explain whether the difference was most likely the result of frictions, structural change, or the business cycle.
 - Why are teenage unemployment rates much higher than those for older workers?
 - How might the unemployment of marginally attached workers influence the duration of unemployment in 2010 compared with that in 2000?
2. The Bureau of Labor Statistics reported that in the second quarter of 2008 the working-age population was 233,410,000, the labor force was 154,294,000, and employment was 146,089,000. Calculate for that quarter the labor force participation rate and the unemployment rate.
3. In July 2011, in the economy of Sandy Island, 10,000 people were employed and 1,000 were unemployed. During August 2011, 80 people lost their jobs and didn't look for new ones, 20 people quit their jobs and retired, 150 people who had looked for work were hired, 50 people became discouraged workers, and 40 new graduates looked for work. Calculate the change in the unemployment rate from July 2011 to August 2011.
4. The BLS survey reported the following data in a community of 320 people: 200 worked at least 1 hour as paid employees; 20 did not work but were temporarily absent from their jobs; 40 did not have jobs and didn't want to work; 10 were available for work and last week they had looked for work; and 6 were available for work and were waiting to be recalled to their previous job. Calculate the unemployment rate and the labor force participation rate.
5. Describe the trends and fluctuations in the unemployment rate in the United States from 1949 through 2011. In which periods was the unemployment rate above average and in which periods was it below average?
6. Describe how the labor force participation rate in the United States changed between 1960 and 2010. Contrast and explain the different trends in the labor force participation rates of women and men.
7. Explain why the natural unemployment rate is not zero and why the unemployment rate fluctuates around the natural unemployment rate.

Use the following information to work Problems 8 and 9.

Michigan unemployment tops 15%

The U.S. Department of Labor reported that Michigan's unemployment rate in June 2009 rose to 15.2%, becoming the first state in 25 years to suffer an unemployment rate exceeding 15%. Michigan has been battered by the collapse of the auto industry and the housing crisis and has had the highest unemployment rate in the nation for the past 12 months.

Source: CNN Money, July 17, 2009

8. Why is the reality of the unemployment problem in Michigan actually worse than the unemployment rate statistic of 15.2 percent?
9. Is this increased unemployment frictional, structural, or cyclical? Explain.

MyEconLab

You can work this quiz in Chapter 15 Study Plan and get instant feedback.

Multiple Choice Quiz

1. The BLS count Jody as being unemployed if she _____.
 - A. had a job last month but not this month
 - B. doesn't have a job because the U.S. factory where she worked cannot compete with cheap Chinese imports
 - C. wants a job and looked for a job last year but has now stopped looking
 - D. wants a job and is willing to take a job but after searching last week cannot find a job
2. A marginally attached worker is a person who _____.
 - A. works part time for economic reasons
 - B. works part time for noneconomic reasons
 - C. doesn't work, is available and willing to work, but hasn't looked for a job recently
 - D. has no job but would like one and has gone back to school to retrain
3. If the BLS included all marginally attached workers as being unemployed, the _____ would be _____.
 - A. unemployment rate; higher
 - B. labor force; unchanged
 - C. labor force participation rate; lower
 - D. unemployment rate; lower
4. When the economy goes into recession, the biggest increase in unemployment is _____.
 - A. structural because jobs are lost in most states
 - B. cyclical because jobs are lost in many industries as they cut production
 - C. frictional because the creation of jobs slows
 - D. the combination of structural and frictional as few new jobs are created
5. The economy is at full employment when all unemployment is _____.
 - A. structural
 - B. cyclical
 - C. structural and cyclical
 - D. structural and frictional
6. Potential GDP is the value of real GDP when _____.
 - A. the unemployment rate equals the natural unemployment rate
 - B. there is no frictional unemployment
 - C. there is no structural unemployment
 - D. the unemployment rate is zero
7. When the unemployment rate _____ the natural unemployment rate, real GDP is _____ potential GDP and the output gap is _____.
 - A. exceeds; below; negative
 - B. is below; below; negative
 - C. exceeds; above; positive
 - D. is below; above; negative



Which movie *really* was the biggest box office hit?

The CPI and the Cost of Living

When you have completed your study of this chapter, you will be able to

- 1 Explain what the Consumer Price Index (CPI) is and how it is calculated.
- 2 Explain the limitations of the CPI and describe other measures of the price level.
- 3 Adjust money values for inflation and calculate real wage rates and real interest rates.



CHAPTER CHECKLIST

16.1 THE CONSUMER PRICE INDEX

Consumer Price Index

A measure of the average of the prices paid by urban consumers for a fixed market basket of consumption goods and services.

Reference base period

A period for which the CPI is defined to equal 100. Currently, the reference base period is 1982–1984.

The **Consumer Price Index** (CPI) is a measure of the average of the prices paid by urban consumers for a fixed market basket of consumption goods and services. The Bureau of Labor Statistics (BLS) calculates the CPI every month, and we can use these numbers to compare what the fixed market basket costs this month with what it cost in some previous month or other period.

■ Reading the CPI Numbers

The CPI is defined to equal 100 for a period called the **reference base period**. Currently, the reference base period is 1982–1984. That is, the CPI equals 100 on the average over the 36 months from January 1982 through December 1984.

In July 2011, the CPI was 225.4. This number tells us that the average of the prices paid by urban consumers for a fixed market basket of consumption goods and services was 125.4 percent higher in July 2011 than it was on the average during 1982–1984.

In June 2011, the CPI was 224.3. Comparing the July CPI with the June CPI tells us that the average of the prices paid by urban consumers for a fixed market basket of consumption goods and services *increased* by 1.1 percentage points in July 2011.

■ Constructing the CPI

Constructing the CPI is a huge operation that costs millions of dollars and involves three stages:

- Selecting the CPI market basket
- Conducting the monthly price survey
- Calculating the CPI

■ The CPI Market Basket

The first stage in constructing the CPI is to determine the *CPI market basket*. This “basket” contains the goods and services represented in the index and the relative importance, or weight, attached to each of them. The idea is to make the weight of the items in the CPI basket the same as in the budget of an average urban household. For example, if the average household spends 2 percent of its income on public transportation, then the CPI places a weight of 2 percent on the prices of bus, subway, and other transit system rides.

Although the CPI is calculated every month, the CPI market basket isn’t updated every month. The information used to determine the CPI market basket comes from a survey, called the *Consumer Expenditure Survey*, that discovers what people actually buy. This survey is an ongoing activity, and the CPI market basket in 2011 was based on a survey conducted during 2007 and 2008. An astonishing 88,000 individuals and families contributed information. Some of them were interviewed every three months, and others kept detailed diaries for two weeks in which they listed absolutely everything they bought. (Before 1999, the Consumer Expenditure Survey was conducted much less frequently.)

The reference base period for the CPI has been fixed at 1982–1984 for more than 20 years and doesn’t change when a new Consumer Expenditure Survey is used to update the market basket.

Figure 16.1 shows the CPI market basket in July 2011. The basket contains around 80,000 goods and services arranged in the eight large groups shown in the figure. The most important item in a household's budget is housing, which accounts for 41.5 percent of total expenditure. Transportation comes next at 17.3 percent. Third in relative importance is food and beverages at 14.8 percent. These three groups account for almost three quarters of the average household budget. Medical care, recreation, and education and communication take a bit more than 6 percent each, and apparel (clothing and footwear) takes 3.6 percent. Another 3.5 percent is spent on other goods and services.

The BLS breaks down each of these categories into smaller ones. For example, education and communication breaks down into textbooks and supplies, tuition, telephone services, and personal computer services.

As you look at these numbers, remember that they apply to the average household. Each individual household is spread around the average. Think about your own expenditure and compare it with the average.

■ The Monthly Price Survey

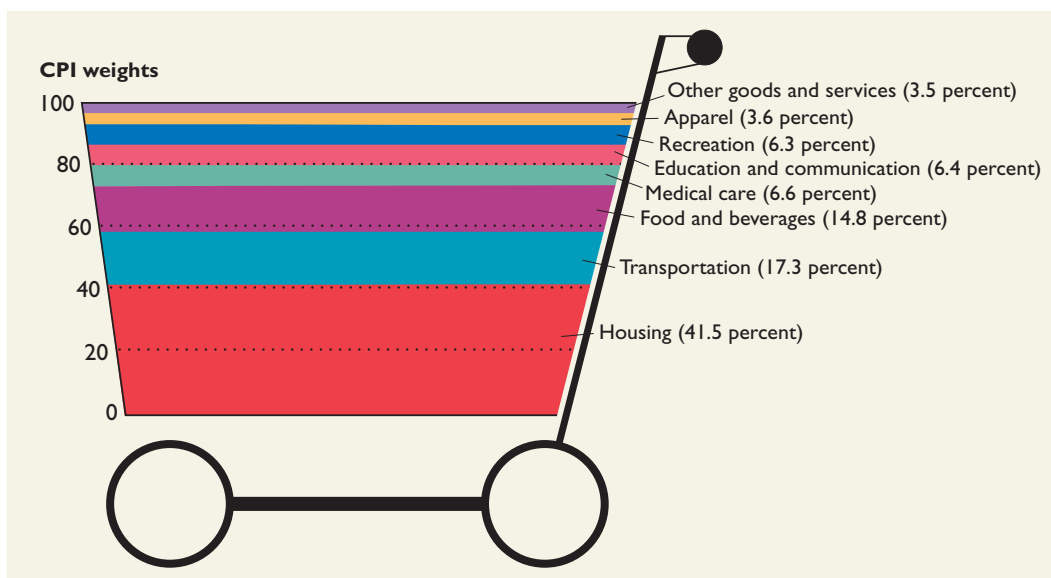
Each month, BLS employees check the prices of the 80,000 goods and services in the CPI market basket in 30 metropolitan areas. Because the CPI aims to measure price changes, it is important that the prices recorded each month refer to exactly the same items. For example, suppose the price of a box of jelly beans has increased but a box now contains more beans. Has the price of a jelly bean increased? The BLS employee must record the details of changes in quality, size, weight, or packaging so that price changes can be isolated from other changes.

Once the raw price data are in hand, the next task is to calculate the CPI.

■ FIGURE 16.1

The CPI Market Basket

MyEconLab Animation



This shopping cart is filled with the items that an average household buys. Housing (41.5 percent), transportation (17.3 percent), and food and beverages (14.8 percent) take almost 75 percent of household income.

SOURCE OF DATA: Bureau of Labor Statistics.

■ Calculating the CPI

The CPI calculation has three steps:

- Find the cost of the CPI market basket at base period prices.
- Find the cost of the CPI market basket at current period prices.
- Calculate the CPI for the base period and the current period.

We'll work through these three steps for a simple example. Suppose the CPI market basket contains only two goods and services: oranges and haircuts. We'll construct an annual CPI rather than a monthly CPI with the reference base period 2005 and the current period 2012.

Table 16.1 shows the quantities in the CPI market basket and the prices in the base period and the current period. Part (a) contains the data for the base period. In that period, consumers bought 10 oranges at \$1 each and 5 haircuts at \$8 each. To find the cost of the CPI market basket in the base period prices, multiply the quantities in the CPI market basket by the base period prices. The cost of oranges is \$10 (10 at \$1 each), and the cost of haircuts is \$40 (5 at \$8 each). So total expenditure in the base period on the CPI market basket is \$50 (\$10 + \$40).

Part (b) contains the price data for the current period. The price of an orange increased from \$1 to \$2, which is a 100 percent increase ($\$1 \div \$1 \times 100 = 100$ percent). The price of a haircut increased from \$8 to \$10, which is a 25 percent increase ($\$2 \div \$8 \times 100 = 25$ percent).

The CPI provides a way of averaging these price increases by comparing the cost of the basket rather than the price of each item. To find the cost of the CPI market basket in the current period, 2012, multiply the quantities in the basket by their 2012 prices. The cost of oranges is \$20 (10 at \$2 each), and the cost of haircuts is \$50 (5 at \$10 each). So total expenditure on the fixed CPI market basket at current period prices is \$70 (\$20 + \$50).

TABLE 16.1

The Consumer Price Index: A Simplified CPI Calculation

(a) The cost of the CPI basket at base period prices: 2005

| CPI market basket | | | Cost of CPI basket |
|---|----------|----------|-----------------------|
| Item | Quantity | Price | |
| Oranges | 10 | \$1 each | \$10 |
| Haircuts | 5 | \$8 each | \$40 |
| Cost of CPI market basket at base period prices | | | \$50 |

(b) The cost of the CPI basket at current period prices: 2012

| CPI market basket | | | Cost of CPI basket |
|--|----------|-----------|-----------------------|
| Item | Quantity | Price | |
| Oranges | 10 | \$2 each | \$20 |
| Haircuts | 5 | \$10 each | \$50 |
| Cost of CPI market basket at current period prices | | | \$70 |

You've now taken the first two steps toward calculating the CPI. The third step uses the numbers you've just calculated to find the CPI for 2005 and 2012. The formula for the CPI is

$$\text{CPI} = \frac{\text{Cost of CPI basket at current period prices}}{\text{Cost of CPI basket at base period prices}} \times 100.$$

In Table 16.1, you established that in 2005, the cost of the CPI market basket was \$50 and in 2012, it was \$70. If we use these numbers in the CPI formula, we can find the CPI for 2005 and 2012. The base period is 2005, so

$$\text{CPI in 2005} = \frac{\$50}{\$50} \times 100 = 100.$$

$$\text{CPI in 2012} = \frac{\$70}{\$50} \times 100 = 140.$$

The principles that you've applied in this simplified CPI calculation apply to the more complex calculations performed every month by the BLS.

Figure 16.2(a) shows the CPI in the United States during the 40 years between 1971 and 2011. The CPI increased every year during this period until 2009 when it fell slightly. During the late 1970s and in 1980, the CPI was increasing rapidly, but since the early 1980s, the rate of increase has slowed.

■ Measuring Inflation and Deflation

A major purpose of the CPI is to measure *changes* in the cost of living and in the value of money. To measure these changes, we calculate the **inflation rate**, which is the percentage change in the price level from one year to the next. To calculate the inflation rate, we use the formula

$$\text{Inflation rate} = \frac{(\text{CPI in current year} - \text{CPI in previous year})}{\text{CPI in previous year}} \times 100.$$

Suppose that the current year is 2012 and the CPI for 2012 is 140. And suppose that in the previous year, 2011, the CPI was 120. Then in 2012,

$$\text{Inflation rate} = \frac{(140 - 120)}{120} \times 100 = 16.7 \text{ percent.}$$

If the inflation rate is *negative*, the price level is *falling* and we have **deflation**. The United States has rarely experienced deflation but 2009 was one of those rare years. You can check the latest data by visiting the BLS Web site. In July 2009, the CPI was 214.8, and in July 2008, it was 219.1. So during the year to July 2009,

$$\text{Inflation rate} = \frac{(214.8 - 219.1)}{219.1} \times 100 = -2.0 \text{ percent.}$$

Figure 16.2(b) shows the inflation rate in the United States between 1971 and 2011. The change in the price level in part (a) and the inflation rate in part (b) are related. When the price *level* rises rapidly, the inflation rate is high; when the price *level* rises slowly, the inflation rate is low; and when the price level is falling, the inflation rate is negative.

Inflation rate

The percentage change in the price level from one year to the next.

Deflation

A situation in which the price level is *falling* and the inflation rate is *negative*.



EYE on THE PAST

700 Years of Inflation and Deflation

These extraordinary data show that inflation became a persistent problem only after 1900. During the preceding 600 years, inflation was almost unknown. Inflation increased slightly during the sixteenth century after Europeans discovered gold in America. But this inflation barely reached 2 percent a year—less than we have today—and eventually subsided. The Industrial Revolution saw a temporary burst of inflation followed by a period of deflation.

SOURCES OF DATA: E.H. Phelps Brown and Sheila V. Hopkins, *Economica*, 1955, and Robert Sahr, http://oregonstate.edu/dept/pol_sci/fac/sahr/sahr.htm.

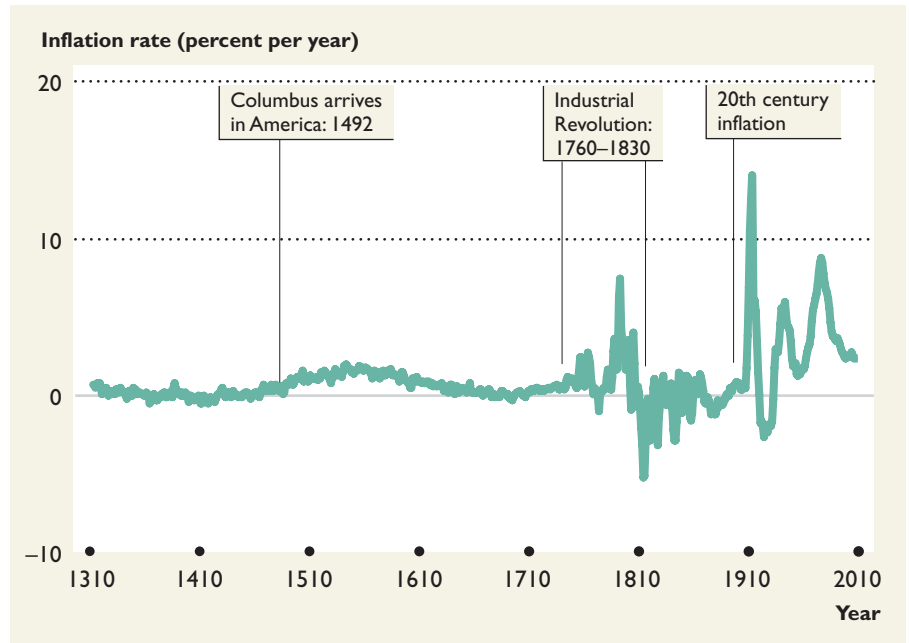
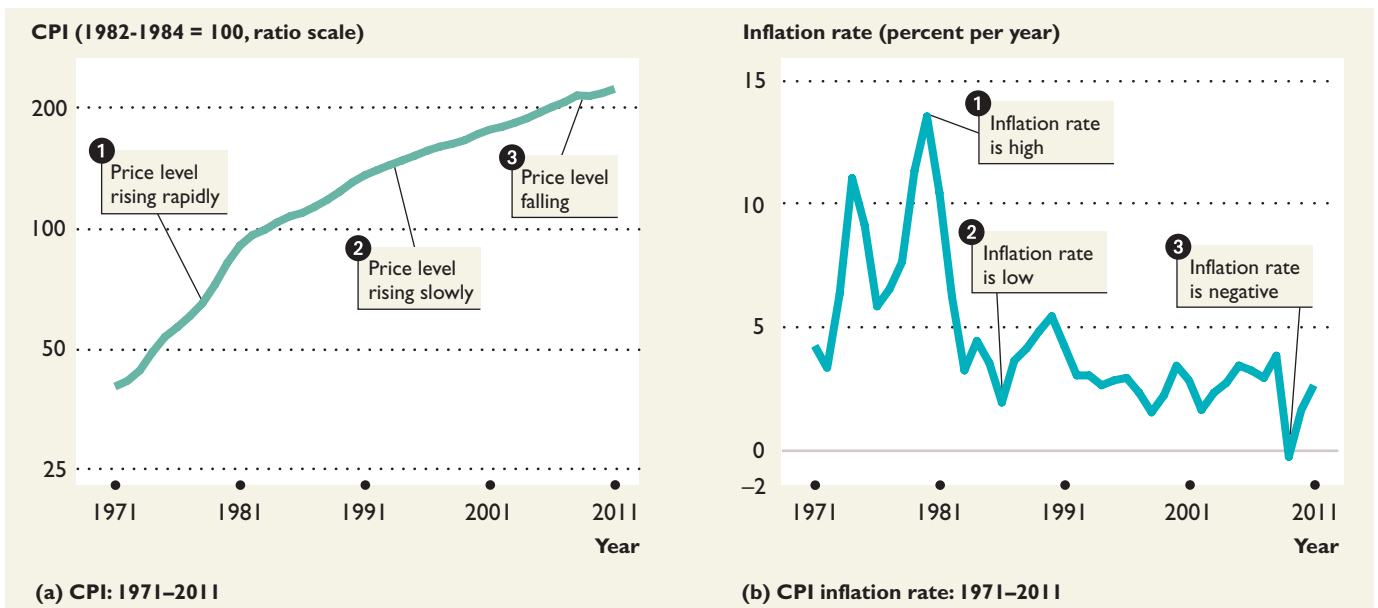


FIGURE 16.2

The CPI and the Inflation Rate: 1971–2011

MyEconLab Real-time data



SOURCE OF DATA: Bureau of Labor Statistics.

1 The price level in part (a) was rising rapidly during the 1970s and 1980s and the inflation rate in part (b) was high. 2 The price level was rising slowly during the 1990s and 2000s and the inflation

rate was low. 3 In 2009, the price level fell and the inflation rate was negative.

CHECKPOINT 16.1

Explain what the Consumer Price Index (CPI) is and how it is calculated.

Practice Problems

A Consumer Expenditure Survey in Sparta shows that people buy only juice and cloth. In 2010, the year of the Consumer Expenditure Survey and also the reference base year, the average household spent \$40 on juice and \$25 on cloth. Table 1 sets out the prices of juice and cloth in 2010 and 2012.

1. Calculate the CPI market basket and the percentage of the average household budget spent on juice in the reference base year.
2. Calculate the CPI in 2012 and the inflation rate between 2010 and 2012.
3. Table 2 shows the CPI in Russia. Calculate the inflation rates in 2006 and 2007. Did the price level rise in 2007? Did the inflation rate increase in 2007?

In the News

Consumer price index rises 0.2% in May

The CPI in May 2011 was 226, 0.2% higher than the April CPI. That's down from April's increase of 0.4%. Food prices rose 0.4%, but energy prices fell 1%.

Source: *USA Today*, June 15, 2011

Distinguish between the price level and the inflation rate and explain why the CPI rose when energy prices fell by more than food prices rose.

Solutions to Practice Problems

1. The CPI market basket is the quantities bought during the Consumer Expenditure Survey year, 2010. The average household spent \$40 on juice at \$4 a bottle, so it bought 10 bottles of juice. The average household spent \$25 on cloth at \$5 a yard, so it bought 5 yards of cloth. The CPI market basket is made up of 10 bottles of juice and 5 yards of cloth.
In the reference base year, the average household spent \$40 on juice and \$25 on cloth, so the household budget was \$65. Expenditure on juice was 61.5 percent of the household budget: $(\$40 \div \$65) \times 100 = 61.5$ percent.
2. To calculate the CPI in 2012, find the cost of the CPI market basket in 2010 and 2012. In 2010, the CPI basket costs \$65 (\$40 for juice + \$25 for cloth). In 2012, the CPI market basket costs \$70 (10 bottles of juice at \$4 a bottle + 5 yards of cloth at \$6 a yard). The CPI in 2012 is $(\$70 \div \$65) \times 100 = 107.7$. The inflation rate is $[(107.7 - 100) \div 100] \times 100 = 7.7$ percent.
3. The inflation rate in 2006 is $[(219 - 200) \div 200] \times 100 = 9.5$ percent. The inflation rate in 2007 is $[(237 - 219) \div 219] \times 100 = 8.2$ percent. In 2007, the price level increased, but the inflation rate decreased.

Solution to In the News

The CPI is the price level. The percentage change in the CPI is the inflation rate. Food is 14.8 percent of the CPI basket. Energy is included in transportation and housing. For the CPI to have risen by 0.2 percent when energy prices fell 1 percent, other prices must have risen by more than 0.2 percent.

MyEconLab

You can work these problems in Study Plan 16.1 and get instant feedback.

TABLE 1 PRICES

| | 2010 | 2012 |
|-------|--------------|--------------|
| Juice | \$4 a bottle | \$4 a bottle |
| Cloth | \$5 a yard | \$6 a yard |

TABLE 2

| Year | CPI |
|------|-----|
| 2005 | 200 |
| 2006 | 219 |
| 2007 | 237 |

16.2 THE CPI AND OTHER PRICE LEVEL MEASURES

Cost of living index

A measure of the change in the amount of money that people need to spend to achieve a given standard of living.

The purpose of the CPI is to measure the cost of living or what amounts to the same thing, the *value of money*. The CPI is sometimes called a **cost of living index**—a measure of the change in the amount of money that people need to spend to achieve a given standard of living. The CPI is not a perfect measure of the cost of living (value of money) for two broad reasons.

First, the CPI does not try to measure all the changes in the cost of living. For example, the cost of living rises in a severe winter as people buy more natural gas and electricity to heat their homes. A rise in the prices of these items increases the CPI. The increased quantities of natural gas and electricity bought don't change the CPI because the CPI market basket is fixed. So part of this increase in spending—the increase in the cost of maintaining a given standard of living—doesn't show up as an increase in the CPI.

Second, even those components of the cost of living that are measured by the CPI are not always measured accurately. The result is that the CPI is possibly a biased measure of changes in the cost of living.

Let's look at some of the sources of bias in the CPI and the ways the BLS tries to overcome them.

■ Sources of Bias in the CPI

The potential sources of bias in the CPI are

- New goods bias
- Quality change bias
- Commodity substitution bias
- Outlet substitution bias

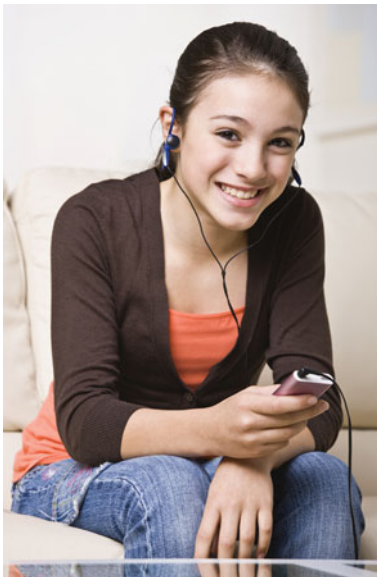
New Goods Bias

Every year, some new goods become available and some old goods disappear. Make a short list of items that you take for granted today that were not available 10 or 20 years ago. This list includes cell phones, iPods, laptop computers, and flat-panel, large-screen television sets. A list of items no longer available or rarely bought includes audiocassette players, vinyl records, photographic film, and typewriters.

When we want to compare the price level in 2011 with that in 2001, 1991, or 1981, we must do so by comparing the prices of different baskets of goods. We can't compare the same baskets because today's basket wasn't available 10 years ago and the basket of 10 years ago isn't available today.

To make comparisons, the BLS tries to measure the price of the service performed by yesterday's goods and today's goods. It tries to compare, for example, the price of listening to recorded music, regardless of the technology that delivers that service. But the comparison is hard to make. Today's iPod delivers an improved quality of sound and level of convenience compared to yesterday's Walkman and Discman.

How much of a new product represents an increase in quantity and quality and how much represents a higher price? The BLS does its best to answer this question, but there is no sure way of making the necessary adjustment. It is believed that the arrival of new goods puts an upward bias into the CPI and its measure of the inflation rate.



To measure the CPI, the BLS must compare the price of today's iPod with that of the 1970s Walkman and 1980s Discman.

Quality Change Bias

Cars, cell phones, laptops, and many other items get better every year. For example, central locking, airbags, and antilock braking systems all add to the quality of a car. But they also add to the cost. Is the improvement in quality greater than the increase in cost? Or do car prices rise by more than can be accounted for by quality improvements? To the extent that a price rise is a payment for improved quality, it is not inflation. Again, the BLS does the best job it can to estimate the effects of quality improvements on price changes. But the CPI probably counts too much of any price rise as inflation and so overstates inflation.

Commodity Substitution Bias

Changes in relative prices lead consumers to change the items they buy. People cut back on items that become relatively more costly and increase their consumption of items that become relatively less costly. For example, suppose the price of carrots rises while the price of broccoli remains constant. Now that carrots are more costly relative to broccoli, you might decide to buy more broccoli and fewer carrots. Suppose that you switch from carrots to broccoli, spend the same amount on vegetables as before, and get the same enjoyment as before. Your cost of vegetables has not changed. The CPI says that the price of vegetables has increased because it ignores your substitution between goods in the CPI market basket.

Outlet Substitution Bias

When confronted with higher prices, people use discount stores more frequently and convenience stores less frequently. This phenomenon is called *outlet substitution*. Suppose, for example, that gas prices rise by 10¢ a gallon. Instead of buying from your nearby gas station for \$4.579 a gallon, you now drive farther to a gas station that charges \$4.479 a gallon. Your cost of gas has increased because you must factor in the cost of your time and the gas that you use driving several blocks down the road. But your cost has not increased by as much as the 10¢ a gallon increase in the pump price. However, the CPI says that the price of gas has increased by 10¢ a gallon because the CPI does not measure outlet substitution.

The growth of online shopping in recent years has provided an alternative to discount stores that makes outlet substitution even easier and potentially makes this source of bias more serious.

■ The Magnitude of the Bias

You have reviewed the sources of bias in the CPI. But how big is the bias? When this question was tackled in 1996 by a Congressional Advisory Commission chaired by Michael Boskin, an economics professor at Stanford University, the answer was that the CPI overstated inflation by 1.1 percentage points a year. That is, if the CPI reports that inflation is 3.1 percent a year, most likely inflation is actually 2 percent a year.

In the period since the Boskin Commission reported, the BLS has taken steps to reduce the CPI bias. The more frequent Consumer Expenditure Survey that we described earlier in this chapter is one of these steps. Beyond that, the BLS uses ever more sophisticated models and methods to try to eliminate the sources of bias and make the CPI as accurate as possible.



To compare the price of today's cars with those of earlier years, the BLS must value the improvements in features and quality.



When consumers substitute lower priced broccoli for higher priced carrots, the CPI overstates the rise in the price of vegetables.



As consumers shop around for the lowest prices, outlet substitution occurs and the CPI overstates the rise in prices actually paid.

■ Two Consequences of the CPI Bias

Avoiding bias in the CPI is important for two main reasons. Bias leads to

- Distortion of private contracts
- Increases in government outlays and decreases in taxes

Distortion of Private Contracts

Many wage contracts contain a cost of living adjustment. For example, the United Auto Workers Union (UAW) and Ford Motor Company might agree on a wage rate of \$30 an hour initially that increases over three years at the same rate as the cost of living increases. The idea is that both the union and the employer want a contract in “real” terms. As the cost of living rises, the firm wants to pay the workers the number of dollars per hour that buys a given market basket of goods and services. And the firm is happy to pay the higher wage because it can sell its output for a higher price.

Suppose that over the three years of a UAW and Ford contract, the CPI increases by 5 percent each year. The wage rate paid by Ford will increase to \$31.50 in the second year and \$33.08 in the third year.

But suppose that the CPI is biased and the true price increase is 3 percent a year. The workers’ cost of living increases by this amount, so in the second year, \$30.90 rather than \$31.50 is the intended wage. In the third year, a wage rate of \$31.83 and not \$33.08 compensates for the higher cost of living. So in the second year, the workers gain 60¢ an hour, or \$21 for a 35-hour workweek. And in the third year, they gain \$1.25 an hour, or \$43.75 for a 35-hour workweek.

The workers’ gain is Ford’s loss. With a work force of a few thousand, the loss amounts to several thousand dollars a week and a few million dollars over the life of a 3-year wage contract.

If the CPI bias was common knowledge and large, the CPI would not be used without some adjustment in contracts. Unions and employers would seek agreement on the extent of the bias and make an appropriate adjustment to their contract. But for a small bias, the cost of negotiating a more complicated agreement might be too large.

Increases in Government Outlays and Decreases in Taxes

Because rising prices decrease the buying power of the dollar, the CPI is used to adjust the incomes of the 49 million Social Security beneficiaries, 27 million food stamp recipients, and 4 million retired former military personnel and federal civil servants (and their surviving spouses). The CPI is also used to adjust the budget for 3 million school lunches.

Close to a third of federal government outlays are linked directly to the CPI. If the CPI has a 1.1 percentage point bias, all of these expenditures increase by more than required to compensate for the fall in the buying power of the dollar and, although a bias of 1.1 percent a year seems small, accumulated over a decade, it adds up to almost a trillion dollars of additional government outlays.

The CPI is also used to adjust the income levels at which higher tax rates apply. The tax rates on large incomes are higher than those on small incomes so, as incomes rise, if these adjustments were not made, the burden of taxes would rise relentlessly. To the extent that the CPI is biased upward, the tax adjustments over-compensate for rising prices and decrease the amount paid in taxes.

■ Alternative Measures of the Price Level and Inflation Rate

Several alternative measures of the price level and inflation rate are available. One based on wholesale prices and another based on producers' prices are similar to the CPI, both in the way they are constructed and their potential for bias. But three other price indexes that we'll briefly describe here are less biased. These indexes are the

- GDP price index
- Personal consumption expenditures (PCE) price index
- PCE price index excluding food and energy

GDP Price Index

The **GDP price index** (also called the *GDP deflator*) is an average of the current prices of all the goods and services included in GDP expressed as a percentage of base-year prices. Two key differences between the GDP price index and the CPI result in different estimates of the price level and inflation rate.

First, the GDP price index uses the prices of all the goods and services in GDP—consumption goods and services, capital goods, government goods and services, and export goods and services—while the CPI uses prices of consumption goods and services only. For example, the GDP price index includes the prices of paper mills bought by 3M to make Post-it® Notes, nuclear submarines bought by the Defense Department, and Boeing 747s bought by British Airways.

Second, the GDP price index weights each item using information about current quantities. In contrast, the CPI weights each item using information from a *past* Consumer Expenditure Survey. But because of the breadth of the items that the GDP price index includes, it is not an alternative to the CPI as a measure of the cost of living.

Personal Consumption Expenditures (PCE) Price Index

The **Personal Consumption Expenditures price index** (or **PCE price index**) is an average of the current prices of the goods and services included in the consumption expenditure component of GDP expressed as a percentage of base-year prices. The PCE price index has the same advantages as the GDP price index—it uses current information on quantities and to some degree overcomes the sources of bias in the CPI. It also has an advantage shared by the CPI of focusing on consumption expenditure and therefore being a possible measure of the cost of living.

A weakness of the PCE price index is that it is based on data that become known after the lapse of several months. So the CPI provides more current information about the inflation rate than what the PCE price index provides.

PCE Price Index Excluding Food and Energy

Food and energy prices fluctuate much more than other prices and their changes can obscure the underlying trends in prices. By excluding these highly variable items, the underlying price level and inflation trends can be seen more clearly. The percentage change in the PCE price index excluding food and energy is called the **core inflation rate**.

Figure 16.3(a) shows the three *price levels* measured by the CPI, the PCE price index, and PCE price index excluding food and energy. The two measures based on the PCE price index are very similar but the CPI measure rises above the other

GDP price index

An average of the current prices of all the goods and services included in GDP expressed as a percentage of base-year prices.

PCE price index

An average of the current prices of the goods and services included in the consumption expenditure component of GDP expressed as a percentage of base-year prices.

Core inflation rate

The annual percentage change in the PCE price index excluding the prices of food and energy.

two and the gap widens to 100 percentage points over the 40 years shown here.

Figure 16.3(b) shows the three consumer price *inflation rates*. These measures move up and down in similar ways, but the CPI measure exceeds the PCE price index measures. The average difference between the CPI and PCE measures is about a half a percentage point. The core inflation rate has almost the same average as the PCE inflation rate, but it fluctuates less. You can see why this measure provides a better indication of the inflation trend than the index that includes food and energy prices.

This higher CPI is a reflection of its bias and a confirmation that the PCE price index, which is based on current period actual expenditures, avoids most of the sources of bias in the CPI.

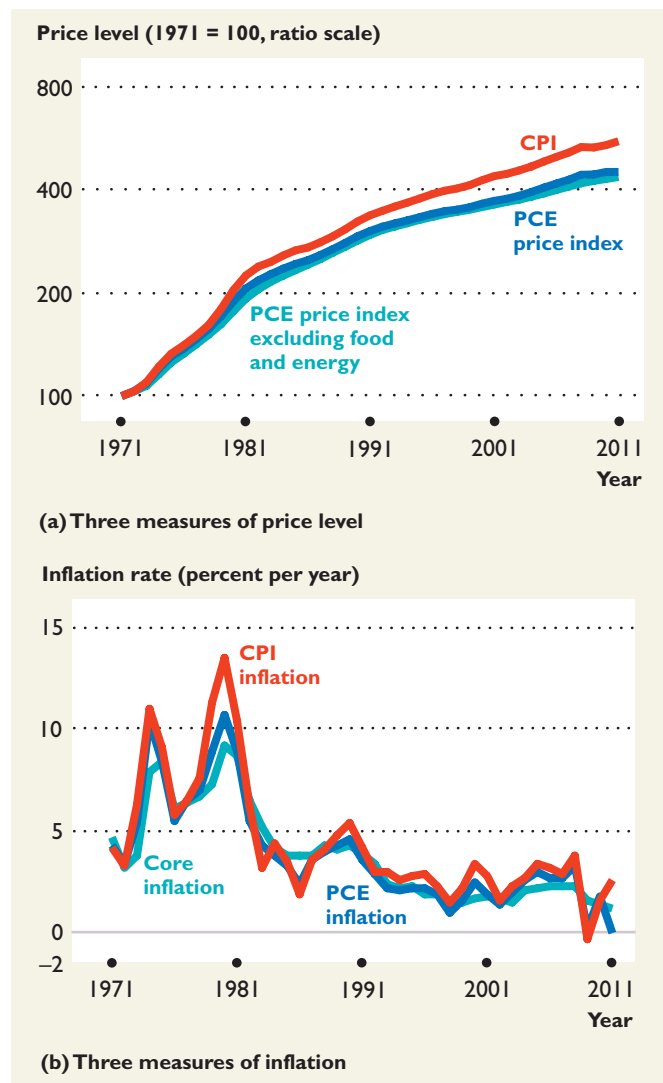
FIGURE 16.3

Three Measures of Consumer Prices

MyEconLab Real-time data

The three measures of the *price level* in part (a), rise together but the CPI rises above the two PCE measures reflecting the bias in the CPI.

The three measures of the *inflation rate* in part (b) fluctuate together, but the CPI inflation rate is higher than the PCE price index inflation rate or the core inflation rate. The core inflation rate fluctuates less than the other two measures.



SOURCES OF DATA: Bureau of Labor Statistics and Bureau of Economic Analysis.

CHECKPOINT 16.2

Explain the limitations of the CPI and describe other measures of the price level.

Practice Problems

Economists in the Statistics Bureau decide to check the CPI substitution bias. To do so, they conduct a Consumer Expenditure Survey in both 2010 and 2011. Table 1 shows the results of the survey. It shows the items that consumers buy and their prices. The Statistics Bureau fixes the reference base year as 2010.

1. Calculate the CPI in 2011 if the CPI basket contains the 2010 quantities.
2. Calculate the CPI in 2011 if the CPI basket contains the 2011 quantities.
3. Is there any substitution bias in the CPI that uses the 2010 basket? Explain.

In the News

News releases

In 2011, the CPI increased by 1.4 percent, the GDP price index increased by 1.2 percent, and the PCE price index increased by 1.8 percent.

Source: Bureau of Economic Analysis, August 29, 2011

Why do these three measures of the price level give different inflation rates?

Solutions to Practice Problems

1. Table 2 shows the calculation of the CPI in 2011 when the CPI basket is made of the 2010 quantities. The cost of the 2010 basket at 2010 prices is \$60 and the cost of the 2010 basket at 2011 prices is \$90. So the CPI in 2011 using the 2010 basket is $(\$90 \div \$60) \times 100 = 150$.
2. Table 3 shows the calculation of the CPI in 2011 when the CPI basket is made of the 2011 quantities. The cost of the 2011 basket at 2010 prices is \$65, and the cost of the 2011 basket at 2011 prices is \$85. So the CPI in 2011 using the 2011 basket is $(\$85 \div \$65) \times 100 = 131$.
3. The CPI that uses the 2010 basket displays some bias. With the price of broccoli constant and the price of carrots rising, consumers buy fewer carrots and more broccoli and they spend \$85 on vegetables. But they would have spent \$90 if they had not substituted broccoli for some carrots. The price of vegetables does not rise by 50 percent as shown by the CPI. Because of substitution, the price of vegetables rises by only 42 percent (\$85 is 42 percent greater than \$60). Using the 2011 basket, the price of vegetables rises by only 31 percent (\$85 compared with \$65). A CPI substitution bias exists.

Solution to In the News

These three measures of the price level are based on the prices of different baskets of goods and services. The GDP price index is the broadest measure and its basket contains all the goods and services that are counted in GDP—U.S.-produced goods and services that households, firms, governments, and foreigners buy in the current year. The basket of the PCE price index contains the goods and services in GDP that households buy in the current year. The CPI basket contains only the goods and services that urban consumers buy in the base year.

MyEconLab

You can work these problems in Study Plan 16.2 and get instant feedback.

TABLE 1

| Item | 2010 | | 2011 | |
|----------|----------|--------|----------|--------|
| | Quantity | Price | Quantity | Price |
| Broccoli | 10 | \$3.00 | 15 | \$3.00 |
| Carrots | 15 | \$2.00 | 10 | \$4.00 |

TABLE 2

| Item | 2010 basket at 2010 prices | 2010 basket at 2011 prices |
|----------|----------------------------|----------------------------|
| Broccoli | \$30 | \$30 |
| Carrots | \$30 | \$60 |
| Total | \$60 | \$90 |

TABLE 3

| Item | 2011 basket at 2010 prices | 2011 basket at 2011 prices |
|----------|----------------------------|----------------------------|
| Broccoli | \$45 | \$45 |
| Carrots | \$20 | \$40 |
| Total | \$65 | \$85 |



Which postage stamp has the higher real price: the 2¢ stamp of 1911 or today's 44¢ stamp?

16.3 NOMINAL AND REAL VALUES

In 2011, it cost 44 cents to mail a first-class letter. One hundred years earlier, in 1911, that same letter would have cost 2 cents to mail. Does it *really* cost you 22 times the amount that it cost your great-great-grandmother to mail a letter?

You know that it does not. You know that a dollar today buys less than what a dollar bought in 1911, so the cost of a stamp has not really increased to 22 times its 1911 level. But has it increased at all? Did it really cost you any more to mail a letter in 2011 than it cost your great-great-grandmother in 1911?

The CPI can be used to answer questions like these. In fact, that is one of the main reasons for constructing a price index. Let's see how we can compare the price of a stamp in 1911 and the price of a stamp in 2011.

■ Dollars and Cents at Different Dates

To compare dollar amounts at different dates, we need to know the CPI at those dates. Currently, the CPI has a base of 100 for 1982–1984. That is, the average of the CPI in 1982, 1983, and 1984 is 100. (The numbers for the three years are 96.4, 99.6, and 103.9, respectively. Calculate the average of these numbers and check that it is indeed 100.)

In 2011, the CPI was 225.4, and in 1911, it was 9.8. By using these two numbers, we can calculate the relative value of the dollar in 1911 and 2011. To do so, we divide the 2011 CPI by the 1911 CPI. That ratio is $225.4 \div 9.8 = 23$. That is, prices on average were 23 times higher in 2011 than in 1911.

We can use this ratio to convert the price of a 2-cent stamp in 1911 into its 2011 equivalent. The formula for this calculation is

$$\begin{aligned} \text{Price of stamp in 2011 dollars} &= \text{Price of stamp in 1911 dollars} \times \frac{\text{CPI in 2011}}{\text{CPI in 1911}} \\ &= 2 \text{ cents} \times \frac{225.4}{9.8} = 46 \text{ cents.} \end{aligned}$$

So your great-great-grandmother paid a bit more than you pay! It really cost her two cents more to mail that first-class letter than it cost you in 2011. She paid the equivalent of 46 cents in 2011 money, and you paid 44 cents.

We've just converted the 1911 price of a stamp to its 2011 equivalent. We can do a similar calculation the other way around—converting the 2011 price to its 1911 equivalent. The formula for this alternative calculation is

$$\begin{aligned} \text{Price of stamp in 1911 dollars} &= \text{Price of stamp in 2011 dollars} \times \frac{\text{CPI in 1911}}{\text{CPI in 2011}} \\ &= 44 \text{ cents} \times \frac{9.8}{225.4} = 1.91 \text{ cents.} \end{aligned}$$

The interpretation of this number is that you pay the *equivalent* of 1.91 cents in 1911 dollars. Your *real* price of a stamp is 1.91 cents expressed in 1911 dollars.

The calculations that we've just done are examples of converting a *nominal* value into a *real* value. A nominal value is one that is expressed in current dollars. A real value is one that is expressed in the dollars of a given year. We're now going to see how we convert nominal macroeconomic variables into real variables using a similar method.

Nominal and Real Values in Macroeconomics

Macroeconomics makes a big issue of the distinction between nominal and real values. Three nominal and real variables occupy a central position in macroeconomics. They are

- Nominal GDP and real GDP
- The nominal wage rate and the real wage rate
- The nominal interest rate and the real interest rate

We begin our examination of real and nominal variables in macroeconomics by reviewing what you've already learned about the distinction between nominal GDP and real GDP and interpreting that distinction in a new way.

Nominal GDP and Real GDP

When we calculated the 1911 value of a 44-cent 2011 postage stamp, we multiplied the 2011 price by the ratio of the CPI in 1911 to the CPI in 2011. By this calculation, we found the “real” value of a 2011 stamp in 1911 dollars.

But when we calculated the real GDP of 2011 in 2005 dollars in Chapter 14 (pp. 378–379 and 393–395), we didn't multiply nominal GDP in 2011 by the ratio of a price index in the two years. Instead, we expressed the values of the goods and services produced in 2011 in terms of the prices that prevailed in 2005. We calculated real GDP directly.

But we can *interpret* real GDP in 2011 as nominal GDP in 2011 multiplied by the ratio of the GDP price index in 2005 to the GDP price index in 2011. The GDP price



EYE on the U.S. ECONOMY

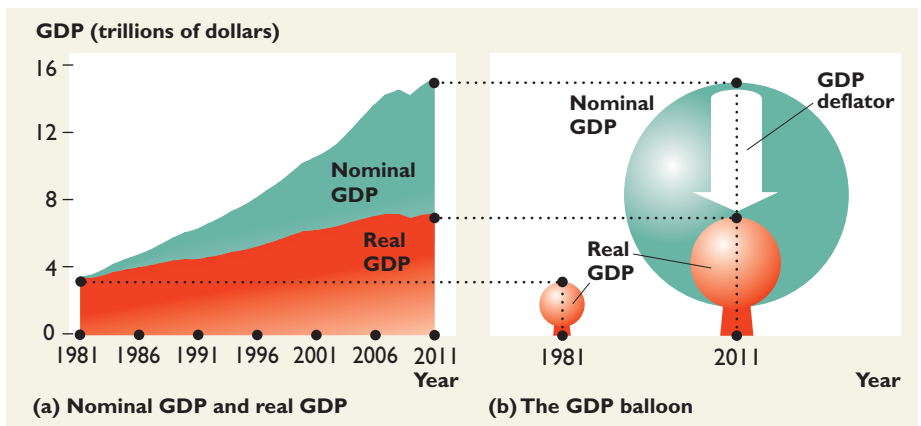
Deflating the GDP Balloon

Nominal GDP

increased every year between 1981 and 2011 except for 2009. Part of the increase reflects increased production, and part of it reflects rising prices.

You can think of GDP as a balloon that is blown up by growing production and rising prices. In the figure, the GDP price index or *GDP deflator* lets the inflation air—the contribution of rising prices—out of the nominal GDP balloon so that we can see what has happened to real GDP.

The small red balloon for 1981 shows real GDP in that year. The green balloon shows nominal GDP in 2011. The red balloon for 2011 shows



SOURCE OF DATA: Bureau of Economic Analysis.

real GDP for that year.

To see real GDP in 2011, we use the GDP price index to deflate nomi-

nal GDP. With the inflation air removed, we can see by how much real GDP grew from 1981 to 2011.

index in 2005 (the base year) is defined to be 100, so we can interpret real GDP in any year as nominal GDP divided by the GDP price index in that year multiplied by 100. We don't calculate real GDP this way, but we can interpret it this way.

The GDP price index, or the CPI, or some other price index might be used to convert a nominal variable to a real variable.

■ Nominal Wage Rate and Real Wage Rate

The price of labor services is the wage rate—the income that an hour of labor earns. In macroeconomics, we are interested in economy-wide performance, so we focus on the *average* hourly wage rate. The **nominal wage rate** is the average hourly wage rate measured in *current* dollars. The **real wage rate** is the average hourly wage rate measured in the dollars of a given reference base year.

To calculate the real wage rate relevant to a consumer, we divide the nominal wage rate by the CPI and multiply by 100. That is,

$$\text{Real wage rate in 2011} = \frac{\text{Nominal wage rate in 2011}}{\text{CPI in 2011}} \times 100.$$

In 2011, the nominal wage rate (average hourly wage rate) of production workers was \$19.04 and the CPI was 225.4, so

$$\text{Real wage rate in 2011} = \frac{\$19.04}{225.4} \times 100 = \$8.45.$$

Because we measure the real wage rate in constant base period dollars, a change in the real wage rate measures the change in the quantity of goods and ser-

Nominal wage rate

The average hourly wage rate measured in current dollars.

Real wage rate

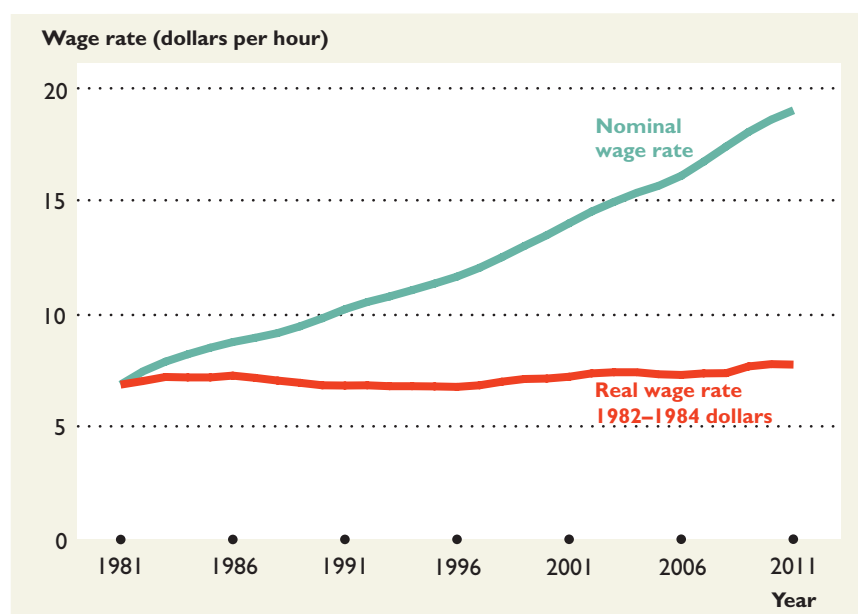
The average hourly wage rate measured in the dollars of a given reference base year.

■ FIGURE 16.4

Nominal and Real Wage Rates: 1981–2011

MyEconLab Real-time data

The nominal wage rate has increased every year since 1981. The real wage rate decreased slightly from 1981 through the mid-1990s, after which it increased slightly again. Over the entire 30-year period, the real wage rate remained steady.



SOURCE OF DATA: *Economic Report of the President*, 2011.

vices that an hour's work can buy. In contrast, a change in the nominal wage rate measures a combination of a change in the quantity of goods and services that an hour's work can buy and a change in the price level. So the real wage rate removes the effects of inflation from the changes in the nominal wage rate.

The real wage rate is a significant economic variable because it measures the real reward for labor, which is a major determinant of the standard of living. The real wage rate is also significant because it measures the real cost of labor services, which influences the quantity of labor that firms are willing to hire.

Figure 16.4 shows what has happened to the nominal wage rate and the real wage rate in the United States between 1981 and 2011. The nominal wage rate is the average hourly earnings of production workers. This measure is just one of several different measures of average hourly earnings that we might have used.

The nominal wage rate increased from \$6.85 an hour in 1981 to \$19.04 an hour in 2011, but the real wage rate barely changed. In 1982–1984 dollars (the CPI base period dollars), the real wage rate in 2011 was only \$8.45 an hour.

The real wage rate barely changed as the nominal wage rate increased because the nominal wage rate grew at a rate almost equal to the inflation rate. When the effects of inflation are removed from the nominal wage rate, we can see what is happening to the buying power of the average wage rate.

You can also see that the real wage rate has fluctuated a little. It decreased slightly until the mid-1990s, after which it increased slightly.

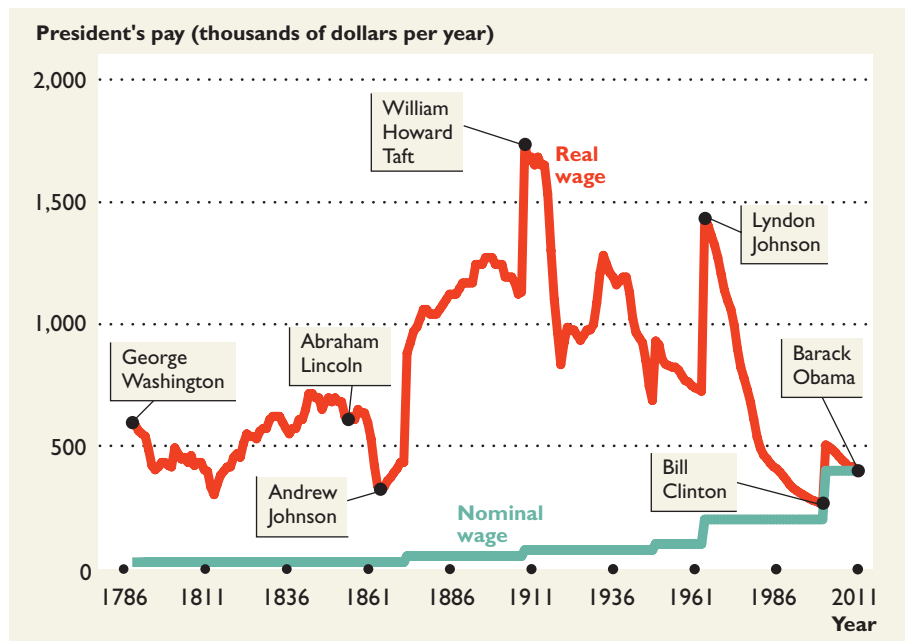


EYE on the PAST

The Nominal and Real Wage Rates of Presidents of the United States

Who earned more, Barack Obama in 2011, or George Washington in 1789? George Washington's pay was \$25,000 (on the green line) but in 2011 dollars it was \$597,000 (on the red line). Barack Obama was paid \$400,000 in 2011.

But presidential accommodations are more comfortable today, and presidential travel arrangements are a breeze compared to earlier times. So adding in the perks of the job, Barack Obama doesn't get such a raw deal.



SOURCE OF DATA: Robert Sahr, Oregon State University, http://www.orst.edu/dept/pol_sci/sci/fac/sahr/sahr.htm.

■ Nominal Interest Rate and Real Interest Rate

You've just seen that we can calculate real values from nominal values by deflating them using the CPI. And you've seen that to make this calculation, we *divide* the nominal value by a price index. Converting a nominal interest rate to a real interest rate is a bit different. To see why, we'll start with their definitions.

Nominal interest rate

The dollar amount of interest expressed as a percentage of the amount loaned.

Real interest rate

The goods and services forgone in interest expressed as a percentage of the amount loaned and calculated as the nominal interest rate minus the inflation rate.

A **nominal interest rate** is the dollar amount of interest expressed as a percentage of the amount loaned. For example, suppose that you have \$1,000 in a bank deposit—a loan by you to a bank—on which you receive interest of \$50 a year. The nominal interest rate is \$50 as a percentage of \$1,000, which is 5 percent a year.

A **real interest rate** is the goods and services forgone in interest expressed as a percentage of the amount loaned. Continuing with the above example, at the end of one year your bank deposit has increased to \$1,050—the original \$1,000 plus the \$50 interest. Suppose that prices have increased by 3 percent, so now you need \$1,030 to buy what \$1,000 would have bought a year earlier. How much interest have you *really* received? The answer is \$20, or a real interest rate of 2 percent a year.

To convert a nominal interest rate to a real interest rate, we *subtract* the *inflation rate*. That is,

$$\text{Real interest rate} = \text{Nominal interest rate} - \text{Inflation rate.}$$

Plug your numbers into this formula. Your nominal interest rate is 5 percent a year, and the inflation rate is 3 percent a year. Your real interest rate is 5 percent minus 3 percent, which equals 2 percent a year.

Figure 16.5 shows the nominal and the real interest rates in the United States between 1971 and 2011. When the inflation rate is high, the gap between the real interest rate and nominal interest rate is large. Sometimes, the real interest rate is negative (as it was in the mid-1970s) and the lender pays the borrower!



EYE on BOX OFFICE HITS

Which Movie *Really* Was the Biggest Box Office Hit?

Gone with the Wind is the answer to the question that we posed at the beginning of this chapter.

To get this answer, Box-Office Mojo (www.boxofficemojo.com) calculates the amount that a movie *really* earns by converting the dollars earned to their equivalent in current-year dollars. But rather than use the CPI, it uses the average prices of movie tickets as its price index.

Gone with the Wind was made in 1939. Looking only at its performance in the United States, the movie was re-

leased in nine subsequent years and by 2011 it had earned a total box office revenue of almost \$200 million.

Harry Potter and the Deathly Hallows, Part 2 was released in 2011 and during the summer of that year it earned \$366 million.

So the 2011 *Harry Potter* movie earned 1.83 times the dollars earned by *Gone with the Wind*.

To convert the *Gone with the Wind* revenues into 2011 dollars, Box-Office Mojo multiplies the dollars received each year by the 2011 ticket price and

divides by the ticket price for the year in which the dollars were earned.

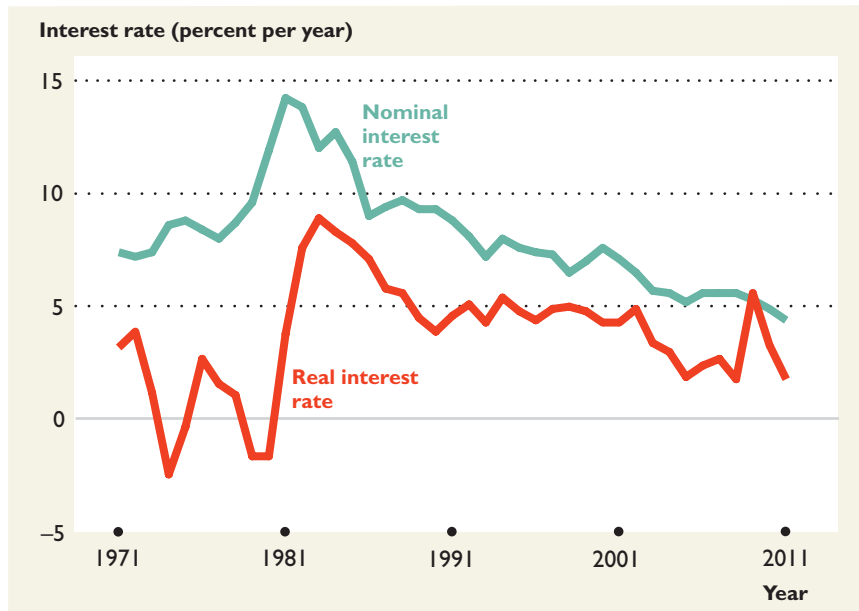
According to Box-Office Mojo, valuing the tickets for *Gone with the Wind* at 2011 movie-ticket prices, it has earned \$1,620,000,000, about 4.4 times *Harry Potters'* revenue.

Because Box-Office Mojo uses average ticket prices, the real variable that it compares is the number of tickets sold. The average ticket price in 2011 was \$7.96, so 204 million have seen *Gone with the Wind* and 46 million have seen the 2011 *Harry Potter* movie.

FIGURE 16.5

Nominal and Real Interest Rates: 1971–2011

MyEconLab Real-time data



The interest rate shown here is that paid by the safest large corporations on long-term bonds (known as Moody's AAA). The real interest rate equals the nominal interest rate minus the inflation rate. The vertical gap between the nominal interest rate and the real interest rate is the inflation rate. The real interest rate is usually positive, but during the 1970s, it became negative.

SOURCE OF DATA: *Economic Report of the President*, 2011.



EYE on YOUR LIFE

A Student's CPI

The CPI measures the percentage change in the average prices paid for the basket of goods and services bought by a typical urban household.

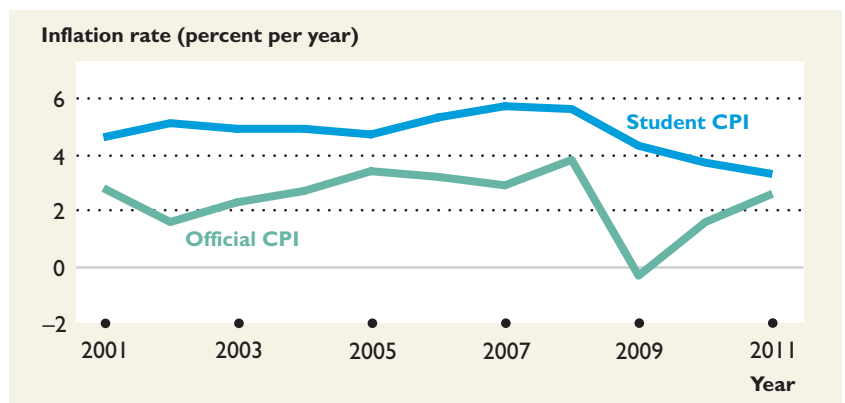
A student is not a typical household. How have the prices of a student's basket of goods and services changed? The answer is by a lot more than those of an average household.

Suppose that a student spends 25 percent of her income on rent, 25 percent on tuition, 25 percent on books and study supplies, 10 percent on food, 10 percent on transportation, and 5 percent on clothing.

We can use these weights and the data collected by the BLS on individual

price categories to find the student's CPI and the inflation rate that it implies.

The graph shows this student's inflation rate compared to that of the offi-



SOURCE OF DATA: Bureau of Labor Statistics.

cial CPI. Between 2001 and 2011, a student's CPI rose 28 percent above the official CPI. Rent, textbooks, and tuition are the main items whose prices rose faster than average.

MyEconLab

You can work these problems in Study Plan 16.3 and get instant feedback.

TABLE 1

| Year | Price of gasoline (cents per gallon) | CPI |
|------|--------------------------------------|-------|
| 1971 | 36 | 40.5 |
| 1981 | 138 | 90.9 |
| 1991 | 114 | 136.2 |
| 2001 | 146 | 176.6 |

TABLE 2

| Year | Price of gasoline (cents per gallon) | CPI | Price of gasoline (1982–1984 cents per gallon) |
|------|--------------------------------------|-------|--|
| 1971 | 36 | 40.5 | 89 |
| 1981 | 138 | 90.9 | 152 |
| 1991 | 114 | 136.2 | 84 |
| 2001 | 146 | 176.6 | 83 |

CHECKPOINT 16.3

Adjust money values for inflation and calculate real wage rates and real interest rates.

Practice Problems

- Table 1 shows the price of gasoline and the CPI for four years. The reference base period is 1982–1984. Calculate the real price of gasoline each year. In which year was this real price highest and in which year was it lowest?
- Ford says it cut its labor costs by 35 percent between 2006 and 2011. Ford's wage rate, including benefits, was \$80 an hour in 2006 and \$58 an hour in 2011. The CPI was 202 in 2006 and 218 in 2011. Did the real wage rate fall by more or less than 35 percent?
- Sally worked all year and put her savings into a mutual fund that paid a nominal interest rate of 7 percent a year. During the year, the CPI increased from 165 to 177. What was the real interest rate that Sally earned?

In the News

Inflation can act as a safety valve

Workers will more readily accept a real wage cut that arises from an increase in the CPI than a cut in their nominal wage rate.

Source: FT.com, May 28, 2009

Explain why inflation influences a worker's real wage rate. Why might this observation be true?

Solutions to Practice Problems

- To calculate the real price, divide the nominal price by the CPI and multiply by 100. Table 2 shows the calculations. The real price was highest in 1981, when it was 152 cents (1982–1984 cents) per gallon. The real price was lowest in 2001, when it was 83 cents (1982–1984 cents) per gallon.
- The real wage rate in 2006, expressed in dollars of the reference base year, equals $(\$80 \div 202) \times 100$, or \$39.60 an hour. The real wage rate in 2011, expressed in dollars of the reference base year, equals $(\$58 \div 218) \times 100$, or \$26.61 an hour. The real wage rate of these workers fell by 32.8 percent.
- The inflation rate during the year equals $(177 - 165) \div 165 \times 100 = 7.3$ percent. The real interest rate that Sally earned equals the nominal interest rate minus the inflation rate, which is $7.0 - 7.3 = -0.3$ percent. Sally's real interest rate was negative. (If Sally had kept her savings in cash, her nominal interest rate would have been zero, and her real interest rate would have been -7.3 percent. She would have been worse off.)

Solution to In the News

The real wage rate equals the $(\text{Nominal wage rate} \div \text{CPI}) \times 100$. Two reasons why a real wage cut from inflation is more acceptable are: A rising CPI *gradually* lowers the real wage rate, while a cut in the nominal wage rate *suddenly* lowers the real wage rate. Inflation lowers everyone's real wage rate but a cut in one worker's nominal wage rate lowers only that worker's real wage rate.

CHAPTER SUMMARY

Key Points

1 Explain what the Consumer Price Index (CPI) is and how it is calculated.

- The Consumer Price Index (CPI) is a measure of the average of the prices of the goods and services that an average urban household buys.
- The CPI is calculated by dividing the cost of the CPI market basket in the current period by its cost in the base period and then multiplying by 100.

2 Explain the limitations of the CPI and describe other measures of the price level.

- The CPI does not include all the items that contribute to the cost of living.
- The CPI cannot provide an accurate measure of price changes because of new goods, quality improvements, and substitutions that consumers make when relative prices change.
- Other measures of the price level include the GDP price index, the PCE price index, and the PCE price index excluding food and energy.
- Both the GDP price index and the PCE price index use current information on quantities and to some degree overcome the sources of bias in the CPI.
- The PCE price index excluding food and energy is used to calculate the core inflation rate, which shows the inflation trend.

3 Adjust money values for inflation and calculate real wage rates and real interest rates.

- To adjust a money value (also called a nominal value) for inflation, we express the value in terms of the dollars of a given year.
- To convert a dollar value of year B to the dollars of year A , multiply the value in year B by the price level in year A and divide by the price level in year B .
- The real wage rate equals the nominal wage rate divided by the CPI and multiplied by 100.
- The real interest rate equals the nominal interest rate minus the inflation rate.

Key Terms

Consumer Price Index, 420
 Core inflation rate, 429
 Cost of living index, 426
 Deflation, 423
 GDP price index, 429
 Inflation rate, 423

Nominal interest rate, 436
 Nominal wage rate, 434
 PCE price index, 429
 Real interest rate, 436
 Real wage rate, 434
 Reference base period, 420

MyEconLab

You can work these problems in Chapter 16 Study Plan and get instant feedback.

TABLE 1 DATA FOR WEEK 1

| Item | Quantity | Price (per unit) |
|----------|------------|------------------|
| Coffee | 11 cups | \$3.25 |
| DVDs | 1 | \$25.00 |
| Gasoline | 15 gallons | \$2.50 |

TABLE 2 DATA FOR WEEK 2

| Item | Quantity | Price (per unit) |
|----------|-----------|------------------|
| Coffee | 11 cups | \$3.25 |
| DVDs | 3 | \$12.50 |
| Gasoline | 5 gallons | \$3.00 |
| Concert | 1 ticket | \$95.00 |

TABLE 3

| Item | Price in June | Price in July |
|----------|--------------------|---------------|
| | (dollars per unit) | |
| Steak | 4.11 | 4.01 |
| Bread | 3.25 | 3.12 |
| Bacon | 3.62 | 3.64 |
| Milk | 2.62 | 2.62 |
| Tomatoes | 1.60 | 1.62 |
| Apples | 1.18 | 1.19 |
| Bananas | 0.62 | 0.66 |
| Chicken | 1.28 | 1.26 |
| Lettuce | 1.64 | 1.68 |

CHAPTER CHECKPOINT

Study Plan Problems and Applications

- Looking at some travel magazines, you read that the CPI in Turkey in 2008 was 434 and in Russia, it was 224. You do some further investigating and discover that the reference base period in Turkey is 2000 and in Russia it is 2001. The CPI in Russia in 2000 was 82. Calculate the percentage rise in the CPI in Turkey and in Russia from 2000 to 2008.
- In Brazil, the reference base period for the CPI is 2000. By 2005, prices had risen by 51 percent since the base period. The inflation rate in Brazil in 2006 was 10 percent, and in 2007, the inflation rate was 9 percent. Calculate the CPI in Brazil in 2006 and 2007. Brazil's CPI in 2008 was 173. Did Brazil's inflation rate increase or decrease in 2008?
- Tables 1 and 2 show the quantities of the goods that Suzie bought and the prices she paid during two consecutive weeks. Suzie's CPI market basket contains the goods she bought in Week 1. Calculate the cost of Suzie's CPI market basket in Week 1 and in Week 2. What percentage of the CPI market basket is gasoline? Calculate the value of Suzie's CPI in Week 2 and her inflation rate in Week 2.

Use the following information to work Problems 4 and 5.

The GDP price index in the United States in 2000 was about 90, and real GDP in 2000 was \$11 trillion (2005 dollars). The GDP price index in 2010 was about 111, and real GDP in 2010 was \$13.1 trillion (2005 dollars).

- Calculate nominal GDP in 2000 and in 2010 and the percentage increase in nominal GDP between 2000 and 2010.
- What was the percentage increase in production between 2000 and 2010, and by what percentage did the cost of living rise between 2000 and 2010?
- Table 3 shows the prices that Terry paid for some of his expenditures in June and July 2011. Explain and discuss why these prices might have led to commodity substitution or outlet substitution.
- In 2010, Annie, an 80-year-old, is telling her granddaughter Mary about the good old days. Annie says that in 1930, you could buy a nice house for \$15,000 and a jacket for \$5. Mary says that today such a house costs \$220,000 and such a jacket costs \$70. The CPI in 1930 was 16.7 and in 2010 it was 218.1. Which house and which jacket have the lower prices?

Use the following information to work Problems 8 and 9.

CPI: Inflation rate picks up in August

The CPI rose 3.8% in August compared to a year earlier. Food prices rose 4.6% and clothing prices were up 4.2%, while new car prices rose 3.8% and medical care was up 3.2%.

Source: CNN Money, September 15, 2011

- What percentage change in the CPI during the year to August 2011 is accounted for by the changes in the prices of food, clothing, and medical care?
- Given the changes in the prices of food, clothing, and medical care, by what percentage did the prices of the other items in the CPI basket change?

Instructor Assignable Problems and Applications

Your instructor can assign these problems as homework, a quiz, or a test in [MyEconLab](#).

- Made in 1982, *E.T.: The Extra-Terrestrial* earned \$435 million at the box office. Made in 1997, *Titanic* earned \$601 million. Using BLS data for the CPI in 1982 and 1997, determine which movie had the greater *real* box office revenues.
- Pete is a student who spends 10 percent of his expenditure on books and supplies, 30 percent on tuition, 30 percent on rent, 10 percent on food and drink, 10 percent on transportation, and the rest on clothing. The price index for each item was 100 in 2000. Table 1 shows the prices in 2011. What is Pete's CPI in 2011? (Hint: The contribution of each item to the CPI is its price weighted by its share of total expenditure.) Did Pete experience a higher or lower inflation rate between 2000 and 2011 than the student whose CPI is shown on p. 437?
- The people on Coral Island buy only juice and cloth. The CPI market basket contains the quantities bought in 2010. The average household spent \$60 on juice and \$30 on cloth in 2010 when the price of juice was \$2 a bottle and the price of cloth was \$5 a yard. In the current year, 2011, juice is \$4 a bottle and cloth is \$6 a yard. Calculate the CPI and the inflation rate in 2011.
- Tables 2 and 3 show the quantities of the goods that Harry bought and the prices he paid during two consecutive weeks. Harry's CPI market basket contains the goods he bought in Week 1. Calculate Harry's CPI in Week 2. What was his inflation rate in Week 2?

Use the following information to work Problems 5 and 6.

The base year is 2005. Real GDP in 2005 was \$10 trillion (2005 dollars). The GDP price index in 2009 was 112, and real GDP in 2009 was \$11 trillion (2005 dollars).

- Calculate nominal GDP in 2005 and in 2009 and the percentage increase in nominal GDP from 2005 to 2009.
- What was the percentage increase in production from 2005 to 2009, and by what percentage did the cost of living rise from 2005 to 2009?
- In 1988, the average wage rate was \$9.45 an hour and in 2008 the average wage rate was \$18.00 an hour. The CPI in 1988 was 118.3 and in 2008 it was 215.3. Which real wage rate is higher?
- Imagine that you are given \$1,000 to spend and told that you must spend it all buying items from a Sears catalog. But you do have a choice of catalog. You may select from the 1903 catalog or from Sears.com today. You will pay the prices quoted in the catalog that you choose.

Which catalog will you choose and why? Refer to any biases in the CPI that might be relevant to your choice.

Use the following information to work Problems 9 and 10.

Money market funds are yielding almost nothing

Last month, the interest rate on a money market fund averaged 0.08% a year and on 5-year CDs it was 2.6% a year. The inflation rate was 0.1% a year.

Source: *USA Today*, August 12, 2009

- Calculate the real interest rate on each of these financial assets.
- To maintain these real interest rates in the coming months, how will these nominal rates change if the inflation rate increases to 0.2 percent a year?

TABLE 1

| Item | Price in 2011 |
|--------------------|---------------|
| Books and supplies | 172.6 |
| Tuition | 169.0 |
| Rent | 159.0 |
| Food and drink | 129.8 |
| Transportation | 115.4 |
| Clothing | 92.9 |

TABLE 2 DATA FOR WEEK 1

| Item | Quantity | Price (per unit) |
|--------------|------------|------------------|
| Coffee | 5 cups | \$3.00 |
| iTunes songs | 5 | \$1.00 |
| Gasoline | 10 gallons | \$2.00 |

TABLE 3 DATA FOR WEEK 2

| Item | Quantity | Price (per unit) |
|--------------|------------|------------------|
| Coffee | 4 cups | \$3.25 |
| iTunes songs | 10 | \$1.00 |
| Gasoline | 10 gallons | \$3.00 |

MyEconLab

You can work this quiz in Chapter 16 Study Plan and get instant feedback.

Multiple Choice Quiz

1. The CPI measures the average prices paid by _____ for _____.
 - A. urban consumers; a fixed basket of consumption goods and services
 - B. urban consumers; the average basket of goods and services they buy
 - C. all consumers; housing, transportation, and food
 - D. everyone who earns an income; the necessities of life
2. The BLS reported that the CPI in July 2010 was 226. This news tells you that _____.
 - A. consumer prices during July were 226 percent higher than they were during the base year
 - B. the CPI inflation rate in July was 26 percent a year
 - C. consumer prices rose by 26 percent during the month of July
 - D. the prices of consumption goods and services have risen, on average, by 126 percent since the base year
3. When the price level _____ the inflation rate _____.
 - A. rises rapidly; increases
 - B. rises rapidly; is high
 - C. falls; is zero
 - D. rises slowly; falls
4. The CPI bias arises from all of the following items *except* _____.
 - A. the introduction of new goods and services
 - B. the improved quality of goods
 - C. the goods and services bought by poor people
 - D. consumers' responses to price changes
5. Of the alternative measures of the price level, _____ overcomes the bias of the CPI and is a better measure of the cost of living because it _____.
 - A. GDP price index; uses a current basket
 - B. PCE price index; uses a current basket of all consumption goods
 - C. PCE price index excluding food and energy; is less volatile
 - D. GDP price index; includes all goods and services bought by Americans
6. If nominal GDP increases by 5 percent a year and the GDP price index rises by 2 percent a year, then real GDP increases by _____.
 - A. 7 percent a year
 - B. 3 percent a year
 - C. 2.5 percent a year
 - D. 10 percent a year
7. When the CPI increases from 200 in 2010 to 210 in 2011 and the nominal wage rate is constant at \$10 an hour, the real wage rate _____.
 - A. increases by 10 percent
 - B. increases to \$15 an hour
 - C. decreases by 5 percent
 - D. is \$10 an hour
8. When the price level is rising at _____ and the real interest rate is 1 percent a year, the nominal interest rate is 3 percent a year.
 - A. 4 percent a year
 - B. 3 percent a year
 - C. 2 percent a year
 - D. 1 percent a year



Why do Americans earn more and produce more than Europeans?

Potential GDP and the Economic Growth

When you have completed your study of this chapter, you will be able to

- 1 Explain what determines potential GDP.
- 2 Define and calculate the economic growth rate, and explain the implications of sustained growth.
- 3 Identify the main sources of economic growth and explain the growth process.
- 4 Describe the policies that might speed economic growth.



CHAPTER CHECKLIST

MACROECONOMIC APPROACHES AND PATHWAYS

In the three previous chapters, you learned how economists define and measure real GDP, employment and unemployment, the price level, and the inflation rate—the key variables that *describe* macroeconomic performance. Your task in this chapter and those that follow is to learn the *macroeconomic theory* that *explains* macroeconomic performance and provides the basis for *policies* that might improve it.

The macroeconomic theory that we present is today's consensus view on how the economy works. But it isn't the view of all macroeconomists. Today's consensus is a merger of three earlier schools of thought that have sharply contrasting views about the causes of recessions and the best policies for dealing with them. Some economists continue to identify with these schools of thought, and the severity of the 2008–2009 recession and slow recovery intensified debate and gave economists of all shades of opinion a platform from which to present their views.

We begin with an overview of the three schools of thought from which today's consensus has emerged.

■ The Three Main Schools of Thought

The three main schools of macroeconomic thought are:

- Classical macroeconomics
- Keynesian macroeconomics
- Monetarist macroeconomics

Classical Macroeconomics

According to **classical macroeconomics**, markets work well and deliver the best available macroeconomic performance. Aggregate fluctuations are a natural consequence of an expanding economy with rising living standards, and government intervention can only hinder the ability of the market to allocate resources efficiently. The first classical macroeconomists included Adam Smith, David Ricardo, and John Stuart Mill, all of whom worked in the 18th and 19th centuries. Modern day classical economists include the 2004 Nobel Laureates Edward C. Prescott of the University of Arizona and Finn E. Kydland of Carnegie-Mellon University and the University of California at Santa Barbara.

Classical macroeconomics fell into disrepute during the Great Depression of the 1930s, a time when many people believed that *capitalism*, the political system of private ownership, free markets, and democratic political institutions, could not survive and began to advocate *socialism*, a political system based on state ownership of capital and central economic planning.

Classical macroeconomics predicted that the Great Depression would eventually end but offered no method for ending it more quickly.

Keynesian Macroeconomics

According to **Keynesian macroeconomics**, the market economy is inherently unstable and requires active government intervention to achieve full employment and sustained economic growth. One person, John Maynard Keynes, and his book *The General Theory of Employment, Interest, and Money*, published in 1936, began this school of thought. Keynes' theory was that depression and high unemployment occur when households don't spend enough on consumption goods and services

Classical macroeconomics

The view that the market economy works well, that aggregate fluctuations are a natural consequence of an expanding economy, and that government intervention cannot improve the efficiency of the market economy.

Keynesian macroeconomics

The view that the market economy is inherently unstable and needs active government intervention to achieve full employment and sustained economic growth.

and businesses don't spend enough investing in new capital. That is, too little *private* spending is the cause of depression (and recession). To counter the problem of too little private spending, *government* spending must rise.

This Keynesian view picked up many followers and by the 1950s it was the mainstream, but it lost popularity during the inflationary 1970s when it seemed ever more remote from the problems of that decade. The global recession of 2008–2009 and the fear of another great depression revived interest in Keynesian ideas and brought a new wave of attacks on classical macroeconomics with Nobel Laureate Paul Krugman leading the charge in the columns of the *New York Times*.

Monetarist Macroeconomics

According to **monetarist macroeconomics**, the *classical* view of the world is broadly correct but in addition to fluctuations that arise from the normal functioning of an expanding economy, fluctuations in the quantity of money generate the business cycle. A slowdown in the growth rate of money brings recession and a large decrease in the quantity of money brought the Great Depression.

Milton Friedman, intellectual leader of the Chicago School of economists during the 1960s and 1970s, was the most prominent monetarist. The view that monetary contractions are the sole source of recessions and depressions is held by few economists today. But the view that the quantity of money plays a role in economic fluctuations is accepted by all economists and is part of today's consensus.

Monetarist macroeconomics

The view that the market economy works well, that aggregate fluctuations are a natural consequence of an expanding economy, but that fluctuations in the quantity of money generate the business cycle.

■ Today's Consensus

Each of the earlier schools provides insights and ingredients that survive in today's consensus. *Classical* macroeconomics provides the story of the economy at or close to full employment. But the classical approach doesn't explain how the economy performs in the face of a major slump in spending.

Keynesian macroeconomics takes up the story in a recession or depression. When spending is cut and the demand for most goods and services and the demand for labor all decrease, prices and wage rates don't fall but the quantity of goods and services sold and the quantity of labor employed do fall and the economy goes into recession. In a recession, an increase in spending by governments, or a tax cut that leaves people with more of their earnings to spend, can help to restore full employment.

Monetarist macroeconomics elaborates the Keynesian story by emphasizing that a contraction in the quantity of money brings higher interest rates and borrowing costs, which are a major source of cuts in spending that bring recession. Increasing the quantity of money and lowering the interest rate in a recession can help to restore full employment. And keeping the quantity of money growing steadily in line with the expansion of the economy's production possibilities can help to keep inflation in check and can also help to moderate the severity of a recession.

Another component of today's consensus is the view that the *long-term* problem of economic growth is more important than the *short-term* problem of recessions. Take a look at *Eye on the U.S. Economy*, on p.446, and you will see why. Even a small slowdown in economic growth brings a huge cost in terms of a permanently lower level of income per person. This cost is much larger than that arising from the income lost during recessions. But the costs of recessions are serious because they are concentrated on those who are unemployed.

■ The Road Ahead

This book bases your tour of macroeconomics on the new consensus. We begin in this chapter and the two that follow by explaining what determines potential GDP and the pace at which it grows. We then study money and explain what brings inflation. Finally, we explain how real and monetary forces interact to bring about the business cycle. We also explain the policy tools available to governments and central banks to improve macroeconomic performance.



EYE on the U.S. ECONOMY

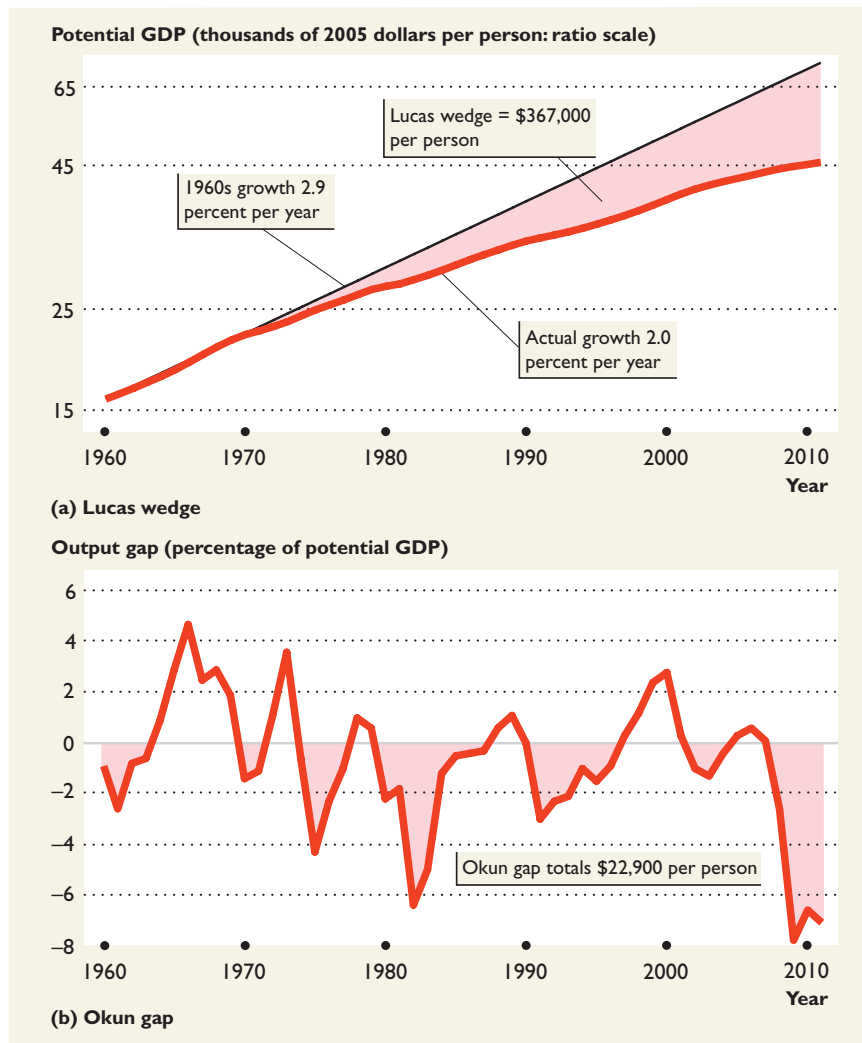
The Lucas Wedge and the Okun Gap

During the 1960s, U.S. real GDP per person grew at a rate of 2.9 percent a year. The black line in part (a) shows the path that would have been followed if this growth rate had been maintained. After 1970, growth slowed to 2.0 percent per year and the red line shows the path that potential GDP followed. University of Chicago economist Robert E. Lucas, Jr. pointed out the large output loss that resulted from this growth slowdown. Part (a) shows this loss as the *Lucas wedge*, which is equivalent to a staggering \$367,000 per person or more than 8 years' income.

Real GDP fluctuates around potential GDP and when the output gap is negative, output is lost. Brookings Institution economist Arthur B. Okun drew attention to this loss. Part (b) shows this loss as the *Okun gap*, which is equivalent to \$22,900 per person or about 6 months' income.

Smoothing the business cycle and eliminating the Okun gap has a big payoff. But finding ways of restoring real GDP growth to its 1960s rate has a vastly bigger payoff.

SOURCES OF DATA: Bureau of Economic Analysis and the Congressional Budget Office.



17.1 POTENTIAL GDP

Potential GDP is the value of real GDP when all the economy's factors of production—labor, capital, land, and entrepreneurial ability—are fully employed. It is vital to understand the forces that determine potential GDP for three reasons. First, when the economy is *at* full employment, real GDP equals potential GDP; so actual real GDP is determined by the same factors that determine potential GDP. Second, real GDP can exceed potential GDP only temporarily as it approaches and then recedes from a business cycle peak. So potential GDP is the *sustainable* upper limit of production. Third, real GDP fluctuates around potential GDP, which means that on the average over the business cycle, real GDP equals potential GDP.

We produce the goods and services that make up real GDP by using the *factors of production*: labor and human capital, physical capital, land (and natural resources), and entrepreneurship. At any given time, the quantities of capital, land, and entrepreneurship and the state of technology are fixed. But the quantity of labor is not fixed. It depends on the choices that people make about the allocation of time between work and leisure. So with fixed quantities of capital, land, and entrepreneurship and fixed technology, real GDP depends on the quantity of labor employed. To describe this relationship between real GDP and the quantity of labor employed, we use a relationship that is similar to the production possibilities frontier, which is called the production function.

Potential GDP

The value of real GDP when all the economy's factors of production—labor, capital, land, and entrepreneurial ability—are fully employed.



EYE on the GLOBAL ECONOMY

Potential GDP in the United States and European Union

In 2010, real GDP in the United States was \$59 per hour worked. In 14 major European economies, real GDP averaged only \$52 per hour worked—a gap of 13 percent. (Both numbers are measured in 2010 U.S. dollars.) Part (a) of the figure shows this difference.

Not only do Americans produce more per hour than Europeans, they work longer hours too. In 2010, Americans worked an average of 34 hours per week while Europeans worked only an average of 30 hours per week—a difference of more than 13 percent. Part (b) of the figure shows this difference.

Europeans achieve their shorter work hours by taking longer vacations

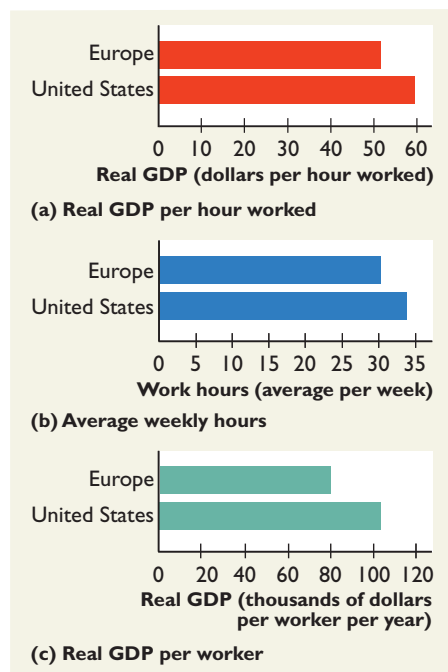
and having more sick days than Americans.

The combination of greater production per hour and longer work hours translates into a substantially larger real GDP per worker in the United States than in Europe.

In 2010, real GDP per worker in the United States was \$103,000 while in Europe it was only \$80,000—a gap of more than 20 percent.

This chapter enables you to understand the sources of these differences in wage rates, work hours, and production.

SOURCE OF DATA: Bureau of Labor Statistics.



The Production Function

Production function

A relationship that shows the maximum quantity of real GDP that can be produced as the quantity of labor employed changes and all other influences on production remain the same.

Diminishing returns

The tendency for each additional hour of labor employed to produce a successively smaller additional amount of real GDP.

The **production function** is a relationship that shows the maximum quantity of real GDP that can be produced as the quantity of labor employed changes and all other influences on production remain the same. Figure 17.1 shows a production function, which is the curve labeled *PF*.

In Figure 17.1, 100 billion labor hours can produce a real GDP of \$9 trillion (at point *A*); 200 billion hours can produce a real GDP of \$13 trillion (at point *B*); and 300 billion hours can produce a real GDP of \$16 trillion (at point *C*).

The production function shares a feature of the *production possibilities frontier* that you studied in Chapter 3 (p. 60). Like the *PPF*, the production function is a boundary between the attainable and the unattainable. It is possible to produce at any point along the production function and beneath it in the shaded area. But it is not possible to produce at points above the production function. Those points are unattainable.

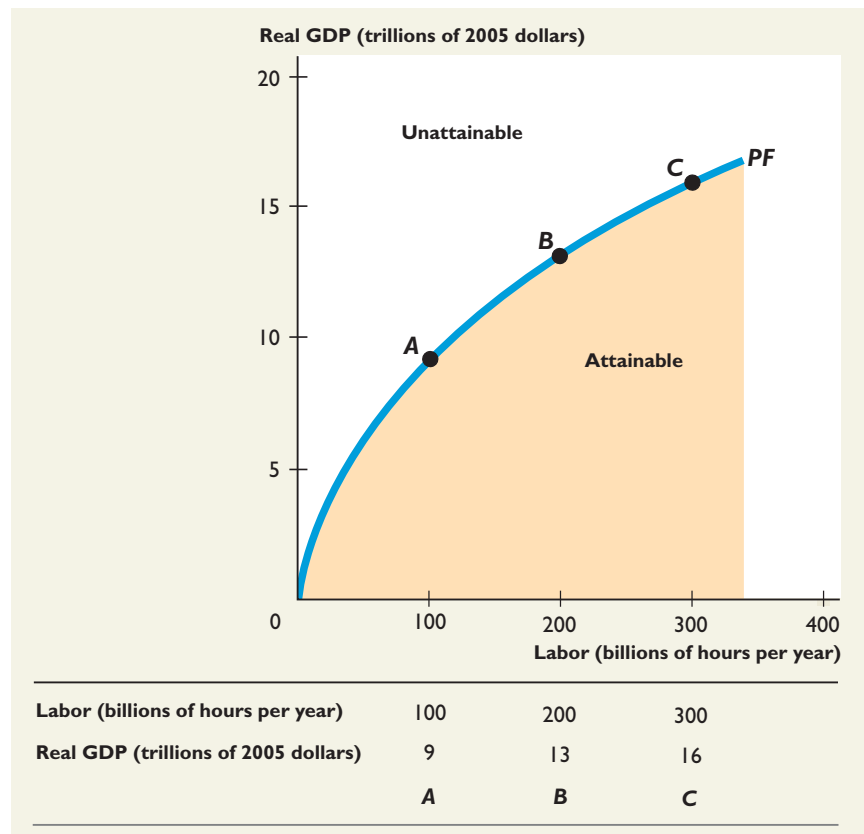
The production function displays **diminishing returns**—each additional hour of labor employed produces a successively smaller additional amount of real GDP. The first 100 billion hours of labor produces \$9 trillion of real GDP. The second 100 billion hours of labor increases real GDP from \$9 trillion to \$13 trillion, so the sec-

FIGURE 17.1
The Production Function

MyEconLab Animation

The production function shows the maximum quantity of real GDP that can be produced as the quantity of labor employed changes and all other influences on production remain the same. In this example, 100 billion hours of labor can produce \$9 trillion of real GDP at point *A*, 200 billion hours of labor can produce \$13 trillion of real GDP at point *B*, and 300 billion hours of labor can produce \$16 trillion of real GDP at point *C*.

The production function separates attainable combinations of labor hours and real GDP from unattainable combinations and displays diminishing returns: Each additional hour of labor produces a successively smaller additional amount of real GDP.



and 100 billion hours produces only an additional \$4 trillion of real GDP. The third 100 billion hours of labor increases real GDP from \$13 trillion to \$16 trillion, so the third 100 billion hours produces only an additional \$3 trillion of real GDP.

Diminishing returns arise because the quantity of capital (and other factors of production) is fixed. As more labor is hired, the additional output produced decreases because the extra workers have less capital with which to work. For example, a forest service has three chain saws and an axe and hires three workers to clear roads and trails of fallen trees and debris during the spring thaw. Hiring a fourth worker will contribute less to the amount cleared than the amount that the third worker added, and hiring a fifth worker will add even less.

Because real GDP depends on the quantity of labor employed, potential GDP depends on the production function and the quantity of labor employed. To find potential GDP, we must understand what determines the quantity of labor employed.

■ The Labor Market

You've already studied the tool that we use to determine the quantity of labor employed: demand and supply. In macroeconomics, we apply the concepts of demand, supply, and market equilibrium to the economy-wide labor market.

The quantity of labor employed depends on firms' decisions about how much labor to hire (the demand for labor). It also depends on households' decisions about how to allocate time between employment and other activities (the supply of labor). And it depends on how the labor market coordinates the decisions of firms and households (labor market equilibrium). So we will study

- The demand for labor
- The supply of labor
- Labor market equilibrium

The Demand for Labor

The **quantity of labor demanded** is the total labor hours that all the firms in the economy plan to hire during a given time period at a given real wage rate. The **demand for labor** is the relationship between the quantity of labor demanded and the real wage rate when all other influences on firms' hiring plans remain the same. The lower the real wage rate, the greater is the quantity of labor demanded.

The real wage rate is the *nominal wage rate* (the dollars per hour that people earn on average) divided by the price level (see Chapter 16, p. 434). We express the real wage rate in constant dollars—today in 2005 dollars. Think of the real wage rate as the quantity of real GDP that an hour of labor earns.

The lower the real wage rate, the greater is the quantity of labor that firms find it profitable to hire. The real wage rate influences the quantity of labor demanded because what matters to firms is not the number of dollars they pay for an hour of labor (the nominal wage rate) but how much output they must sell to earn those dollars. So firms compare the extra output that an hour of labor can produce with the real wage rate.

If an additional hour of labor produces at least as much additional output as the real wage rate, a firm hires that labor. At a small quantity of labor, an extra hour of labor produces more output than the real wage rate. But each additional hour of labor produces less additional output than the previous hour. As a firm hires more labor, eventually the extra output from an extra hour of labor equals the real wage rate. This equality determines the quantity of labor demanded at the real wage rate.

Quantity of labor demanded

The total labor hours that all the firms in the economy plan to hire during a given time period at a given real wage rate.

Demand for labor

The relationship between the quantity of labor demanded and the real wage rate when all other influences on firms' hiring plans remain the same.

The Demand for Labor in a Soda Factory You might understand the demand for labor better by thinking about a single firm rather than the economy as a whole. Suppose that the money wage rate is \$15 an hour and that the price of a bottle of soda is \$1.50. For the soda factory, the real wage rate is a number of bottles of soda. To find the soda factory's real wage rate, divide the money wage rate by the price of its output—\$15 an hour \div \$1.50 a bottle. The real wage rate is 10 bottles of soda an hour. It costs the soda factory 10 bottles of soda to hire an hour of labor. As long as the soda factory can hire labor that produces more than 10 additional bottles of soda an hour, it is profitable to hire more labor. Only when the extra output produced by an extra hour of labor falls to 10 bottles an hour has the factory reached the profit-maximizing quantity of labor.

Labor Demand Schedule and Labor Demand Curve We can represent the demand for labor as either a demand schedule or a demand curve. The table in Figure 17.2 shows part of a demand for labor schedule. It tells us the quantity of labor demanded at three different real wage rates. For example, if the real wage rate is \$50 an hour (row *B*), the quantity of labor demanded is 200 billion hours a year. If the real wage rate rises to \$80 an hour (row *A*), the quantity of labor demanded decreases to 100 billion hours a year. And if the real wage rate falls to \$25 an hour (row *C*), the quantity of labor demanded increases to 300 billion hours a year.

Figure 17.2 shows the demand for labor curve. Points *A*, *B*, and *C* on the demand curve correspond to rows *A*, *B*, and *C* of the demand schedule.

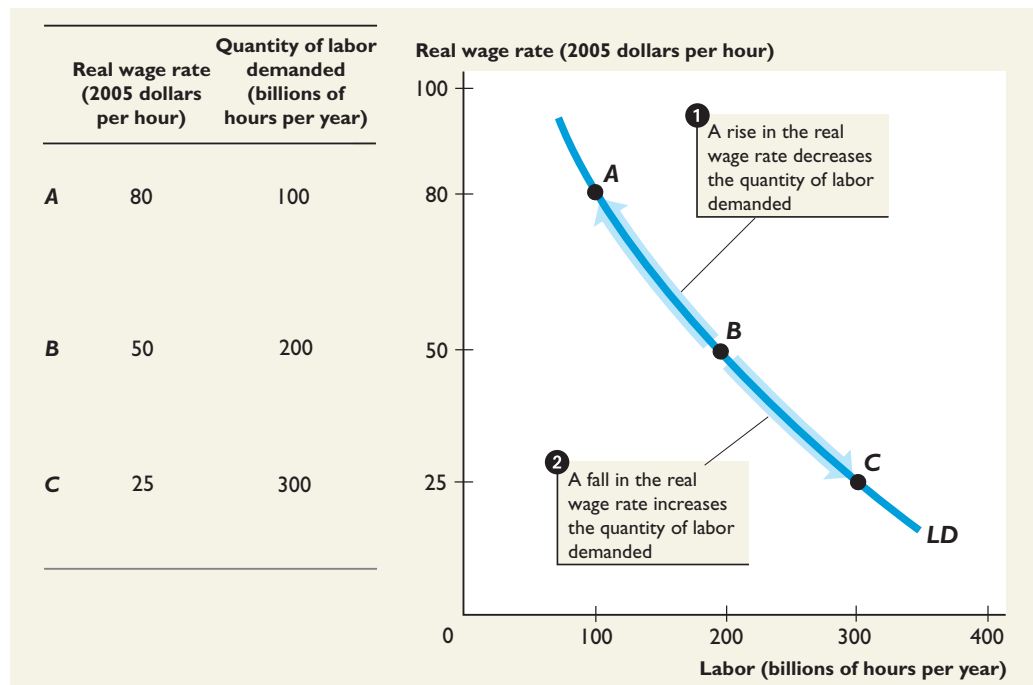
FIGURE 17.2
The Demand for Labor

MyEconLab Animation

Firms are willing to hire labor only if the labor produces more than its real wage rate. So the lower the real wage rate, the more labor firms can profitably hire and the greater is the quantity of labor demanded.

At a real wage rate of \$50 an hour, the quantity of labor demanded is 200 billion hours at point *B*.

- 1 If the real wage rate rises to \$80 an hour, the quantity of labor demanded decreases to 100 billion hours at point *A*.
- 2 If the real wage rate falls to \$25 an hour, the quantity of labor demanded increases to 300 billion hours at point *C*.



The Supply of Labor

The **quantity of labor supplied** is the number of labor hours that all the households in the economy plan to work during a given time period at a given real wage rate. The **supply of labor** is the relationship between the quantity of labor supplied and the real wage rate when all other influences on work plans remain the same.

We can represent the supply of labor as either a supply schedule or a supply curve. The table in Figure 17.3 shows a supply of labor schedule. It tells us the quantity of labor supplied at three different real wage rates. For example, if the real wage rate is \$50 an hour (row *B*), the quantity of labor supplied is 200 billion hours a year. If the real wage rate falls to \$25 an hour (row *A*), the quantity of labor supplied decreases to 100 billion hours a year. And if the real wage rate rises to \$75 an hour (row *C*), the quantity of labor supplied increases to 300 billion hours a year.

Figure 17.3 shows the supply of labor curve. It corresponds to the supply schedule, and the points *A*, *B*, and *C* on the supply curve correspond to the rows *A*, *B*, and *C* of the supply schedule.

The real wage rate influences the quantity of labor supplied because what matters to people is not the number of dollars they earn but what those dollars will buy.

The quantity of labor supplied increases as the real wage rate increases for two reasons:

- Hours per person increase.
- Labor force participation increases.

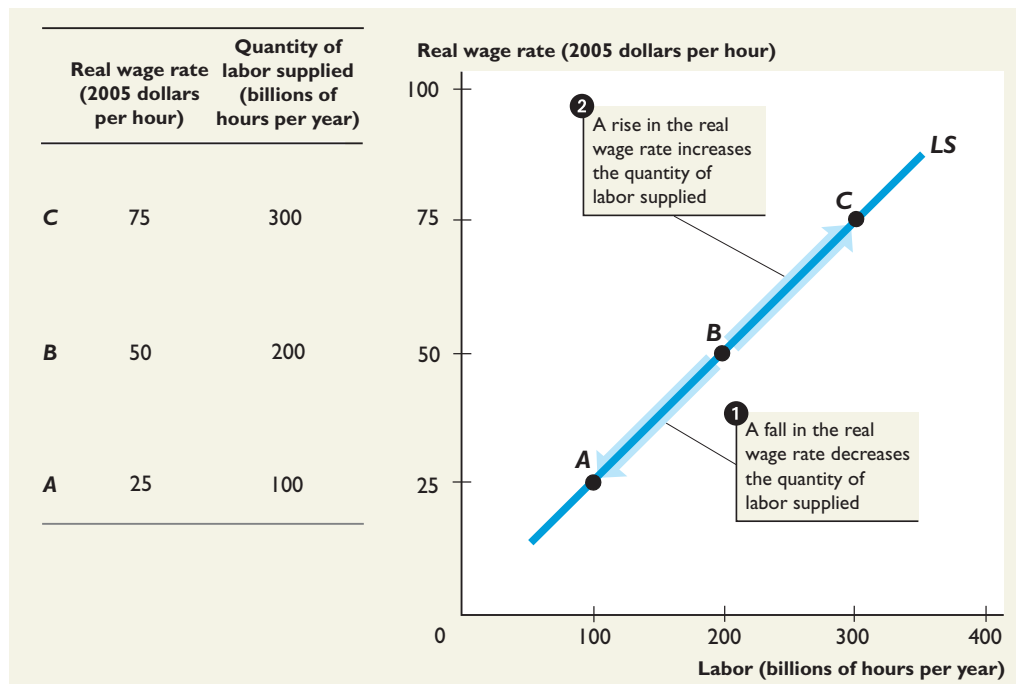
Quantity of labor supplied

The number of labor hours that all the households in the economy plan to work during a given time period at a given real wage rate.

Supply of labor

The relationship between the quantity of labor supplied and the real wage rate when all other influences on work plans remain the same.

FIGURE 17.3
The Supply of Labor



MyEconLab Animation

Households are willing to supply labor only if the real wage rate is high enough to attract them from other activities. The higher the real wage rate, the greater is the quantity of labor supplied.

At a real wage rate of \$50 an hour, the quantity of labor supplied is 200 billion hours at point *B*.

- 1 If the real wage rate falls to \$25 an hour, the quantity of labor supplied decreases to 100 billion hours at point *A*.
- 2 If the real wage rate rises to \$75 an hour, the quantity of labor supplied increases to 300 billion hours at point *C*.

Hours per Person The real wage rate is the opportunity cost of taking leisure and not working. As the opportunity cost of taking leisure rises, other things remaining the same, households choose to work more. But other things don't remain the same. A higher real wage rate brings a higher income, which increases the demand for leisure and encourages less work.

So a rise in the real wage rate has two opposing effects. But for most households, the opportunity cost effect is stronger than the income effect, so a rise in the real wage rate brings an increase in the quantity of labor supplied.

Labor Force Participation Most people have productive opportunities outside the labor force and choose to work only if the real wage rate exceeds the value of other productive activities. For example, a parent might spend time caring for her or his child. The alternative is day care. The parent will choose to work only if he or she can earn enough per hour to pay the cost of day care and have enough left to make the work effort worthwhile. The higher the real wage rate, the more likely it is that a parent will choose to work and so the greater is the labor force participation rate.

Other Influences on Labor Supply Decisions Many factors other than the real wage rate influence labor supply decisions and influence the position of the labor supply curve. Income taxes and unemployment benefits are two of these factors.

The work-leisure decision depends on the *after-tax* wage rate—the wage rate actually received by the household. So, for a given wage rate, the income tax decreases the after-tax wage rate and the quantity of labor supplied decreases. The result is a decrease in the supply of labor. (The income tax rate doesn't change the demand for labor because for the employer, the cost of labor is the before-tax wage rate.)

Unemployment benefits lower the cost of searching for a job and encourage unemployed workers to take longer to find the best job available. The result is a decrease in the supply of labor.

Higher income tax rates and more generous unemployment benefits decrease the supply of labor—the labor supply curve lies farther to the left.

Let's now see how the labor market determines employment, the real wage rate, and potential GDP.

Labor Market Equilibrium

The forces of supply and demand operate in labor markets just as they do in the markets for goods and services. The price of labor services is the real wage rate. A rise in the real wage rate eliminates a shortage of labor by decreasing the quantity demanded and increasing the quantity supplied. A fall in the real wage rate eliminates a surplus of labor by increasing the quantity demanded and decreasing the quantity supplied. If there is neither a shortage nor a surplus, the labor market is in equilibrium.

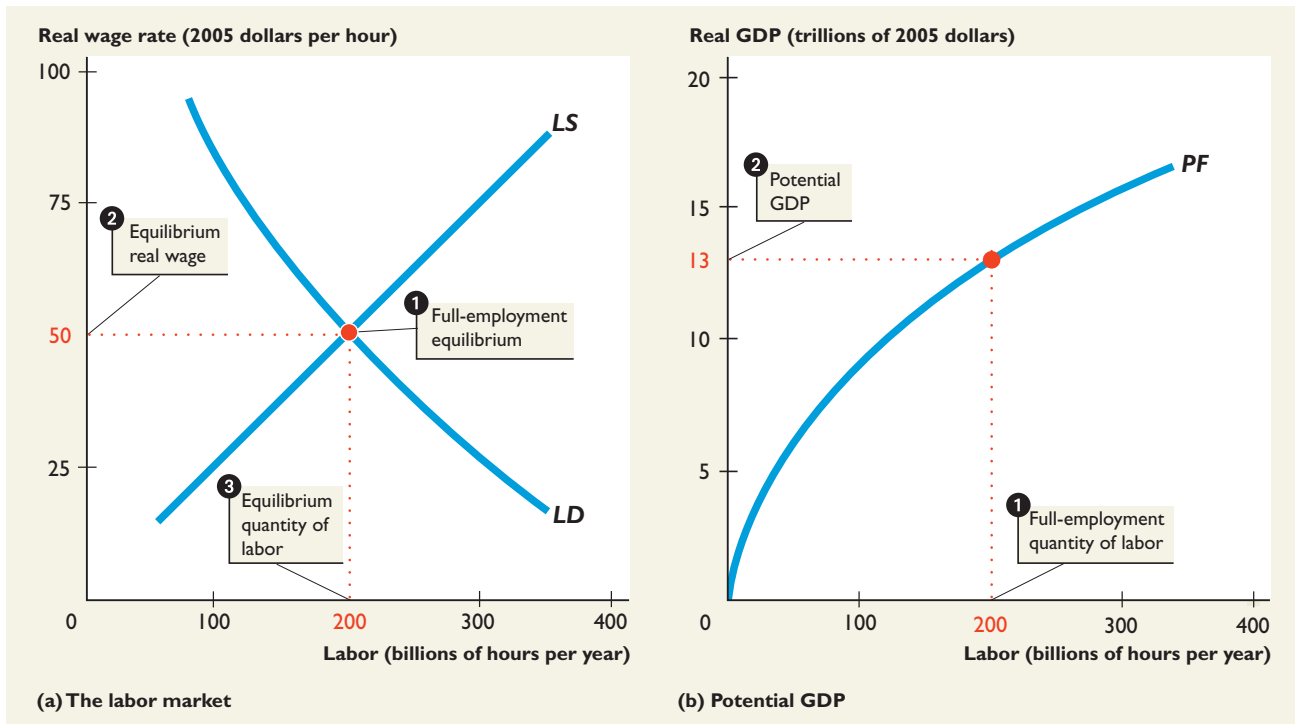
Figure 17.4(a) shows the labor market equilibrium. The demand curve and the supply curve are the same as those in Figures 17.2 and 17.3. In part (a), if the real wage rate is less than \$50 an hour, the quantity of labor demanded exceeds the quantity supplied and there is a shortage of labor. In this situation, the real wage rate rises.

If the real wage rate exceeds \$50 an hour, the quantity of labor supplied exceeds the quantity demanded and there is a surplus of labor. In this situation, the real wage rate falls.

If the real wage rate is \$50 an hour, the quantity of labor demanded equals the quantity supplied and there is neither a shortage nor a surplus of labor. In this

FIGURE 17.4
Labor Market Equilibrium and Potential GDP

MyEconLab Animation



1 Full employment occurs when the quantity of labor demanded equals the quantity of labor supplied. 2 The equilibrium real wage rate is \$50 an hour, and 3 the equilibrium quantity of labor employed is 200 billion hours a year.

Potential GDP is the real GDP produced on the production function by the full-employment quantity of labor. 1 The full-employment quantity of labor, 200 billion hours a year, produces a 2 potential GDP of \$13 trillion.

situation, the labor market is in equilibrium and the real wage rate remains constant. The equilibrium quantity of labor is 200 billion hours a year. When the equilibrium quantity of labor is employed, the economy is at full employment. So the full-employment quantity of labor is 200 billion hours a year.

Full Employment and Potential GDP

When the labor market is in equilibrium, the economy is at full employment and real GDP equals potential GDP.

You've seen that the quantity of real GDP depends on the quantity of labor employed. The production function tells us how much real GDP a given amount of employment can produce. Now that we've determined the full-employment quantity of labor, we can find potential GDP.

Figure 17.4(b) shows the relationship between labor market equilibrium and potential GDP. The equilibrium quantity of labor employed in Figure 17.4(a) is 200 billion hours. The production function in Figure 17.4(b) tells us that 200 billion hours of labor produces \$13 trillion of real GDP. This quantity of real GDP is potential GDP.



EYE on U.S. POTENTIAL GDP

Why Do Americans Earn More and Produce More Than Europeans?

The quantity of capital per worker is greater in the United States than in Europe, and U.S. technology, on the average, is more productive than European technology.

These differences between the United States and Europe mean that U.S. labor is more productive than European labor.

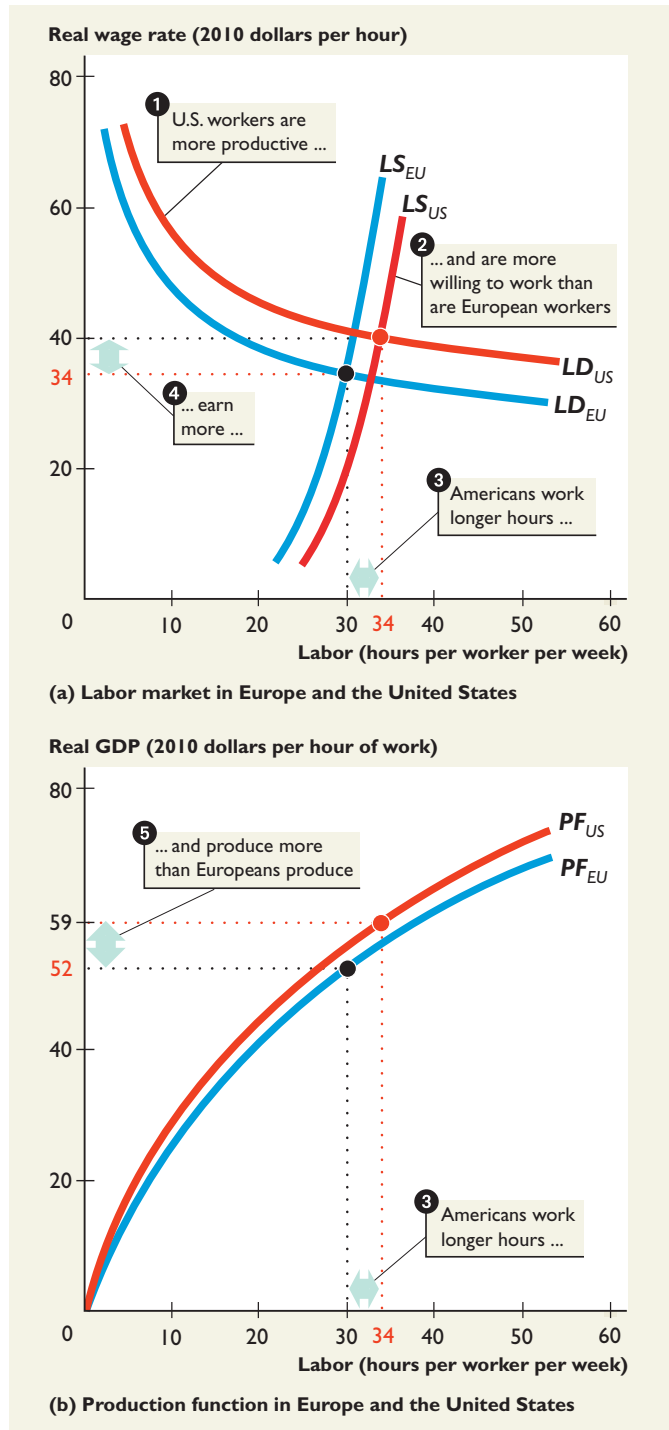
Because U.S. labor is more productive than European labor, U.S. employers are willing to pay more for a given quantity of labor than European employers are. So the demand for labor curve in the United States, LD_{US} lies to the right of the European demand for labor curve, LD_{EU} in part (a) of the figure.

This difference in the productivity of labor also means that the U.S. production function, PF_{US} lies above the European production function, PF_{EU} in part (b) of the figure.

Higher income taxes and unemployment benefits in Europe mean that to induce a person to take a job, a firm in Europe must offer a higher wage rate than a firm in the United States has to offer. So the European labor supply curve, LS_{US} lies to the left of the U.S. labor supply curve, LS_{EU} .

Equilibrium employment is higher in the United States than in Europe—Americans work longer hours—and the equilibrium real wage rate is higher in the United States than in Europe.

Potential GDP is higher in the United States than in Europe for two reasons: U.S. workers are more productive per hour of work and they work longer hours than Europeans.



CHECKPOINT 17.1

Explain what determines potential GDP.

Practice Problem

- Table 1 describes an economy's production function and demand for labor.

TABLE 1

| | | | | | |
|---|----|----|----|----|-----|
| Quantity of labor demanded (billions of hours per year) | 0 | 1 | 2 | 3 | 4 |
| Real GDP (billions of 2005 dollars) | 0 | 40 | 70 | 90 | 100 |
| Real wage rate (2005 dollars per hour) | 50 | 40 | 30 | 20 | 10 |

Table 2 describes the supply of labor in this economy.

TABLE 2

| | | | | | |
|---|----|----|----|----|----|
| Quantity of labor supplied (billions of hours per year) | 0 | 1 | 2 | 3 | 4 |
| Real wage rate (2005 dollars per hour) | 10 | 20 | 30 | 40 | 50 |

Use the data in Tables 1 and 2 to make graphs of the labor market and production function. What are the equilibrium real wage rate and employment? What is potential GDP?

In the News

Chevron signs \$73b gas deal

Gorgon, Chevron's huge liquefied natural gas project, is finally going forward. The company, along with Exxon Mobil and Shell, will produce natural gas off the northwest coast of Australia. Gorgon and surrounding fields hold an estimated 40 trillion cubic feet of natural gas, the equivalent of 6.7 billion barrels of oil. Gorgon is located for easy shipment to Asia and will employ 10,000 workers.

Source: Radio Australia, September 10, 2009

Explain how this huge project will influence Australia's potential GDP and U.S. potential GDP.

Solution to Practice Problem

- The demand for labor is a graph of the first and last row of Table 1 and the supply of labor is a graph of the data in Table 2 (Figure 1). The production function is a graph of the first two rows of Table 1 (Figure 2).

Labor market equilibrium occurs when the real wage rate is \$30 an hour and 2 billion hours of labor are employed (Figure 1). Potential GDP is the real GDP produced by the equilibrium quantity of labor (2 billion hours in Figure 1). Potential GDP is \$70 billion (Figure 2).

Solution to In the News

Australia's potential GDP will increase, but U.S. potential GDP will not change. Accessing these new resources will shift Australia's production function upward. With no change in employment, real GDP would increase. But the project will increase the demand for labor, increase the full-employment quantity of labor, and increase potential GDP. Even though this project is undertaken by U.S. firms, the production takes place in Australia. Neither the U.S. production function nor the U.S. demand for labor changes, so the project has no effect on U.S. potential GDP.

MyEconLab

You can work these problems in Study Plan 17.1 and get instant feedback.

FIGURE 1

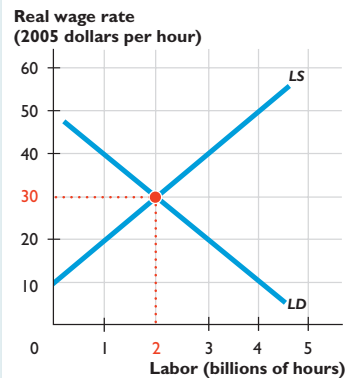
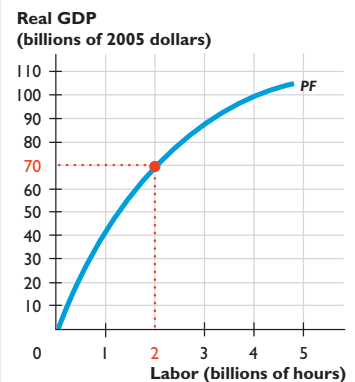


FIGURE 2



17.2 THE BASICS OF ECONOMIC GROWTH

Economic growth

A sustained expansion of production possibilities.

Economic growth is a sustained expansion of production possibilities. Maintained over decades, rapid economic growth can transform a poor nation into a rich one. Such has been the experience of Hong Kong, South Korea, Taiwan, and some other Asian economies. Slow economic growth or the absence of growth can condemn a nation to devastating poverty. Such has been the fate of Sierra Leone, Somalia, Zambia, and much of the rest of Africa.

Economic growth is different from the rise in incomes that occurs during the recovery from a recession. Economic growth is a sustained trend, not a temporary cyclical expansion.

Calculating Growth Rates

We express the **economic growth rate** as the annual percentage change of real GDP. To calculate this growth rate, we use the formula:

$$\text{Growth rate of real GDP} = \frac{\text{Real GDP in current year} - \text{Real GDP in previous year}}{\text{Real GDP in previous year}} \times 100.$$

For example, if real GDP in the current year is \$8.4 trillion and if real GDP in the previous year was \$8.0 trillion, then

$$\text{Growth rate of real GDP} = \frac{\$8.4 \text{ trillion} - \$8.0 \text{ trillion}}{\$8.0 \text{ trillion}} \times 100 = 5 \text{ percent.}$$

The growth rate of real GDP tells us how rapidly the total economy is expanding. This measure is useful for telling us about potential changes in the balance of economic power among nations, but it does not tell us about changes in the standard of living.

The standard of living depends on **real GDP per person** (also called *per capita real GDP*), which is real GDP divided by the population. So the contribution of real GDP growth to the change in the *standard of living* depends on the growth rate of real GDP per person. We use the above formula to calculate this growth rate, replacing real GDP with real GDP per person.

Suppose, for example, that in the current year, when real GDP is \$8.4 trillion, the population is 202 million. Then real GDP per person in the current year is \$8.4 trillion divided by 202 million, which equals \$41,584. And suppose that in the previous year, when real GDP was \$8.0 trillion, the population was 200 million. Then real GDP per person in that year was \$8.0 trillion divided by 200 million, which equals \$40,000.

Use these two values of real GDP per person with the growth formula to calculate the growth rate of real GDP per person. That is,

$$\text{Growth rate of real GDP per person} = \frac{\$41,584 - \$40,000}{\$40,000} \times 100 = 4 \text{ percent.}$$

Economic growth rate

The annual percentage change of real GDP.

Real GDP per person

Real GDP divided by the population.

We can also calculate the growth rate of real GDP per person by using the formula:

$$\text{Growth rate of real GDP per person} = \text{Growth rate of real GDP} - \text{Growth rate of population.}$$

In the example you've just worked through, the growth rate of real GDP is 5 percent. The population changes from 200 million to 202 million, so

$$\text{Growth rate of population} = \frac{202 \text{ million} - 200 \text{ million}}{200 \text{ million}} \times 100 = 1 \text{ percent}$$

and

$$\text{Growth rate of real GDP per person} = 5 \text{ percent} - 1 \text{ percent} = 4 \text{ percent.}$$

This formula makes it clear that real GDP per person grows only if real GDP grows faster than the population grows. If the growth rate of the population exceeds the growth of real GDP, then real GDP per person falls.

■ The Magic of Sustained Growth

Sustained growth of real GDP per person can transform a poor society into a wealthy one. The reason is that economic growth is like compound interest. Suppose that you put \$100 in the bank and earn 5 percent a year interest on it. After one year, you have \$105. If you leave that money in the bank for another year, you earn 5 percent interest on the original \$100 and on the \$5 interest that you earned last year. You are now earning interest on interest! The next year, things get even better. Then you earn 5 percent on the original \$100 and on the interest earned in the first year and the second year. Your money in the bank is *growing* at a rate of 5 percent a year. Before too many years have passed, you'll have \$200 in the bank. But after *how many* years?

The answer is provided by a formula known as the **Rule of 70**, which states that the number of years it takes for the level of any variable to double is approximately 70 divided by the annual percentage growth rate of the variable. Using the Rule of 70, you can now calculate how many years it takes your \$100 to become \$200. It is 70 divided by 5, which is 14 years.

The Rule of 70 applies to any variable, so it applies to real GDP per person. Table 17.1 shows the doubling time for a selection of other growth rates. You can see that real GDP per person doubles in 70 years (70 divided by 1)—an average human life span—if the growth rate is 1 percent a year. It doubles in 35 years if the growth rate is 2 percent a year and in just 10 years if the growth rate is 7 percent a year.

We can use the Rule of 70 to answer other questions about economic growth. For example, in 2010, U.S. real GDP per person was approximately 4 times that of China. China's recent growth rate of real GDP per person was 7 percent a year. If this growth rate were to be maintained, how long would it take China's real GDP per person to reach that of the United States in 2010?

The answer, provided by the Rule of 70, is 20 years. China's real GDP per person doubles in 10 (70 divided by 7) years. It doubles again to 4 times its current level in another 10 years. So after 20 years of growth at 7 percent a year—that is by 2030—China's real GDP per person would be 4 times its current level and equal to that of the United States in 2010.

Rule of 70

The number of years it takes for the level of any variable to double is approximately 70 divided by the annual percentage growth rate of the variable.

TABLE 17.1 GROWTH RATES

| Growth rate (percent per year) | Years for level to double |
|--------------------------------------|---------------------------------|
| 1 | 70 |
| 2 | 35 |
| 3 | 23 |
| 4 | 18 |
| 5 | 14 |
| 6 | 12 |
| 7 | 10 |
| 8 | 9 |
| 9 | 8 |
| 10 | 7 |



EYE on the GLOBAL ECONOMY

Why Are Some Nations Rich and Others Poor?

Political stability, property rights protected by the rule of law, and limited government intervention in markets: These are key features of the economies that enjoy high or rapidly rising incomes and they are the features missing in economies that remain poor. All the rich nations have possessed these growth-inducing characteristics for the many decades during which their labor productivity and standard of living have been rising.

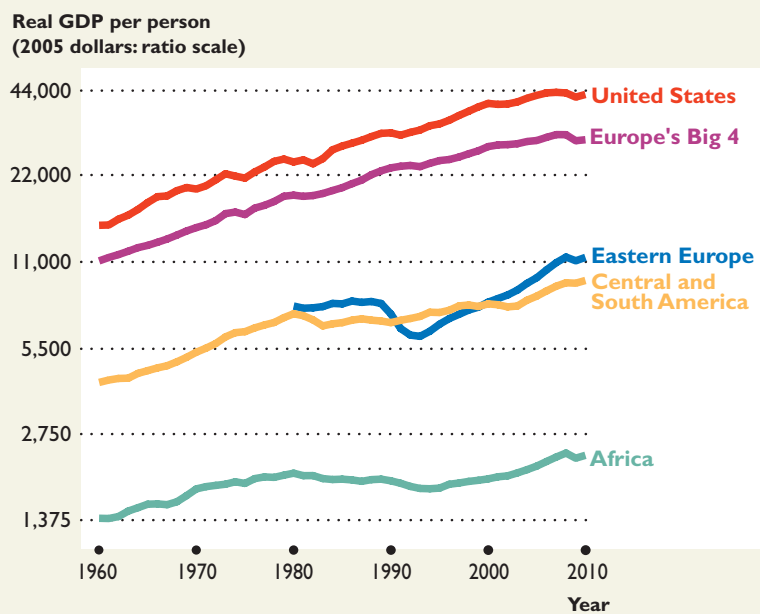
The United States started to grow rapidly 150 years ago and overtook Europe in the early 20th century. In the past 50 years, the gaps between these countries haven't changed much. See part (a) of the figure.

In a transition from Communism to a market economy, Eastern Europe is now growing faster.

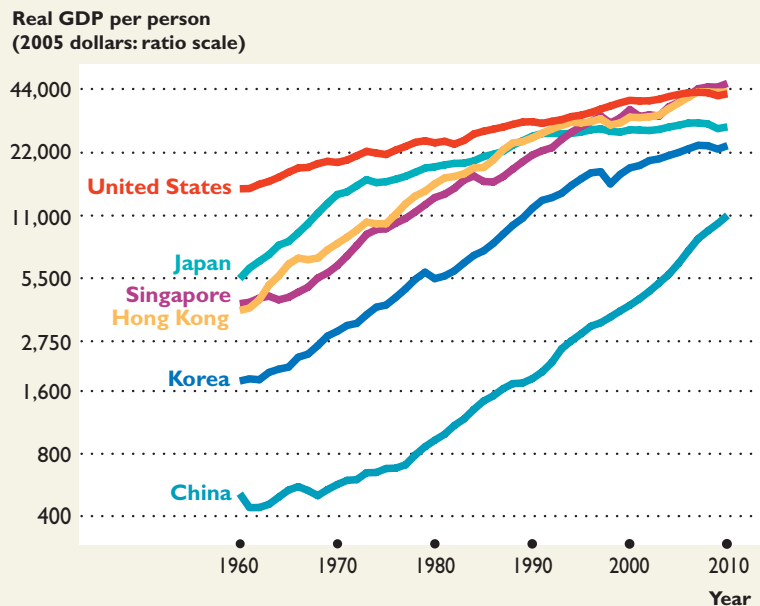
Tribal conflict in Africa and bureaucratic overload in Central and South America have kept growth slow and the gap between the United States and these regions has widened.

Real GDP per person in East Asian economies, in part (b), has converged toward that in the United States. These economies are like fast trains running on the same track at similar speeds with roughly constant gaps between them. Hong Kong and Singapore are the lead trains and run about 15 years in front of Taiwan, 20 years in front of South Korea, and almost 40 years in front of China.

Between 1960 and 2010, Hong Kong and Singapore transformed themselves from poor developing economies to take their places among the world's richest economies.



(a) Persistent gaps



(b) Convergence

SOURCE OF DATA: International Monetary Fund, *World Economic Outlook Database*.

CHECKPOINT 17.2

Define and calculate the economic growth rate, and explain the implications of sustained growth.

MyEconLab

You can work these problems in Study Plan 17.2 and get instant feedback.

Practice Problems

1. Mexico's real GDP was 8,762 billion pesos in 2010 and 9,105 billion pesos in 2011. Mexico's population growth rate in 2011 was 1 percent. Calculate Mexico's economic growth rate in 2011 and the growth rate of real GDP per person in Mexico in 2011.
2. Calculate the approximate number of years it will take for real GDP per person to double if an economy maintains an economic growth rate of 12 percent a year and a population growth rate of 2 percent a year.
3. Calculate the change in the number of years it will take for real GDP per person in India to double if the growth rate of real GDP per person increases from 8 percent a year to 10 percent a year.

In the News

ADB reduces China growth estimate

Since 1980 China's real GDP per person has grown at 10 percent a year. The Asian Development Bank (ADB) cut its estimate for China's growth to 9.3 percent this year.

Source: Bloomberg, September 13, 2011

If China's growth rate remains at 9.3 percent a year, how many additional years will it take for China to double its real GDP per person?

Solutions to Practice Problems

1. Mexico's economic growth rate in 2011 was 3.9 percent. The economic growth rate equals the percentage change in real GDP:

$$[(\text{Real GDP in 2011} - \text{Real GDP in 2010}) \div \text{Real GDP in 2010}] \times 100$$
 which is $[(9,105 \text{ billion} - 8,762 \text{ billion}) \div 8,762 \text{ billion}] \times 100$, or 3.9 percent.
 The growth rate of real GDP per person equals 2.9 percent.

$$\text{Growth rate of real GDP per person} = (\text{Growth rate of real GDP} - \text{Population growth rate})$$
 which is $(3.9 \text{ percent} - 1 \text{ percent})$, or 2.9 percent.
2. It will take 7 years for real GDP per person to double. The growth rate of real GDP per person equals the economic growth rate minus the population growth rate. Real GDP per person grows at 12 percent minus 2 percent, which is 10 percent a year. The Rule of 70 tells us that the level of a variable that grows at 10 percent a year will double in $70 \div 10$ years, or 7 years.
3. Two years. The Rule of 70 tells us that a variable that grows at 8 percent a year will double in $70 \div 8$ years, which is approximately 9 years. By increasing its growth rate to 10 percent a year, the variable will double in 7 years.

Solution to In the News

With a growth rate of 10 percent a year, real GDP per person will double in 7 years ($70 \div 10$). If the growth rate is maintained at 9.3 percent a year, real GDP per person will double in 7.5 years ($70 \div 9.3$)—taking an additional 0.5 year.

17.3 LABOR PRODUCTIVITY GROWTH

Real GDP grows when the quantities of the factors of production grow or when persistent advances in technology make them increasingly productive. To understand what determines the growth rate of real GDP, we must understand what determines the growth rates of the factors of production and the rate of increase in their productivity. You're going to see how saving and investment determine the growth rate of physical capital and how the growth of physical capital and human capital and advances in technology interact to determine the economic growth rate.

We are interested in real GDP growth because it contributes to improvements in our standard of living. But our standard of living improves only if we produce more goods and services with each hour of labor. So our main concern is to understand the forces that make our labor more productive. Let's start by defining labor productivity.

■ Labor Productivity

Labor productivity is the quantity of real GDP produced by one hour of labor. It is calculated by using the formula:

$$\text{Labor productivity} = \frac{\text{Real GDP}}{\text{Aggregate hours}} .$$

For example, if real GDP is \$8,000 billion and if aggregate hours are 200 billion, then we can calculate labor productivity as

$$\text{Labor productivity} = \frac{\$8,000 \text{ billion}}{200 \text{ billion hours}} = \$40 \text{ per hour} .$$

When labor productivity grows, real GDP per person grows. So the growth in labor productivity is the basis of the rising standard of living. What makes labor productivity grow? We'll answer this question by considering the influences on labor productivity growth under two broad headings:

- Saving and investment in physical capital
- Expansion of human capital and discovery of new technologies

These two broad influences on labor productivity growth interact and are the sources of the extraordinary growth in productivity during the past 200 years. Although they interact, we'll begin by looking at each on its own.

■ Saving and Investment in Physical Capital

Saving and investment in physical capital increase the amount of capital per worker and increase labor productivity. Labor productivity took a dramatic upturn when the amount of capital per worker increased during the Industrial Revolution. Production processes that use hand tools can create beautiful objects, but production methods that use large amounts of capital per worker, such as auto plant assembly lines, enable workers to be much more productive. The accumulation of capital on farms and building sites, in textile factories, iron foundries and steel mills, coal mines, chemical plants, and auto plants, and at banks and insurance companies added incredibly to the productivity of our labor.

Labor productivity

The quantity of real GDP produced by one hour of labor.

A strong and experienced farm worker of 1830, using a scythe, could harvest 3 acres of wheat a day. A farm worker of 1831, using a mechanical reaper, could harvest 15 acres a day. And a farm worker of today, using a combine harvester, can harvest and thresh hundreds of acres a day.

The next time you see a movie set in the old West, look carefully at how little capital there is. Try to imagine how productive you would be in such circumstances compared with your productivity today.

Capital Accumulation and Diminishing Marginal Returns

Although saving and investment in additional capital is a source of labor productivity growth, without the expansion of human capital and technological change, it would not bring sustained economic growth. Eventually growth would slow and most likely stop. The reason is a fundamental fact about capital known as the **law of diminishing marginal returns**, which states that:

If the quantity of capital is small, an increase in capital brings a large increase in production; and if the quantity of capital is large, an increase in capital brings a small increase in production.

This law applies to all factors of production, not only to capital, and is the reason why the demand for labor curve slopes downward (see pp. 449–450).

You can see why the law of diminishing marginal returns applies to capital by thinking about how your own productivity is influenced by the capital you own. When you got your first computer your small quantity of capital increased and your productivity increased enormously. You most likely don't have two computers, but if you do, the productivity boost from your second computer was much smaller than that from the first. If you don't have two computers, one of the reasons is that you doubt it would be worth the expense because it would contribute such a small amount to your labor productivity.

Law of diminishing marginal returns

If the quantity of capital is small, an increase in capital brings a large increase in production; and if the quantity of capital is large, an increase in capital brings a small increase in production.



Farm labor productivity increased from harvesting 3 acres per day in 1830 ...



to harvesting hundreds of acres per day in the twenty-first century.

Illustrating the Law of Diminishing Marginal Returns

Figure 17.5 illustrates the relationship between capital and productivity. The curve *PC* is a **productivity curve**, which shows how real GDP per hour of labor changes as the quantity of capital per hour of labor changes.

In Figure 17.5, when the quantity of capital (measured in real dollars) increases from \$40 to \$80 per hour of labor, real GDP per hour of labor increases from \$16 to \$20, a \$4 or 25 percent increase. But when the quantity of capital increases from \$180 to \$220 per hour of labor, the same \$40 increase as before, real GDP per hour of labor increases from \$26 to \$28, only a \$2 or 8 percent increase. If capital per hour of labor keeps increasing, labor productivity increases by ever smaller amounts and eventually stops rising.

■ Expansion of Human Capital and Discovery of New Technologies

The expansion of human capital and the discovery of new technologies have a profoundly different effect on labor productivity than capital accumulation has. They don't display diminishing marginal returns.

Expansion of Human Capital Human capital—the accumulated skill and knowledge of people—comes from three sources:

1. Education and training
2. Job experience
3. Health and diet

■ FIGURE 17.5

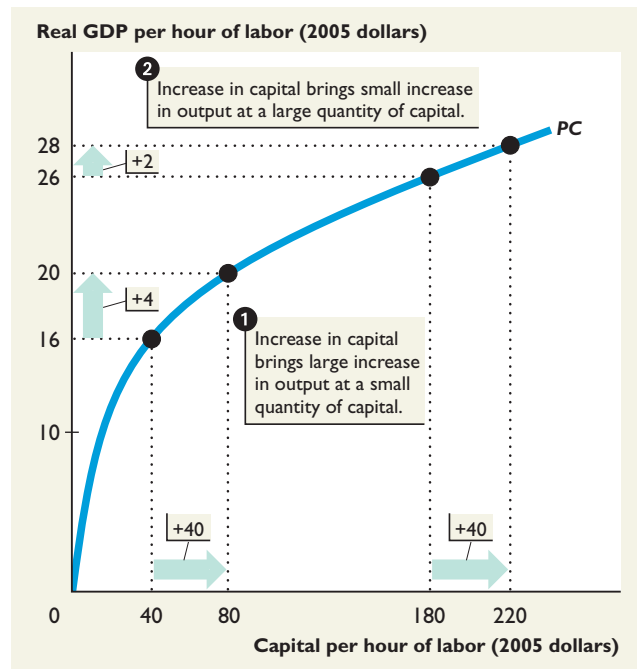
The Effects of an Increase in Capital

MyEconLab Animation

When workers are equipped with more capital, they become more productive. The productivity curve *PC* shows how an increase in capital per hour of labor increases real GDP per hour of labor.

- 1 When the quantity of capital per hour of labor increases from a low \$40 to \$80, real GDP per hour of labor increases by \$4.
- 2 When the quantity of capital per hour of labor increases from a high \$180 to \$220, real GDP per hour of labor increases by \$2.

An equal-size increase in capital per hour of labor brings a diminishing increase in output, the greater is the quantity of capital.



A hundred years ago, most people attended school for around eight years. A hundred years before that, most people had no formal education at all. Today, 90 percent of Americans complete high school and more than 60 percent go to college or university. Our ability to read, write, and communicate effectively contributes enormously to our productivity. And the education of thousands of scientists, engineers, mathematicians, biologists, computer programmers, and people equipped with a host of other specialist skills has made huge contributions to labor productivity and to the advance in technology.

While formal education is productive, school is not the only place where people acquire human capital. We also learn from on-the-job experience—from *learning by doing*. One carefully studied example illustrates the importance of learning by doing. Between 1941 and 1944 (during World War II), U.S. shipyards produced 2,500 Liberty Ships—cargo ships built to a standardized design. In 1941, it took 1.2 million person-hours to build a ship. By 1942, it took 600,000, and by 1943, it took only 500,000. Not much change occurred in the physical capital employed during these years, but an enormous amount of human capital was accumulated. Thousands of workers and managers learned from experience and their productivity more than doubled in two years.

Strong, healthy, well-nourished workers are much more productive than those who lack good nutrition, health care, and opportunities to exercise. This fact creates a virtuous circle. Improved health care, diet, and exercise increase labor productivity; and increased labor productivity brings the increased incomes that make these health improvements possible.

The expansion of human capital is the most fundamental source of economic growth because it directly increases labor productivity and is the source of the discovery of new technologies.

Discovery of New Technologies The growth of physical capital and the expansion of human capital have made large contributions to economic growth, but the discovery of new technologies has made an even greater contribution.

Since the Industrial Revolution, technological change has become a part of everyday life. Firms routinely conduct research to develop technologies that are more productive, and partnerships between business and the universities are commonplace in fields such as biotechnology and electronics.

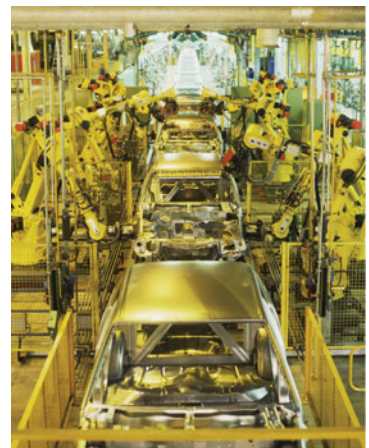
■ Combined Influences Bring Labor Productivity Growth

To reap the benefits of technological change—to use new technologies to make labor productivity grow—capital must increase. Some of the most powerful and far-reaching technologies are embodied in human capital—for example, language, writing, mathematics, physics, biology, and engineering. But most technologies are embodied in physical capital. For example, to increase the productivity of transportation workers by using the discovery of the internal combustion engine, millions of horse-drawn carriages had to be replaced by automobiles and trucks; more recently, to increase the labor productivity of office workers by using the discovery of computerized word processing, millions of typewriters had to be replaced by computers and printers.

Figure 17.6 shows how the combined effects of capital accumulation, the expansion of human capital, and the discovery of new technologies bring labor productivity growth. In 1960, the productivity curve is PC_0 , workers have \$80 of capital per hour and produce \$20 of real GDP per hour. By 2010, capital has increased to \$180 per hour. With no expansion of human capital or technological



Production using 1950s technology.



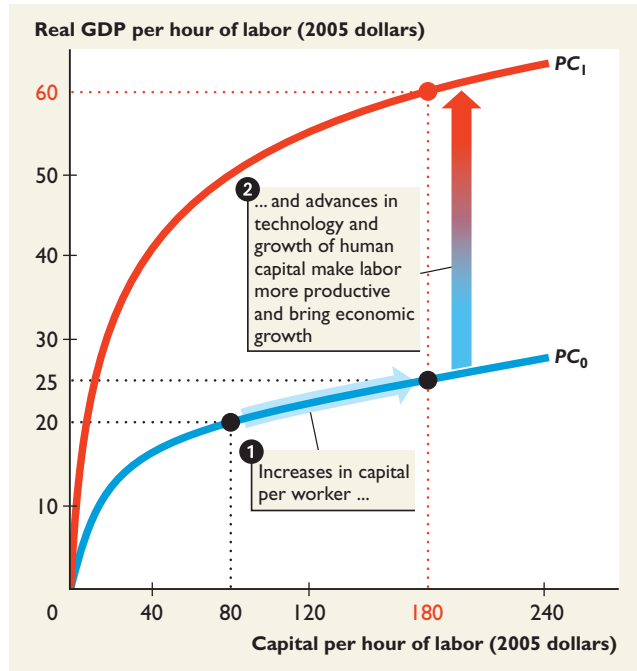
Production using 2000s technology.

FIGURE 17.6
How Labor Productivity Grows

MyEconLab Animation

In 1960, workers had \$80 of capital per hour of labor and produced real GDP per hour of \$20 on PC_0 .

- 1 When the quantity of capital increased from \$80 per hour of labor in 1960 to \$180 per hour of labor in 2010, real GDP per hour of labor increased from \$20 to \$25 along PC_0 .
- 2 The expansion of human capital and discovery of new technologies shifted the productivity curve upward and increased real GDP per hour of labor from \$25 to \$60.



advance, real GDP per hour of labor would have increased to \$25. But with the human capital and technology of 2010, output per hour increases to \$60.

You’ve now seen what makes labor productivity grow. Real GDP grows because labor becomes productive and also because the *quantity of labor* increases. Figure 17.7 summarizes the sources of economic growth and shows how the growth in labor productivity together with the growth in the quantity of labor bring real GDP growth. Figure 17.8 illustrates the process of economic growth as perpetual motion machine.

FIGURE 17.7
The Sources of Economic Growth

MyEconLab Animation

Real GDP depends on the quantity of labor and labor productivity.

The quantity of labor depends on the population, the labor force participation rate, and the average hours per worker.

Labor productivity depends on the amounts of physical capital and human capital and the state of technology.

Growth in quantity of labor and growth in labor productivity bring real GDP growth.

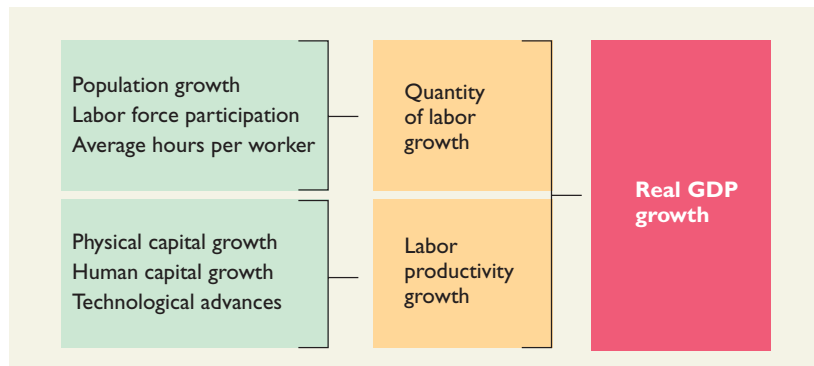
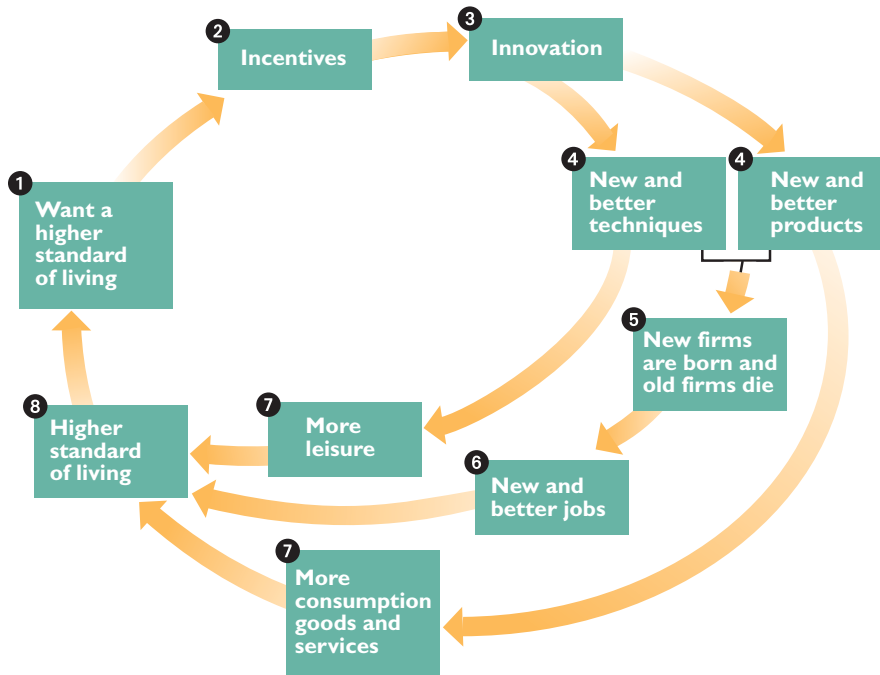


FIGURE 17.8
A Perpetual Motion Machine

MyEconLab Animation



1 People want a higher standard of living and are spurred by 2 profit incentives to make the 3 innovations that lead to 4 new and better techniques and new and better products, which in turn lead to 5 the birth of new firms and the death of some old firms, 6 new and better jobs, and 7 more leisure and more consumption goods and services. The result is 8 a higher standard of living. But people want a yet higher standard of living, and the growth process continues.

Based on a similar figure in *These Are the Good Old Days: A Report on U.S. Living Standards*, Federal Reserve Bank of Dallas 1993 Annual Report.



EYE on YOUR LIFE

How You Influence and Are Influenced by Economic Growth

Many of the choices that you make affect your personal economic growth rate—the pace of expansion of your own standard of living. And these same choices, in combination with similar choices made by millions of other people, have a profound effect on the economic growth of the nation and the world.

The most important of these choices right now is your choice to increase your human capital. By being in school, you have decided to expand your human capital.

You will continue to expand your human capital long after you finish school as your earning power rises with on-the-job experience. You might even decide to return to school at a later stage in your life.

A choice that will become increasingly important later in your life is to accumulate a retirement fund. This choice provides not only a source of income for you when you eventually retire but also financial resources that firms can use to finance the expansion of physical capital.

Not only do your choices influence economic growth; economic growth also has a big influence on you—on how you earn your income and on the standard of living that your income makes possible.

Because of economic growth, the jobs available today are more interesting and less dangerous and strenuous than those of 100 years ago; and jobs are hugely better paid. But for many of us, economic growth means that we must accept change and be ready to learn new skills and get new jobs.

MyEconLab

You can work these problems in Study Plan 17.3 and get instant feedback.

CHECKPOINT 17.3

Explain the sources of labor productivity growth. Identify the main sources of economic growth and explain the growth process.

Practice Problems

Use the data in Table 1 to work Problems 1 and 2.

TABLE 1

| Item | 2009 | 2010 |
|-------------------------------------|-------|-------|
| Aggregate labor hours (billions) | 25.0 | 25.6 |
| Real GDP (billions of 2005 dollars) | 1,000 | 1,050 |

1. Calculate the growth rate of real GDP in 2010.
2. Calculate labor productivity in 2009 and 2010, and the growth rate of labor productivity in 2010.

In the News**Labor productivity on the rise**

The BLS reported the following data for the year to June 2011: In the nonfarm sector, output increased 2.4 percent as aggregate hours increased 1.6 percent; in the manufacturing sector, output increased 4.6 percent as aggregate hours increased by 2.1 percent.

Source: bls.gov/news.release

As aggregate hours increased, output increased but did labor productivity in each sector increase? In which sector was growth in labor productivity greater?

Solutions to Practice Problems

1. The growth rate of real GDP in 2010 was 5 percent.

$$\text{Growth rate} = [(\$1,050 \text{ billion} - \$1,000 \text{ billion}) \div \$1,000 \text{ billion}] \times 100 = 5 \text{ percent}$$
2. Labor productivity is \$40.00 an hour in 2009 and \$41.02 an hour in 2010.
 Labor productivity equals real GDP divided by aggregate labor hours.
 In 2009, labor productivity was $(\$1,000 \text{ billion} \div 25 \text{ billion})$ or \$40.00 per hour of labor.
 In 2010, labor productivity was $(\$1,050 \text{ billion} \div 25.6 \text{ billion})$ or \$41.02 per hour of labor.
 The growth rate of labor productivity in 2010 was 2.55 percent.

$$\text{Labor productivity growth rate} = [(\$41.02 - \$40.00) \div \$40.00] \times 100 \text{ or } 2.55 \text{ percent.}$$

Solution to In the News

Output = Aggregate hours \times Labor productivity. In each sector, output increased by more than the increase in aggregate hours, so labor productivity must have increased. Output growth in manufacturing was almost double that in the nonfarm sector while growth in aggregate hours was approximately the same, so labor productivity must have increased by a larger percentage in the manufacturing sector than in the nonfarm sector.

17.4 ACHIEVING FASTER GROWTH

Why did it take more than a million years of human life before economic growth began? Why are some countries even today still barely growing? Why don't all societies save and invest in new capital, expand human capital, and discover and apply new technologies on a scale that brings rapid economic growth? What actions can governments take to encourage growth?

■ Preconditions for Economic Growth

The main reason economic growth is either absent or slow is that some societies lack the incentive system that encourages growth-producing activities. One of the fundamental preconditions for creating the incentives that lead to economic growth is economic freedom.

Economic Freedom

Economic freedom is present when people are able to make personal choices, their private property is protected by the rule of law, and they are free to buy and sell in markets. The rule of law, an efficient legal system, and the ability to enforce contracts are essential foundations for creating economic freedom. Impediments to economic freedom are corruption in the courts and government bureaucracy; barriers to trade, such as import bans; high tax rates; stringent regulations on business, such as health, safety, and environmental regulation; restrictions on banks; labor market regulations that limit a firm's ability to hire and lay off workers; and illegal markets, such as those that violate intellectual property rights.

No unique political system is necessary to deliver economic freedom. Democratic systems do a good job, but the rule of law, not democracy, is the key requirement for creating economic freedom. Nondemocratic political systems that respect the rule of law can also work well. Hong Kong is the best example of a place with little democracy but a lot of economic freedom—and a lot of economic growth. No country with a high level of economic freedom is economically poor, but many countries with low levels of economic freedom stagnate.

Property Rights

Economic freedom requires the protection of private property—the factors of production and goods that people own. The social arrangements that govern the protection of private property are called **property rights**. They include the rights to physical property (land, buildings, and capital equipment), to financial property (claims by one person against another), and to intellectual property (such as inventions). Clearly established and enforced property rights provide people with the incentive to work and save. If someone attempts to steal their property, a legal system will protect them. Such property rights also assure people that government itself will not confiscate their income or savings.

Markets

Economic freedom also requires free markets. Buyers and sellers get information and do business with each other in *markets*. Market prices send signals to buyers and sellers that create incentives to increase or decrease the quantities demanded and supplied. Markets enable people to trade and to save and invest. But markets cannot operate without property rights.

Economic freedom

A condition in which people are able to make personal choices, their private property is protected by the rule of law, and they are free to buy and sell in markets.

Property rights

The social arrangements that govern the protection of private property.

Property rights and markets create incentives for people to specialize and trade, to save and invest, to expand their human capital, and to discover and apply new technologies. Early human societies based on hunting and gathering did not experience economic growth because they lacked property rights and markets. Economic growth began when societies evolved the institutions that create incentives. But the presence of an incentive system and the institutions that create it do not guarantee that economic growth will occur. They permit economic growth but do not make it inevitable.

Growth begins when the appropriate incentive system exists because people can specialize in the activities at which they have a comparative advantage and trade with each other. You saw in Chapter 3 how everyone gains from such activity. By specializing and trading, everyone can acquire goods and services at the lowest possible cost. Consequently, people can obtain a greater volume of goods and services from their labor.

As an economy moves from one with little specialization to one that reaps the gains from specialization and trade, its production and consumption grow. Real GDP per person increases, and the standard of living rises.

But for growth to be persistent, people must face incentives that encourage them to pursue the three activities that generate *ongoing* economic growth: saving and investment, expansion of human capital, and the discovery and application of new technologies.

■ Policies to Achieve Faster Growth

To achieve faster economic growth, we must increase the growth rate of capital per hour of labor, increase the growth rate of human capital, or increase the pace of technological advance. The main actions that governments can take to achieve these objectives are

- Create incentive mechanisms.
- Encourage saving.
- Encourage research and development.
- Encourage international trade.
- Improve the quality of education.

Create Incentive Mechanisms

Economic growth occurs when the incentives to save, invest, and innovate are strong enough. These incentives require property rights enforced by a well-functioning legal system. Property rights and a legal system are the key ingredients that are missing in many societies. For example, they are absent throughout much of Africa. The first priority for growth policy is to establish these institutions so that incentives to save, invest, and innovate exist. Russia is a leading example of a country that is striving to take this step toward establishing the conditions in which economic growth can occur.

Encourage Saving

Saving finances investment, which brings capital accumulation. So encouraging saving can increase the growth of capital and stimulate economic growth. The East Asian economies have the highest saving rates and the highest growth rates. Some African economies have the lowest saving rates and the lowest growth rates.

Tax incentives can increase saving. Individual Retirement Accounts (IRAs) are an example of a tax incentive to save. Economists claim that a tax on consumption rather than on income provides the best incentive to save.

Encourage Research and Development

Everyone can use the fruits of basic research and development efforts. For example, all biotechnology firms can use advances in gene-splicing technology. Because basic inventions can be copied, the inventor's profit is limited and so the market allocates too few resources to this activity.

Governments can direct public funds toward financing basic research, but this solution is not foolproof. It requires a mechanism for allocating public funds to their highest-valued use. The National Science Foundation is one possibly efficient channel for allocating public funds to universities and public research facilities to finance and encourage basic research. Government programs such as national defense and space exploration also lead to innovations that have wide use. Laptop computers and nonstick coatings are two prominent examples of innovations that came from the U.S. space program.

Encourage International Trade

Free international trade stimulates economic growth by extracting all the available gains from specialization and trade. The fastest-growing nations today are those with the fastest-growing exports and imports. The creation of the North American Free Trade Agreement and the integration of the economies of Europe through the formation of the European Union are examples of successful actions that governments have taken to stimulate economic growth through trade.

Improve the Quality of Education

The free market would produce too little education because it brings social benefits beyond the benefits to the people who receive the education. By funding basic education and by ensuring high standards in skills such as language, mathematics, and science, governments can contribute enormously to a nation's growth potential. Education can also be expanded and improved by using tax incentives to encourage improved private provision. Singapore's Information Technology in Education program is one of the best examples of a successful attempt to stimulate growth through education.

■ How Much Difference Can Policy Make?

It is easy to make a list of policy actions that could increase a nation's economic growth rate. It is hard to convert that list into acceptable actions that make a big difference.

Societies are the way they are because they balance the interests of one group against the interests of another group. Change brings gains for some and losses for others, so change is slow. And even when change occurs, if the economic growth rate can be increased by even as much as half a percentage point, it takes many years for the full benefits to accrue.

A well-intentioned government cannot dial up a big increase in the economic growth rate, but it can pursue policies that will nudge the economic growth rate upward. Over time, the benefits from these policies will be large.

MyEconLab

You can work these problems in Study Plan 17.4 and get instant feedback.

CHECKPOINT 17.4

Describe the policies that might speed economic growth.

Practice Problems

1. What are the preconditions for economic growth?
2. Why does much of Africa experience slow economic growth?
3. Why is economic freedom crucial for achieving economic growth?
4. What role do property rights play in encouraging economic growth?
5. Explain why, other things remaining the same, a country with a well-educated population has a faster economic growth rate than a country that has a poorly educated population.

In the News**India's economy hits the wall**

Just six months ago, the Indian economy was growing rapidly; now growth has halted. India needs to spend \$500 billion upgrading its infrastructure and education and health-care facilities. Agriculture remains unproductive; and reforms, like strengthening the legal system, have been ignored.

Source: *BusinessWeek*, July 1, 2008

Explain how the measures reported in the news clip could lead to faster growth.

Solutions to Practice Problems

1. The preconditions for economic growth are economic freedom, private property rights, and markets. Without these preconditions, people have little incentive to undertake the actions that lead to economic growth.
2. Some African countries experience slow economic growth because they lack economic freedom, private property rights are not enforced, and markets do not function well. People in these countries have little incentive to specialize and trade or to accumulate both physical and human capital.
3. Economic freedom is crucial for achieving economic growth because economic freedom allows people to make choices and gives them the incentives to pursue growth-producing activities.
4. Clearly defined private property rights and a legal system to enforce them give people the incentive to work, save, invest, and accumulate human capital.
5. A well-educated population has more skills and greater labor productivity than a poorly educated population. A well-educated population can contribute to the research and development that create new technology.

Solution to In the News

Investment in infrastructure and education and health-care facilities would increase India's stock of physical capital, which would increase labor productivity. Better education and health care would increase human capital and increase labor productivity. With better technology and more capital used on farms, productivity of farm workers would increase. Strengthening the legal system could better enforce property rights. Each of these measures could lead to faster growth in labor productivity and faster growth in real GDP per person in India.



CHAPTER SUMMARY

Key Points

1 Explain what determines potential GDP.

- Potential GDP is the quantity of real GDP that the full-employment quantity of labor produces.
- At full-employment equilibrium, the real wage rate makes the quantity of labor demanded equal the quantity of labor supplied.

2 Define and calculate the economic growth rate, and explain the implications of sustained growth.

- Economic growth is the sustained expansion of production possibilities. The annual percentage change in real GDP measures the economic growth rate.
- Real GDP per person must grow if the standard of living is to rise.
- Sustained economic growth transforms poor nations into rich ones.
- The Rule of 70 tells us the number of years in which real GDP doubles—70 divided by the percentage growth rate of real GDP.

3 Identify the main sources of economic growth and explain the growth process.

- Real GDP grows when aggregate hours and labor productivity grow.
- Real GDP per person grows when labor productivity grows.
- The interaction of saving and investment in physical capital, expansion of human capital, and technological advances bring labor productivity growth.
- Saving and investment in physical capital alone cannot bring sustained steady growth because of diminishing marginal returns to capital.

4 Describe the policies that might speed economic growth.

- Economic growth requires an incentive system created by economic freedom, property rights, and markets.
- It might be possible to achieve faster growth by encouraging saving, subsidizing research and education, and encouraging international trade.

Key Terms

| | |
|--|---------------------------------|
| Classical macroeconomics, 444 | Monetarist macroeconomics, 445 |
| Demand for labor, 449 | Potential GDP, 447 |
| Diminishing returns, 448 | Production function, 448 |
| Economic freedom, 467 | Property rights, 467 |
| Economic growth, 456 | Real GDP per person, 456 |
| Economic growth rate, 456 | Rule of 70, 457 |
| Keynesian macroeconomics, 444 | Quantity of labor demanded, 449 |
| Labor productivity, 460 | Quantity of labor supplied, 451 |
| Law of diminishing marginal returns, 461 | Supply of labor, 451 |

MyEconLab

You can work these problems in Chapter 17 Study Plan and get instant feedback.

CHAPTER CHECKPOINT**Study Plan Problems and Applications**

Use the following list of events that occur one at a time in the United States to work Problems **1** to **4**.

- Dell introduces a new supercomputer that everyone can afford.
 - A major hurricane hits Florida.
 - More high school graduates go to college.
 - The CPI rises.
 - An economic slump in the rest of the world decreases U.S. exports.
1. Sort the items into four groups: those that change the production function, those that change the demand for labor, those that change the supply of labor, and those that do not change the production function, the demand for labor, or the supply of labor. Say in which direction any changes occur.
 2. Which of the events increase the equilibrium quantity of labor and which decrease it?
 3. Which of the events raise the real wage rate and which lower it?
 4. Which of the events increase potential GDP and which decrease it?
 5. Explain why sustained growth of real GDP per person can transform a poor country into a wealthy one.
 6. In 2005 and 2006, India's real GDP grew by 9.2 percent a year and its population grew by 1.6 percent a year. If these growth rates are sustained, in what years would
 - Real GDP be twice what it was in 2006?
 - Real GDP per person be twice what it was in 2006?
 7. Explain how saving and investment in capital change labor productivity. Why do diminishing returns arise? Provide an example of diminishing returns. Use a graph of the productivity curve to illustrate your answer.
 8. Explain how advances in technology change labor productivity. Do diminishing returns arise? Provide an example of an advance in technology. Use a graph of the productivity curve to illustrate your answer.

Use the following information to work Problems **9** and **10**.

Slowing down growth

China's GDP growth target for the Five-Year-Plan period 2011–2015 is 7 percent a year. This largely symbolic goal (China's average growth rate for the past five years was 11 percent a year) shows that the government wants to fundamentally restructure the economy through slower economic growth, increased consumption, technological advancement, and environmental protection measures.

Source: *The Telegraph*, September 25, 2011

9. If China reduces its economic growth rate from 11 percent a year to 7 percent a year, how many additional years will it take for GDP to double? In what year will China's GDP quadruple?
10. Explain how increased consumption, advances in technology, and increased environmental protection measures will influence the economic growth rate.

Instructor Assignable Problems and Applications



Use the following information to work Problems 1 and 2.

In Korea, real GDP per hour of labor is \$22, the real wage rate is \$15 per hour, and people work an average of 46 hours per week.

1. Draw a graph of the demand for and supply of labor in Korea and the United States. Mark a point at the equilibrium quantity of labor per person per week and the real wage rate in each economy. Explain the difference in the two labor markets.
2. Draw a graph of the production functions in Korea and the United States. Mark a point on each production function that shows potential GDP per hour of work in each economy. Explain the difference in the two production functions.

Use the following events that occur one at a time to work Problems 3 and 4.

- The Middle East cuts supplies of oil to the United States.
 - The New York Yankees win the World Series.
 - U.S. labor unions negotiate wage hikes that affect all workers.
 - A huge scientific breakthrough doubles the output that an additional hour of U.S. labor can produce.
 - Migration to the United States increases the working-age population.
3. Sort the items into those that change (a) the production function, (b) the demand for labor, (c) the supply of labor, and (d) do not change (a), (b) or (c). Say in which direction each change occurs.
 4. Which of the events increase the equilibrium quantity of labor and increase potential GDP?
 5. Distinguish between a low and high income and a low and high economic growth rate. What are the key features of an economy that are present when incomes are high or fast growing and absent when incomes are low and stagnating or growing slowly? Provide an example of an economy with a low income and slow growth rate, a low income and rapid growth rate, and a high income with sustained growth over many decades.
 6. China's growth rate of real GDP in 2005 and 2006 was 10.5 percent a year and its population growth rate was 0.5 percent a year. If these growth rates continue, in what year would real GDP be twice what it was in 2006? In what year would real GDP per person be twice what it was in 2006?
 7. Explain how an increase in physical capital and an increase in human capital change labor productivity. Use a graph to illustrate your answer.
 8. Table 1 describes labor productivity in an economy. What must have occurred in this economy during year 1?
 9. Describe and illustrate in a graph what happened in the economy in Table 1 if in year 1, capital per hour of labor was 30 and in year 2 it was 40.
 10. China invests almost 50 percent of its annual production in new capital compared to 15 percent in the United States. Capital per hour of labor in China is about 25 percent of that in the United States. Explain which economy has the higher real GDP per hour of labor, the faster growth rate of labor productivity, and which experiences the more severe diminishing returns.

Your instructor can assign these problems as homework, a quiz, or a test in [MyEconLab](#).

TABLE 1 LABOR PRODUCTIVITY

| Capital per hour of labor | Real GDP per hour of labor | |
|---------------------------|----------------------------|-----------|
| | in year 1 | in year 2 |
| 10 | 7 | 9 |
| 20 | 13 | 17 |
| 30 | 18 | 24 |
| 40 | 22 | 30 |
| 50 | 25 | 35 |
| 60 | 27 | 39 |
| 70 | 28 | 42 |

MyEconLab

You can work this quiz in Chapter 17 Study Plan and get instant feedback.

Multiple Choice Quiz

1. U.S. potential GDP is the value of the goods and services produced in the United States _____.
 - A. in the reference base year
 - B. when the U.S. unemployment rate is zero
 - C. when the U.S. economy is at full employment
 - D. when the U.S. inflation rate is zero
2. The demand for labor curve shows the relationship between _____.
 - A. the quantity of labor employed and firms' profits
 - B. all households' willingness to work and the real wage rate
 - C. the quantity of labor businesses are willing to hire and the real wage rate
 - D. the labor force and the real wage rate
3. The supply of labor is the relationship between _____.
 - A. the quantity of labor supplied and leisure time forgone
 - B. the real wage rate and the quantity of labor supplied
 - C. firms' willingness to supply jobs and the real wage rate
 - D. the labor force participation rate and the real wage rate
4. Households' labor supply decisions are influenced by all of the following *except* _____.
 - A. the opportunity cost of taking leisure and not working
 - B. the after-tax wage rate
 - C. unemployment benefits
 - D. the number of full-time jobs available
5. If real GDP increases from \$5 billion to \$5.25 billion and the population increases from 2 million to 2.02 million, real GDP per person increases by _____ percent.
 - A. 5.0
 - B. 1.0
 - C. 2.5
 - D. 4.0
6. If the population growth rate is 2 percent, real GDP per person will double in 7 years if real GDP grows by _____ percent per year.
 - A. 7
 - B. 10
 - C. 12
 - D. 14
7. All of the following increase labor productivity *except* _____.
 - A. the accumulation of skill and knowledge
 - B. an increase in capital per hour of labor
 - C. an increase in consumption
 - D. the employment of a new technology
8. An economy can achieve faster economic growth *without* _____.
 - A. markets and property rights
 - B. people being willing to save and invest
 - C. incentives to encourage the research for new technologies
 - D. an increase in the population growth rate



How does the Fed create money and regulate its quantity?

Money and the Monetary System



CHAPTER CHECKLIST

When you have completed your study of this chapter, you will be able to

- 1 Define money and describe its functions.
- 2 Describe the functions of banks.
- 3 Describe the functions of the Federal Reserve System (the Fed).
- 4 Explain how the banking system creates money and how the Fed controls the quantity of money.

18.1 WHAT IS MONEY?

Money, like fire and the wheel, has been around for a very long time. An incredible array of items has served as money. North American Indians used wampum (beads made from shells), Fijians used whales' teeth, and early American colonists used tobacco. Cakes of salt served as money in Ethiopia and Tibet. What do wampum, whales' teeth, tobacco, and salt have in common? Why are they examples of money? Today, when we want to buy something, we use coins or notes (dollar bills), write a check, send an e-check, present a credit or debit card, or use a "smart card." Are all these things that we use today money? To answer these questions, we need a definition of money.

■ Definition of Money

Money is any commodity or token that is generally accepted as a *means of payment*. This definition has three parts that we'll examine in turn.

A Commodity or Token

Money is always something that can be recognized and that can be divided up into small parts. So money might be an actual commodity, such as a bar of silver or gold. But it might also be a token, such as a quarter or a \$10 bill. Money might also be a virtual token, such as an electronic record in a bank's database (more about this type of money later).

Generally Accepted

Money is *generally* accepted, which means that it can be used to buy *anything and everything*. Some tokens can be used to buy some things but not others. For example, a bus pass is accepted as payment for a bus ride, but you can't use your bus pass to buy toothpaste. So a bus pass is not money. In contrast, you can use a \$5 bill to buy either a bus ride or toothpaste—or anything else that costs \$5 or less. So a \$5 bill is money.

Means of Payment

A **means of payment** is a method of settling a debt. When a payment has been made, the deal is complete. Suppose that Gus buys a car from his friend Ann. Gus doesn't have enough money to pay for the car right now, but he will have enough three months from now, when he gets paid. Ann agrees that Gus may pay for the car in three months' time. Gus buys the car with a loan from Ann and then pays off the loan. The loan isn't money. Money is what Gus uses to pay off the loan.

So what wampum, whales' teeth, tobacco, and salt have in common is that they have served as a generally accepted means of payment, and that is why they are examples of money.

■ The Functions of Money

Money performs three vital functions. It serves as a

- Medium of exchange
- Unit of account
- Store of value

Money

Any commodity or token that is generally accepted as a *means of payment*.

Means of payment

A method of settling a debt.

Medium of Exchange

A **medium of exchange** is an object that is generally accepted in return for goods and services. Money is a medium of exchange. Without money, you would have to exchange goods and services directly for other goods and services—an exchange called **barter**. Barter requires a *double coincidence of wants*. For example, if you want a soda and have only a paperback novel to offer in exchange for it, you must find someone who is selling soda and who also wants your paperback novel. Money guarantees that there is a double coincidence of wants because people with something to sell will always accept money in exchange for it. Money acts as a lubricant that smoothes the mechanism of exchange. Money enables you to specialize in the activity in which you have a comparative advantage (see Chapter 3, pp. 74–76) instead of searching for a double coincidence of wants.

Unit of Account

A **unit of account** is an agreed-upon measure for stating the prices of goods and services. To get the most out of your budget, you have to figure out whether going to a rock concert is worth its opportunity cost. But that cost is not dollars and cents. It is the number of movies, cappuccinos, ice-cream cones, or sticks of gum that you must give up to attend the concert. It's easy to do such calculations when all these goods have prices in terms of dollars and cents (see Table 18.1). If a rock concert costs \$64 and a movie costs \$8, you know right away that going to the concert costs you 8 movies. If a cappuccino costs \$4, going to the concert costs 16 cappuccinos. You need only one calculation to figure out the opportunity cost of any pair of goods and services. For example, the opportunity cost of the rock concert is 128 sticks of gum ($\$64 \div 50¢ = 128$ sticks of gum).

Now imagine how troublesome it would be if the rock concert ticket agent posted its price as 8 movies, and if the movie theater posted its price as 2 cappuccinos, and if the coffee shop posted the price of a cappuccino as 2 ice-cream cones, and if the ice-cream shop posted its price as 4 sticks of gum! Now how much running around and calculating do you have to do to figure out how much that rock concert is going to cost you in terms of the movies, cappuccino, ice cream, or sticks of gum that you must give up to attend it? You get the answer for movies right away from the sign posted by the ticket agent. For all the other goods, you're going to have to visit many different places to establish the price of each commodity in terms of another and then calculate prices in units that are relevant for your own decision. Cover up the column labeled "price in money units" in Table 18.1 and see how hard it is to figure out the number of sticks of gum it costs to attend a rock concert. It's enough to make a person swear off rock! How much simpler it is using dollars and cents.

Store of Value

Any commodity or token that can be held and exchanged later for goods and services is called a **store of value**. Money acts as a store of value. If it did not, it would not be accepted in exchange for goods and services. The more stable the value of a commodity or token, the better it can act as a store of value and the more useful it is as money. No store of value is completely stable. The value of a physical object, such as a house, a car, or a work of art, fluctuates over time. The value of the commodities and tokens that we use as money also fluctuates, and when there is inflation, money persistently falls in value.

Medium of exchange

An object that is generally accepted in return for goods and services.

Barter

The direct exchange of goods and services for other goods and services, which requires a double coincidence of wants.

Unit of account

An agreed-upon measure for stating the prices of goods and services.

TABLE 18.1 A UNIT OF ACCOUNT SIMPLIFIES PRICE COMPARISONS

| Good | Price in money units | Price in units of another good |
|----------------|----------------------|--------------------------------|
| Rock concert | \$64.00 | 8 movies |
| Movie | \$8.00 | 2 cappuccinos |
| Cappuccino | \$4.00 | 2 ice-cream cones |
| Ice-cream cone | \$2.00 | 4 sticks of gum |
| Stick of gum | \$0.50 | |

Store of value

Any commodity or token that can be held and exchanged later for goods and services.

Fiat money

Objects that are money because the law decrees or orders them to be money.

Currency

Notes (dollar bills) and coins.

■ Money Today

Money in the world today is called **fiat money**. *Fiat* is a Latin word that means decree or order. Fiat money is money because the law decrees it to be so. The objects used as money have value only because of their legal status as money.

Today's fiat money consists of

- Currency
- Deposits at banks and other financial institutions

Currency

The notes (dollar bills) and coins that we use in the United States today are known as **currency**. The government declares notes to be money with the words printed on every dollar bill, "This note is legal tender for all debts, public and private."

Deposits

Deposits at banks, credit unions, savings banks, and savings and loan associations are also money. Deposits are money because they can be used to make payments. You don't need to go to the bank to get currency to make a payment. You can write a check or use your debit card to tell your bank to move some money from your account to someone else's.

Currency Inside the Banks Is Not Money

Although currency and bank deposits are money, currency *inside the banks* is *not money*. The reason is while currency is inside a bank, it isn't available as a means of payment. When you get some cash from the ATM, you convert your bank deposit into currency. You change the form of your money, but there is no change in the quantity of money that you own. Your bank deposit decreases, and your currency holding increases.

If we counted bank deposits and currency inside the banks as money, think about what would happen to the quantity of money when you get cash from the ATM. The quantity of money would appear to decrease. Your currency would increase, but both bank deposits and currency inside the banks would decrease.

You can see that counting both bank deposits and currency inside the banks as money would be double counting.

■ Official Measures of Money: M1 and M2

Figure 18.1 shows the items that make up two official measures of money. **M1** consists of currency held by individuals and businesses, traveler's checks, and checkable deposits owned by individuals and businesses. **M2** consists of M1 plus savings deposits and time deposits (less than \$100,000), money market funds, and other deposits. Time deposits are deposits that can be withdrawn only after a fixed term. Money market funds are deposits that are invested in short-term securities.

Are M1 and M2 Means of Payment?

The test of whether something is money is whether it is a generally accepted means of payment. Currency passes the test. Checkable deposits also pass the test because they can be transferred from one person to another by using a debit card or writing a check. So all the components of M1 serve as means of payment.

M1

Currency held by individuals and businesses, traveler's checks, and checkable deposits owned by individuals and businesses.

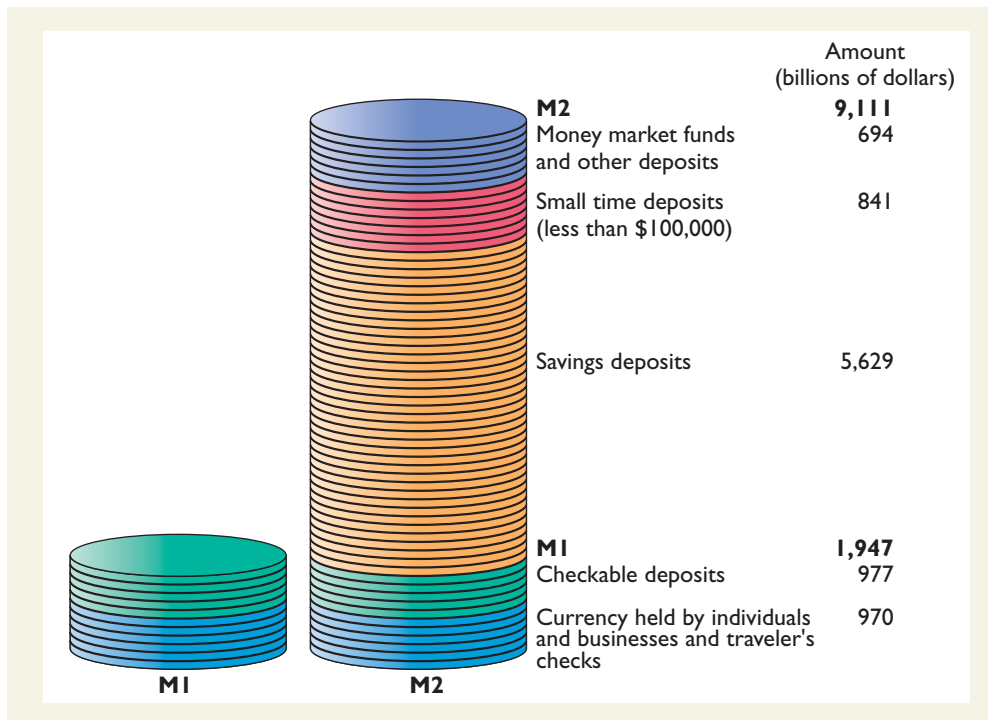
M2

M1 plus savings deposits and small time deposits, money market funds, and other deposits.

FIGURE 18.1

Two Measures of Money: June 2011

MyEconLab Real-time data



SOURCE OF DATA: Federal Reserve.

M1 Currency held by individuals and businesses and traveler's checks plus checkable deposits owned by individuals and businesses.

M2 M1 plus savings deposits plus same time deposits plus money market funds and other deposits.

Some of the savings deposits in M2 are also instantly convertible into a means of payment. You can use the ATM to get currency to pay for your groceries or gas. But other savings deposits, time deposits, and money market funds are not instantly convertible and are *not* a means of payment.

■ Checks, Credit Cards, Debit Cards, and E-Checks

In defining money and describing the things that serve as money today, we have not included checks, credit cards and debit cards, or e-checks. Aren't these things that we use when we buy something also money?

Checks

A check is not money. It is an instruction to a bank to make a payment. The easiest way to see why a check is not money is to think about how the quantity of money you own changes if you write a check. You don't suddenly have more money because you've written a check to pay a bill. Your money is your bank deposit, not the value of the checks you've written.

Credit Cards

A credit card is not money. It is a special type of ID card that gets you an instant loan. Suppose that you use your credit card to buy a textbook. You sign or enter your PIN and leave the store with your book. The book may be in your possession,

but you've not yet paid for it. You've taken a loan from the bank that issued your credit card. Your credit card issuer pays the bookstore and you eventually get your credit card bill, which you pay using money.

Debit Cards

A debit card works like a paper check, only faster. And just as a check isn't money, neither is a debit card. To see why a debit card works like a check, think about what happens if you use your debit card to buy your textbook. When the sales clerk swipes your card in the bookstore, the computer in the bookstore's bank gets a message: Take \$100 from your account and put it in the account of the bookstore. The transaction is done in a flash. But again, the bank deposits are the money and the debit card is the tool that causes money to move from you to the bookstore.

E-Checks

An *electronic check* (or *e-check*) is an electronic equivalent of a paper check. A group of more than 90 banks and other financial institutions have formed the Financial Services Technology Consortium to collaborate on developing the electronic check. Bank of Internet USA offers an Internet e-check system via e-mail. Like a paper check, an e-check is not money. The deposit transferred is money.

You now know that checks, credit cards and debit cards, and e-checks are not money, but one new information-age money is gradually emerging—e-cash.

■ An Embryonic New Money: E-Cash

Electronic cash (or *e-cash*) is an electronic equivalent of paper notes (dollar bills) and coins. It is an electronic currency, and for people who are willing to use it, e-cash works like other forms of money. But for e-cash to become a widely used form of money, it must evolve some of the characteristics of physical currency.

People use physical currency because it is portable, recognizable, transferable, untraceable, and anonymous and can be used to make change. The designers of e-cash aim to reproduce all of these features of notes and coins. Today's e-cash is portable, untraceable, and anonymous, but it has not yet reached the level of recognition that makes it *universally* accepted as a means of payment. E-cash doesn't yet meet the definition of money.

Like notes and coins, e-cash can be used in shops. It can also be used over the Internet. To use e-cash in a shop, the buyer uses a smart card that stores some e-cash and the shop uses a smart card reader. When a transaction is made, e-cash is transferred from the smart card directly to the shop's bank account. Users of smart cards receive their e-cash by withdrawing it from a bank account by using a special ATM or a special cell phone.

Several versions of e-cash in U.S. dollars, euros, and other currencies are available on the Internet. The most popular and widely used e-cash system is PayPal, which is owned by eBay. The most sophisticated and secure e-cash is a currency called Bitcoin, which can be used to settle debts and be traded for dollars and other currencies on the Internet.

A handy advantage of e-cash over paper notes arises when you lose your wallet. If it is stuffed with dollar bills, you're out of luck. If it contains e-cash recorded on your smart card, your bank can cancel the e-cash stored on the card and issue you replacement e-cash.

Although e-cash is not yet universally accepted, it is likely that its use will grow and that it will gradually replace physical forms of currency.



CHECKPOINT 18.1

Define money and describe its functions.

Practice Problems

1. In the United States today, which of the items in List 1 are money?
2. In January 2011, currency held by individuals and businesses was \$920 billion; traveler's checks were \$5 billion; checkable deposits owned by individuals and businesses were \$926 billion; savings deposits were \$5,378 billion; small time deposits were \$905 billion; and money market funds and other deposits were \$705 billion. Calculate M1 and M2 in January 2011.
3. In August 2011, M1 was \$2,108 billion; M2 was \$9,545 billion; checkable deposits owned by individuals and businesses were \$1,127 billion; time deposits were \$810 billion; and money market funds and other deposits were \$716 billion. Calculate currency held by individuals and businesses and traveler's check. Calculate savings deposits.

In the News

The cell phone as wallet: Will the trend catch on?

With the simple swipe of a phone—even when the battery's dead—consumers can now pay for their coffee, gas, or groceries. But as this technology becomes increasingly available, experts ask will it catch on?

Source: CTVNews.ca, September 24, 2011

As people use their cell phones to make payments, will currency disappear? How will the components of M1 change? Will debit cards disappear?

Solutions to Practice Problems

1. Money is defined as a means of payment. Only the quarters inside vending machines and U.S. dollar bills in your wallet are money.
2. M1 is \$1,851 billion. M1 is the sum of currency held by individuals and businesses (\$920 billion), traveler's checks (\$5 billion), and checkable deposits owned by individuals and businesses (\$926 billion).
M2 is \$8,839 billion. M2 is the sum of M1 (\$1,851 billion), savings deposits (\$5,378 billion), small time deposits (\$905 billion), and money market funds and other deposits (\$705 billion).
3. Currency held by individuals and businesses and traveler's checks is \$981 billion. Currency and traveler's checks equals M1 (\$2,108 billion) minus checkable deposits owned by individuals and businesses (\$1,127 billion). Savings deposits are \$5,911 billion. Savings deposits equals M2 (\$9,545 billion) minus M1 (\$2,108 billion) minus time deposits (\$810 billion) minus money market funds and other deposits (\$716 billion)

Solution to In the News

Most people will probably carry less currency, but it won't disappear because currency is used in the underground economy. Most of M1 will be checkable deposits. Cell phones and debit cards will be perfect substitutes, so debit cards will probably disappear.

MyEconLab

You can work these problems in Study Plan 18.1 and get instant feedback.

LIST 1

- Your Visa card
- The quarters inside vending machines
- U.S. dollar bills in your wallet
- The check that you have just written to pay for your rent
- The loan you took out last August to pay for your school fees

18.2 THE BANKING SYSTEM

Banking system

The Federal Reserve and the banks and other institutions that accept deposits and provide the services that enable people and businesses to make and receive payments.

The **banking system** consists of the Federal Reserve and the banks and other institutions that accept deposits and that provide the services that enable people and businesses to make and receive payments. Sitting at the top of the system (see Figure 18.2), the Federal Reserve (or Fed) sets the rules and regulates and influences the activities of the banks and other institutions. Three types of financial institutions accept the deposits that are part of the nation's money:

- Commercial banks
- Thrift institutions
- Money market funds

Here, we describe the functions of these institutions, and in the next section, we describe the structure and functions of the Fed.

Commercial Banks

Commercial bank

A firm that is chartered by the Comptroller of the Currency in the U.S. Treasury (or by a state agency) to accept deposits and make loans.

A **commercial bank** is a firm that is chartered by the Comptroller of the Currency in the U.S. Treasury (or by a state agency) to accept deposits and make loans. In 2011, about 7,250 commercial banks operated in the United States, down from 13,000 a few years ago. The number of banks has shrunk because in 1997 the rules under which banks operate were changed, permitting them to open branches in every state. A wave of mergers followed this change of rules. Also, more than 130 banks failed during the financial crisis of 2008–2009.

Bank Deposits

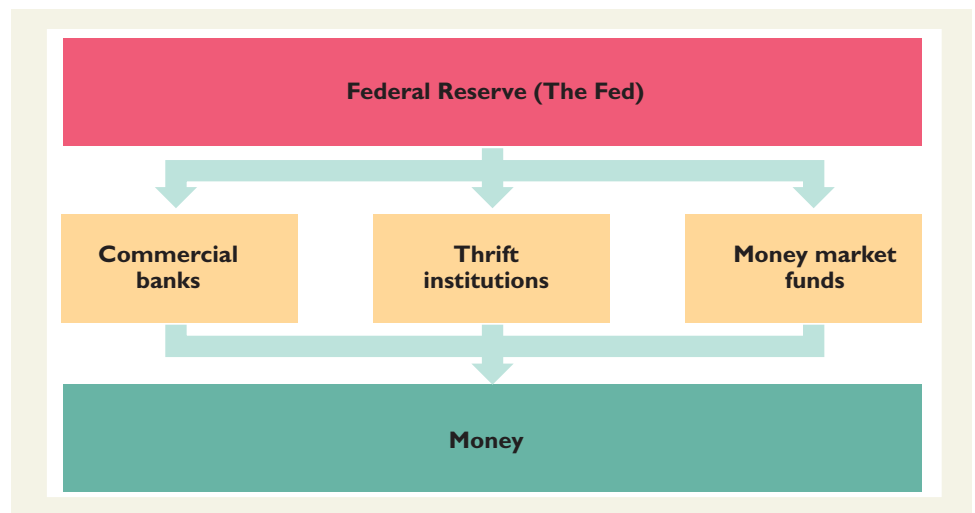
A commercial bank accepts three broad types of deposits: checkable deposits, savings deposits, and time deposits. A bank pays a low interest rate (sometimes zero) on checkable deposits, and it pays the highest interest rate on time deposits.

FIGURE 18.2

The Institutions of the Banking System

MyEconLab Animation

The Federal Reserve regulates and influences the activities of the commercial banks, thrift institutions, and money market funds, whose deposits make up the nation's money.





EYE on the PAST

The “Invention” of Banking

It is the sixteenth century somewhere in Europe: Because gold is valuable and easy to steal, goldsmiths have well-guarded safes in which people “deposit” their gold. The goldsmiths issue gold receipts entitling owners to reclaim their “deposits” on demand.

Isabella, who has a receipt for 100 ounces of gold deposited with Samuel Goldsmith, buys some land from Henry. She can pay for the land in one of two ways: She can visit Samuel, collect her gold, and hand the gold to Henry. Or she can give Henry her gold receipt, which enables Henry to claim

the 100 ounces of gold.

It is a simpler and safer transaction to use the receipt. When Henry wants to buy something, he too can pass the receipt on to someone else.

So Samuel Goldsmith’s gold receipt is circulating as a means of payment. It is money!

Because the receipts circulate while the gold remains in his safe, Samuel realizes that he can lend gold receipts and charge interest for doing so. Samuel writes receipts for gold that he doesn’t own, but has on deposit, and lends these receipts. Samuel is one of the first bankers.



Profit and Risk: A Balancing Act

Commercial banks try to maximize their stockholders’ wealth by lending for long terms at high interest rates and borrowing from depositors and others. But lending is risky. Risky loans sometimes don’t get repaid and the prices of risky securities sometimes fall. In either of these events, a bank incurs a loss that could even wipe out the stockholders’ wealth. Also, when depositors see their bank incurring losses, mass withdrawals—called a run on the bank—might create a crisis. So a bank must perform a balancing act. It must be careful in the way it uses the depositors’ funds and balance security for depositors and stockholders against high but risky returns. To trade off between risk and profit a bank divides its assets into four parts: reserves, liquid assets, securities, and loans.

Reserves

A bank’s **reserves** consist of currency in its vaults plus the balance on its reserve account at a Federal Reserve Bank.

The currency in a bank’s vaults is a reserve to meet its depositors’ withdrawals. Your bank must replenish currency in its ATM every time you and your friends have raided it for cash for a midnight pizza.

A commercial bank’s deposit at a Federal Reserve Bank is similar to your own bank deposit. The bank uses its reserve account at the Fed to receive and make payments to other banks and to obtain currency. The Fed requires banks to hold a minimum percentage of deposits as reserves, called the **required reserve ratio**. Banks’ *desired* reserves might exceed the required reserves, especially when the cost of borrowing reserves is high.

Reserves

The currency in the bank’s vaults plus the balance on its reserve account at a Federal Reserve Bank.

Required reserve ratio

The minimum percentage of deposits that the Fed requires banks and other financial institutions to hold in reserves.

Federal funds rate

The interest rate on interbank loans (loans made in the federal funds market).

Liquid Assets

Banks' *liquid assets* are short-term Treasury bills and overnight loans to other banks. The interest rates on liquid assets are low but these are low-risk assets. The interest rate on interbank loans, called the **federal funds rate**, is the central target of the Fed's monetary policy actions.

Securities and Loans

Securities are bonds issued by the U.S. government and by other organizations. Some bonds have low interest rates and are safe. Some bonds have high interest rates and are risky. Mortgage-backed securities are examples of risky securities.

Loans are the provision of funds to businesses and individuals. Loans earn the bank a high interest rate, but they are risky and, even when not very risky, cannot be called in before the agreed date. Banks earn the highest interest rate on unpaid credit card balances, which are loans to credit card holders.

Bank Assets and Liabilities: The Relative Magnitudes

Figure 18.3 shows the relative magnitudes of the banks' assets and liabilities—deposits and other borrowing—in 2011. After performing their profit-versus-risk balancing acts, the banks kept 13 percent of total assets in reserves, placed another 13 percent in liquid assets, 21 percent in securities, and 53 percent in loans. Checkable deposits (part of M1) were 8 percent of total funds. Another 51 percent of total funds were savings deposits and small time deposits (part of M2).

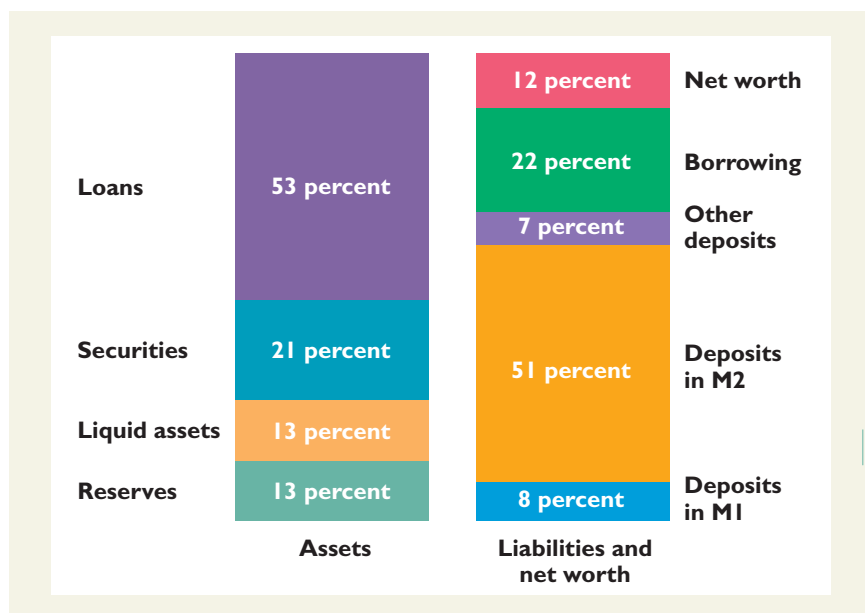
The commercial banks' asset allocation in 2011 is not normal and is a consequence of a financial crisis in 2008 and 2009. *Eye on the U.S. Economy* on the next page contrasts normal times with the immediate aftermath of the crisis.

FIGURE 18.3
Commercial Banks' Assets, Liabilities, and Net Worth

MyEconLab Animation

In 2011, commercial bank loans were 53 percent of total assets, securities were 21 percent, liquid assets were 13 percent, and reserves were 13 percent. Reserves were unusually large in 2011.

The banks obtained the funds allocated to these assets from checkable deposits in M1, which were 8 percent of total funds; savings deposits and small time deposits in M2 were 51 percent; other deposits were 7 percent; other borrowing was 22 percent; and bank stockholders' net worth was 12 percent.



SOURCE OF DATA: Federal Reserve.



EYE on the U.S. ECONOMY

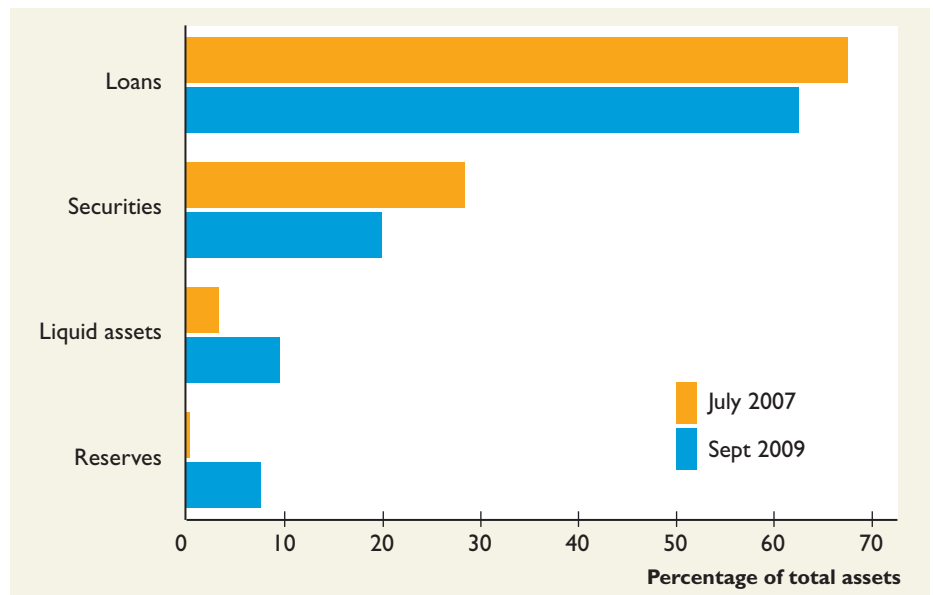
Commercial Banks Under Stress in the Financial Crisis

In normal times, bank reserves are less than 1 percent of total assets and liquid assets are less than 4 percent. Loans are 68 percent and securities 28 percent. July 2007 was such a normal time (the orange bars).

During the financial crisis that started in 2007 and intensified in September 2008, the banks took big hits as the value of their securities and loans fell.

Faced with a riskier world, the banks increased their liquid assets and reserves. In September 2009 (the blue bars), liquid assets were almost 10 percent of total assets and reserves were 8 percent.

The balancing act tipped away from risk-taking and toward security.



SOURCE OF DATA: Federal Reserve.

■ Thrift Institutions

The three types of thrift institutions are savings and loan associations, savings banks, and credit unions. A *savings and loan association (S&L)* is a financial institution that accepts checkable deposits and savings deposits and that makes personal, commercial, and home-purchase loans. A *savings bank* is a financial institution that accepts savings deposits and makes mostly consumer and home-purchase loans. The depositors own some savings banks (called mutual savings banks). A *credit union* is a financial institution owned by a social or economic group, such as a firm's employees, that accepts savings deposits and makes mostly consumer loans.

Like commercial banks, the thrift institutions hold reserves and must meet minimum reserve ratios set by the Fed.

■ Money Market Funds

A *money market fund* is a financial institution that obtains funds by selling shares and uses these funds to buy assets such as U.S. Treasury bills. Money market fund shares act like bank deposits. Shareholders can write checks on their money market fund accounts, but there are restrictions on most of these accounts. For example, the minimum deposit accepted might be \$2,500 and the smallest check a depositor is permitted to write might be \$500.

MyEconLab

You can work these problems in Study Plan 18.2 and get instant feedback.

**CHECKPOINT 18.2**

Describe the functions of banks.

Practice Problems

1. What are the institutions that make up the banking system?
2. What is a bank's balancing act?

Use the following information to work Problems 3 and 4. A bank's deposits and assets are \$320 in checkable deposits, \$896 in savings deposits, \$840 in small time deposits, \$990 in loans to businesses, \$400 in outstanding credit card balances, \$634 in government securities, \$2 in currency, and \$30 in its reserve account at the Fed.

3. Calculate the bank's total deposits, deposits that are part of M1, and deposits that are part of M2.
4. Calculate the bank's loans, securities, and reserves.

In the News**Regulators close Georgia bank in 95th failure for the year**

Regulators shut down Atlanta-based Georgian Bank. On July 24, 2009, Georgian Bank has \$2 billion in assets and \$2 billion in deposits. By September 29, 2009, Georgian Bank had lost about \$2 billion in home loans and other assets.

Source: *USA Today*, September 30, 2009

Explain how Georgian Bank's balancing act failed.

Solutions to Practice Problems

1. The institutions that make up the banking system are the Fed, commercial banks, thrift institutions, and money market funds.
2. A bank makes a profit by borrowing from depositors at a low interest rate and lending at a higher interest rate. The bank must hold enough reserves to meet depositors' withdrawals. The bank's balancing act is to balance the risk of loans (profits for stockholders) against the security for depositors.
3. Total deposits are $\$320 + \$896 + \$840 = \$2,056$.
Deposits that are part of M1 are checkable deposits, \$320.
Deposits that are part of M2 include all deposits, \$2,056.
4. Loans are $\$990 + \$400 = \$1,390$. Securities are \$634.
Reserves are $\$30 + \$2 = \$32$.

Solution to In the News

In July, Georgian Bank's \$2 billion of assets (home loans and securities) balanced its deposits of \$2 billion. The bank expected to make a profit on its assets that exceeded the interest it paid to depositors. The financial crisis increased the risk on all financial assets. The bank was now holding assets that were more risky than it had planned. As people defaulted on their home loans and the value of securities fell, the value of Georgian Bank's assets crashed to zero. With fewer assets than deposits, regulators had no choice other than to close the bank and sell its assets and deposits. The bank failed to balance risk against profit.

18.3 THE FEDERAL RESERVE SYSTEM

The **Federal Reserve System (the Fed)** is the central bank of the United States. A **central bank** is a public authority that provides banking services to banks and governments and regulates financial institutions and markets. A central bank does not provide banking services to businesses and individual citizens. Its only customers are banks such as Bank of America and Citibank and the U.S. government. The Fed is organized into 12 Federal Reserve districts shown in Figure 18.4.

The Fed's main task is to regulate the interest rate and quantity of money to achieve low and predictable inflation and sustained economic expansion.

■ The Structure of the Federal Reserve

The key elements in the structure of the Federal Reserve are

- The Chairman of the Board of Governors
- The Board of Governors
- The regional Federal Reserve Banks
- The Federal Open Market Committee

The Chairman of the Board of Governors

The Chairman of the Board of Governors is the Fed's chief executive, public face, and center of power and responsibility. When things go right, the Chairman gets the credit; when they go wrong, he gets the blame. Ben S. Bernanke, a former Princeton University economics professor, is the Fed's current Chairman.

Federal Reserve System (the Fed)

The central bank of the United States.

Central bank

A public authority that provides banking services to banks and governments and regulates financial institutions and markets.

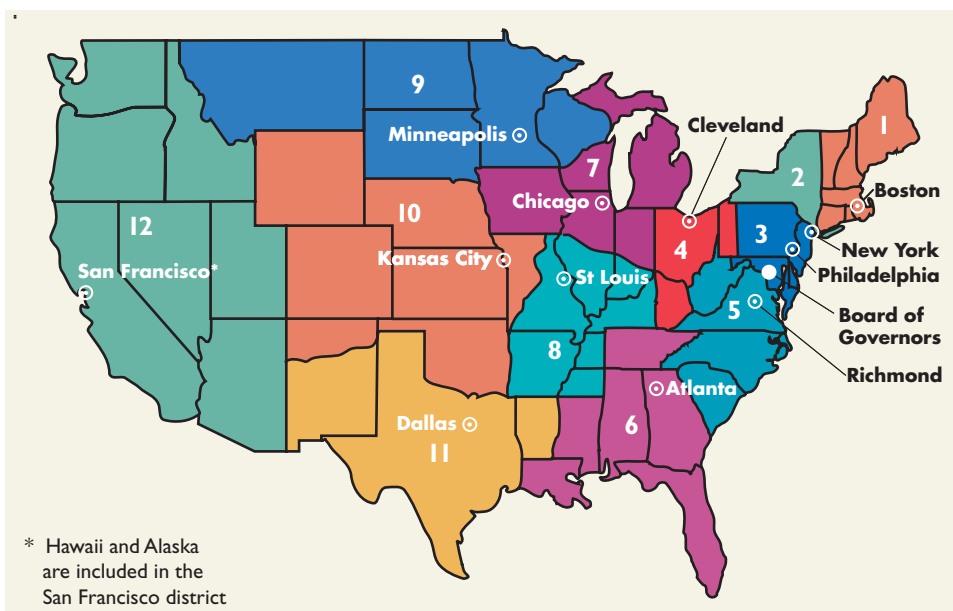


Fed Chairman Ben S. Bernanke

■ FIGURE 18.4

The Federal Reserve Districts

MyEconLab Animation



The nation is divided into 12 Federal Reserve districts, each having a Federal Reserve Bank. (Some of the larger districts also have branch banks.) The Board of Governors of the Federal Reserve System is located in Washington, D.C.

SOURCE: Federal Reserve Bulletin.

The Board of Governors

The Board of Governors has seven members (including the Chairman), who are appointed by the President of the United States and confirmed by the Senate, each for a 14-year term. The terms are staggered so that one seat on the board becomes vacant every two years. The President appoints one of the board members as Chairman for a term of four years, which is renewable.

The Regional Federal Reserve Banks

There are 12 regional Federal Reserve Banks, one for each of the 12 Federal Reserve districts shown in Figure 18.4. Each regional Federal Reserve Bank has nine directors, three of whom are appointed by the Board of Governors and six of whom are elected by the commercial banks in the Federal Reserve district. The directors of each regional Federal Reserve Bank appoint that Bank's president, and the Board of Governors approves this appointment.

The Federal Reserve Bank of New York (known as the New York Fed) occupies a special place because it implements some of the Fed's most important policy decisions.

The Federal Open Market Committee

The **Federal Open Market Committee** (FOMC) is the Fed's main policy-making committee. The FOMC consists of the following twelve members:

- The Chairman and the other six members of the Board of Governors
- The president of the Federal Reserve Bank of New York
- Four presidents of the other regional Federal Reserve Banks (on a yearly rotating basis)

The FOMC meets approximately every six weeks to review the state of the economy and to decide the actions to be carried out by the New York Fed.

■ The Fed's Policy Tools

The Fed's most important tasks are to influence the interest rate and regulate the amount of money circulating in the United States. How does the Fed perform these tasks? It does so by adjusting the reserves of the banking system. Also, by adjusting the reserves of the banking system and standing ready to make loans to banks, the Fed is able to prevent bank failures. The Fed's policy tools are:

- Required reserve ratios
- Discount rate
- Open market operations
- Extraordinary crisis measures

Required Reserve Ratios

You've seen that banks hold reserves of currency and deposits at a Federal Reserve Bank. The Fed requires the banks and thrifts to hold a minimum percentage of deposits as reserves. This minimum is known as a *required reserve ratio*. The Fed determines a required reserve ratio for each type of deposit. Currently, required reserve ratios range from zero to 3 percent on checkable deposits below a specified level to 10 percent on deposits in excess of the specified level.

Federal Open Market Committee

The Fed's main policy-making committee.

Discount Rate

The **discount rate** is the interest rate at which the Fed stands ready to lend reserves to commercial banks. A change in the discount rate begins with a proposal to the FOMC by at least one of the 12 Federal Reserve Banks. If the FOMC agrees that a change is required, it proposes the change to the Board of Governors for its approval.

Discount rate

The interest rate at which the Fed stands ready to lend reserves to commercial banks.

Open Market Operations

An **open market operation** is the purchase or sale of government securities—U.S. Treasury bills and bonds—by the Federal Reserve in the open market. When the Fed conducts an open market operation, it makes a transaction with a bank or some other business but it does not transact with the federal government. The New York Fed conducts the Fed's open market operations.

Open market operation

The purchase or sale of government securities—U.S. Treasury bills and bonds—by the New York Fed in the open market.

Extraordinary Crisis Measures

The financial crisis of 2008, the slow recovery, and ongoing financial stress have brought three more tools into play. They are:

- Quantitative easing (or QE)
- Credit easing
- Operation Twist

Quantitative Easing (QE) When the Fed creates bank reserves by conducting a large-scale open market purchase at a low or possibly zero federal funds rate, the action is called *quantitative easing*. There have been two episodes of quantitative easing, QE1 and QE2—see *Eye on Creating Money* on pp. 498–499.

Credit Easing When the Fed buys private securities or makes loans to financial institutions to stimulate their lending, the action is called *credit easing*.

Operation Twist When the Fed buys long-term government securities and sells short-term government securities, the action is called *Operation Twist*. The idea is to lower long-term interest rates and stimulate long-term borrowing and investment expenditure. An Operation Twist was conducted in September 2011.

■ How the Fed's Policy Tools Work

The Fed's normal policy tools work by changing either the demand for or the supply of the monetary base, which in turn changes the interest rate. The **monetary base** is the sum of coins, Federal Reserve notes, and banks' reserves at the Fed.

By increasing the required reserve ratio, the Fed can force the banks to hold a larger quantity of monetary base. By raising the discount rate, the Fed can make it more costly for the banks to borrow reserves—borrow monetary base. And by selling securities in the open market, the Fed can decrease the monetary base. All of these actions lead to a rise in the interest rate.

Similarly, by decreasing the required reserve ratio, the Fed can permit the banks to hold a smaller quantity of monetary base. By lowering the discount rate, the Fed can make it less costly for the banks to borrow monetary base. And by buying securities in the open market, the Fed can increase the monetary base. All of these actions lead to a decrease in the interest rate.

Open market operations are the Fed's main tool and in the next section you will learn in more detail how they work.

Monetary base

The sum of coins, Federal Reserve notes, and banks' reserves at the Fed.

MyEconLab

You can work these problems in Study Plan 18.3 and get instant feedback.



CHECKPOINT 18.3

Describe the functions of the Federal Reserve System (the Fed).

Practice Problems

1. What is the Fed and what is the FOMC?
2. Who is the Fed's chief executive, and what are the Fed's main policy tools?
3. What is the monetary base?
4. Suppose that at the end of December 2009, the monetary base in the United States was \$700 billion, Federal Reserve notes were \$650 billion, and banks' reserves at the Fed were \$20 billion. Calculate the quantity of coins.

In the News

Risky assets: Counting to a trillion

Prior to September 15, 2008, the start of the credit crisis, the Fed had less than \$1 trillion in assets and most were safe U.S. government securities. By mid-December, 2008, the Fed's balance sheet had increased to more than \$2.3 trillion. Much of the increase was in mortgage-backed securities. The massive expansion began when the Fed starting sending banks cash in exchange for risky assets.

Source: CNN Money, September 29, 2009

What are the Fed's policy tools and which policy tool did the Fed use to increase its assets to \$2.3 trillion in 2008?

Solutions to Practice Problems

1. The Federal Reserve (Fed) is the U.S. central bank—a public authority that provides banking services to banks and the U.S. government and that regulates the quantity of money and the banking system. The FOMC is the Federal Open Market Committee—the Fed's main policy-making committee.
2. The Fed's chief executive is the Chairman of the Board of Governors, currently Ben Bernanke. The Fed's main policy tools are required reserve ratios, the discount rate, and open market operations. In unusual times, extraordinary crisis measures are an additional tool.
3. The monetary base is the sum of coins, Federal Reserve notes (dollar bills), and banks' reserves at the Fed.
4. To calculate the quantity of coins, we use the definition of the monetary base: coins plus Federal Reserve notes plus banks' reserves at the Fed.

$$\text{Quantity of coins} = \text{Monetary base} - \text{Federal Reserve notes} - \text{Banks' reserves at the Fed.}$$

So at the end of December 2009,

$$\begin{aligned} \text{Quantity of coins} &= \$700 \text{ billion} - \$650 \text{ billion} - \$20 \text{ billion} \\ &= \$30 \text{ billion.} \end{aligned}$$

Solution to In the News

The Fed's policy tools are the required reserve ratio, discount rate, open market operations, and extraordinary crisis measures. The Fed used extraordinary crisis measures called *quantitative easing* and *credit easing*—the Fed's lending program bought risky assets of banks and increased their reserve deposits at the Fed.

18.4 REGULATING THE QUANTITY OF MONEY

Banks create money, but this doesn't mean that they have smoke-filled back rooms in which counterfeiters are busily working. Remember, most money is deposits, not currency. What banks create is deposits, and they do so by making loans.

■ Creating Deposits by Making Loans

The easiest way to see that banks create deposits is to think about what happens when Andy, who has a Visa card issued by Citibank, uses his card to buy a tank of gas from Chevron. When Andy signs the card sales slip, he takes a loan from Citibank and obligates himself to repay the loan at a later date. At the end of the business day, a Chevron clerk takes a pile of signed credit card sales slips, including Andy's, to Chevron's bank. For now, let's assume that Chevron also banks at Citibank. The bank immediately credits Chevron's account with the value of the slips (minus the bank's commission).

You can see that these transactions have created a bank deposit and a loan. Andy has increased the size of his loan (his credit card balance), and Chevron has increased the size of its bank deposit. And because deposits are money, Citibank has created money.

If, as we've just assumed, Andy and Chevron use the same bank, no further transactions take place. But the outcome is essentially the same when two banks are involved. If Chevron's bank is the Bank of America, then Citibank uses its reserves to pay the Bank of America. Citibank has an increase in loans and a decrease in reserves; the Bank of America has an increase in reserves and an increase in deposits. The banking system as a whole has an increase in loans, an increase in deposits, and no change in reserves.



EYE on YOUR LIFE

Money and Your Role in Its Creation

Imagine a world without money in which you must barter for everything you buy. What kinds of items would you have available for these trades? Would you keep some stocks of items that you know lots of people are willing to accept? Would you really be bartering, or would you be using a commodity as money? How much longer would it take you to conduct all the transactions of a normal day?

Now think about your own holdings of money today. How much

money do you have in your pocket or wallet? How much do you have in the bank? How does the money you hold change over the course of a month?

Of the money you're holding, which items are part of M1 and which are part of M2? Are all the items in M2 means of payment?

Now think about the role that *you* play in creating money. Every time you charge something to your credit card, you help the bank that issued it to create money. The increase in your credit card balance is a loan from the

bank to you. The bank pays the seller right away. So the seller's bank deposit and your outstanding balance increase together. Money is created.

You contribute to the currency drain that limits the ability of your bank to create money when you visit the ATM and get some cash to pay for your late-night pizza.

Of course, your transactions are a tiny part of the total. But together, you and a few million other students like you play a big role in the money creation process.

If Andy had swiped his card at an automatic payment pump, all these transactions would have occurred at the time he filled his tank, and the quantity of money would have increased by the amount of his purchase (minus the bank's commission for conducting the transactions).

Three factors limit the quantity of deposits that the banking system can create:

- The monetary base
- Desired reserves
- Desired currency holding

The Monetary Base

You've seen that the monetary base is the sum of coins, Federal Reserve notes, and banks' deposits at the Fed. The size of the monetary base limits the total quantity of money that the banking system can create because banks have a desired level of reserves and households and firms have a desired level of currency holding and both of these desired holdings of the monetary base depend on the quantity of money.

Desired Reserves

A bank's *desired reserves* are the reserves that the bank chooses to hold. The *desired reserve ratio* is the ratio of reserves to deposits that a bank wants to hold. This ratio exceeds the *required reserve ratio* by an amount that the banks determine to be prudent on the basis of their daily business requirements.

A bank's *actual reserve ratio* changes when its customers make a deposit or a withdrawal. If a bank's customer makes a deposit, reserves and deposits increase by the same amount, so the bank's reserve ratio increases. Similarly, if a bank's customer makes a withdrawal, reserves and deposits decrease by the same amount, so the bank's reserve ratio decreases.

A bank's **excess reserves** are its actual reserves minus its desired reserves. When the banking system as a whole has excess reserves, banks can create money by making new loans. When the banking system as a whole is short of reserves, banks must destroy money by decreasing the quantity of loans.

Desired Currency Holding

We hold our money in the form of currency and bank deposits. The proportion of money held as currency isn't constant but at any given time, people have a definite view as to how much they want to hold in each form of money.

Because households and firms want to hold some proportion of their money in the form of currency, when the total quantity of bank deposits increases, so does the quantity of currency that they want to hold.

Because desired currency holding increases when deposits increase, currency leaves the banks when loans are made and deposits increase. We call the leakage of currency from the banking system the *currency drain*. And we call the ratio of currency to deposits the *currency drain ratio*.

The greater the currency drain ratio, the smaller is the quantity of deposits and money that the banking system can create from a given amount of monetary base. The reason is that as currency drains from the banks, they are left with a smaller level of reserves (and smaller excess reserves) so they make fewer loans.

Excess reserves

A bank's actual reserves minus its desired reserves.

■ How Open Market Operations Change the Monetary Base

When the Fed buys securities in an open market operation, it pays for them with newly created bank reserves and money. With more reserves in the banking system, the supply of interbank loans increases, the demand for interbank loans decreases, and the federal funds rate—the interest rate in the interbank loans market—falls.

Similarly, when the Fed sells securities in an open market operation, buyers pay for the securities with bank reserves and money. With smaller reserves in the banking system, the supply of interbank loans decreases, the demand for interbank loans increases, and the federal funds rate rises. The Fed sets a target for the federal funds rate and conducts open market operations on the scale needed to hit its target.

A change in the federal funds rate is only the first stage in an adjustment process that follows an open market operation. If banks' reserves increase, the banks can increase their lending and create even more money. If banks' reserves decrease, the banks must decrease their lending, which decreases the quantity of money. We'll study the effects of open market operations in some detail, beginning with an open market purchase.

The Fed Buys Securities

Suppose the Fed buys \$100 million of U.S. government securities in the open market. There are two cases to consider, depending on who sells the securities. A bank might sell some of its securities, or a person or business that is not a commercial bank—the general public—might sell. The outcome is essentially the same in the two cases. To convince you of this fact, we'll study the two cases, starting with the simpler case in which a commercial bank sells securities. (The seller will be someone who thinks the Fed is offering a good price for securities and it is profitable to make the sale.)



FOMC meeting.

A Commercial Bank Sells When the Fed buys \$100 million of securities from the Manhattan Commercial Bank, two things happen:

1. The Manhattan Commercial Bank has \$100 million less in securities, and the Fed has \$100 million more in securities.
2. To pay for the securities, the Fed increases the Manhattan Commercial Bank’s reserve account at the New York Fed by \$100 million.

Figure 18.5 shows the effects of these actions on the balance sheets of the Fed and the Manhattan Commercial Bank. Ownership of the securities passes from the commercial bank to the Fed, so the bank’s securities decrease by \$100 million and the Fed’s securities increase by \$100 million, as shown by the red-to-blue arrow running from the Manhattan Commercial Bank to the Fed.

The Fed increases the Manhattan Commercial Bank’s reserves by \$100 million, as shown by the green arrow running from the Fed to the Manhattan Commercial Bank. This action increases the reserves of the banking system.

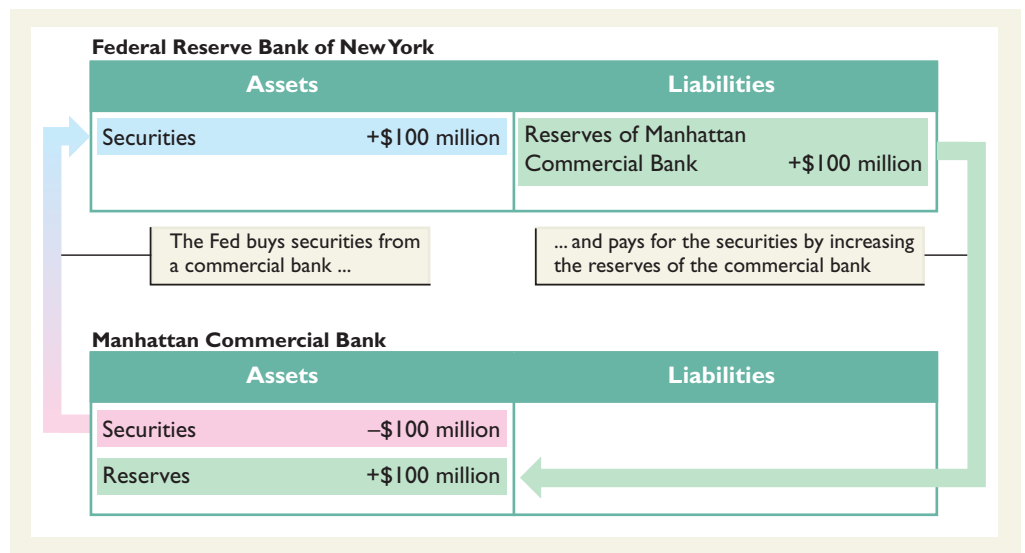
The commercial bank’s total assets remain constant, but their composition changes. Its holdings of government securities decrease by \$100 million, and its reserves increase by \$100 million. The bank can use these additional reserves to make loans. When the bank makes loans, it creates deposits and the quantity of money increases.

We’ve just seen that when the Fed buys government securities from a bank, the bank’s reserves increase. What happens if the Fed buys government securities from the public—say, from AIG, an insurance company?

FIGURE 18.5

The Fed Buys Securities from a Commercial Bank

MyEconLab Animation



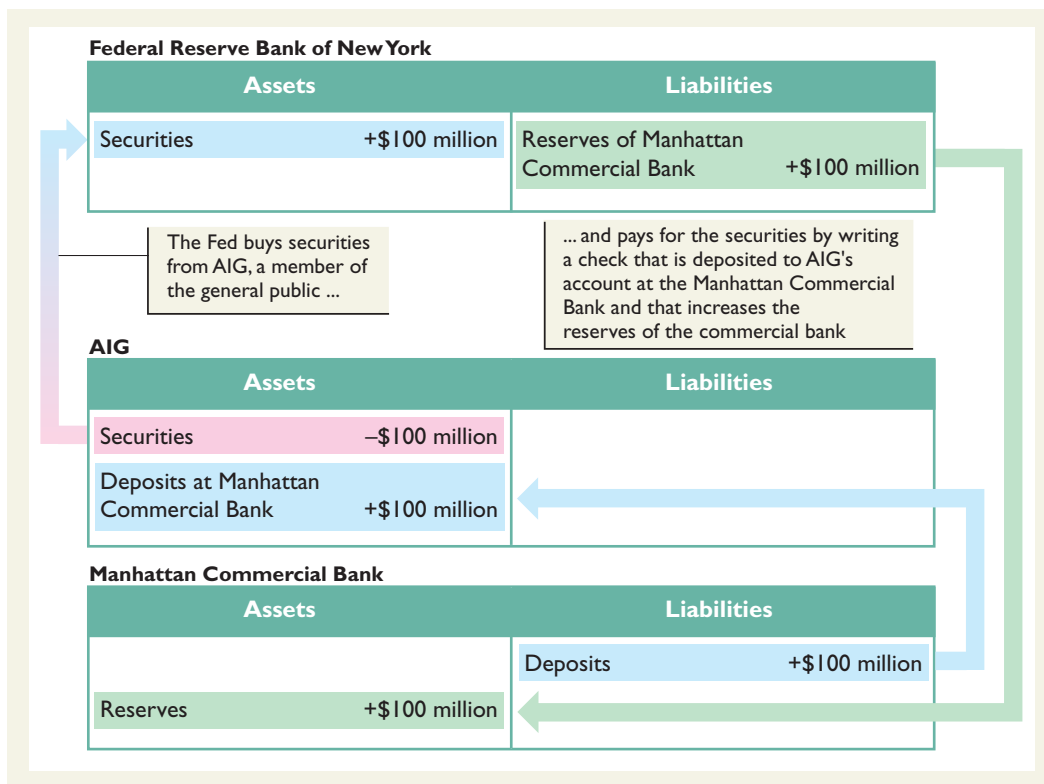
The Nonbank Public Sells When the Fed buys \$100 million of securities from AIG, three things happen:

1. AIG has \$100 million less in securities, and the Fed has \$100 million more in securities.
2. The Fed pays for the securities with a check for \$100 million drawn on itself, which AIG deposits in its account at the Manhattan Commercial Bank.
3. The Manhattan Commercial Bank collects payment of this check from the Fed, and the Manhattan Commercial Bank's reserves increase by \$100 million.

Figure 18.6 shows the effects of these actions on the balance sheets of the Fed, AIG, and the Manhattan Commercial Bank. Ownership of the securities passes from AIG to the Fed, so AIG's securities decrease by \$100 million and the Fed's securities increase by \$100 million (red-to-blue arrow). The Fed pays for the securities with a check payable to AIG, which AIG deposits in the Manhattan Commercial Bank. This payment increases Manhattan's reserves by \$100 million (green arrow). It also increases AIG's deposit at the Manhattan Commercial Bank by \$100 million (blue arrow). This action increases the reserves of the banking system.

FIGURE 18.6
The Fed Buys Securities from the Public

MyEconLab Animation



AIG has the same total assets as before, but their composition has changed. It now has more money and fewer securities. The Manhattan Commercial Bank's reserves increase, and so do its deposits—both by \$100 million. Because bank reserves and deposits have increased by the same amount, the bank has excess reserves, which it can use to make loans. When it makes loans, the quantity of money increases.

We've worked through what happens when the Fed buys government securities from either a bank or the public. When the Fed sells securities, the transactions that we've just traced operate in reverse.

The Fed Sells Securities

If the Fed sells \$100 million of U.S. government securities in the open market, most likely a person or business other than a bank buys them. (A bank would buy them only if it had excess reserves and couldn't find a better use for its funds.)

When the Fed sells \$100 million of securities to AIG, three things happen:

1. AIG has \$100 million more in securities, and the Fed has \$100 million less in securities.
2. AIG pays for the securities with a check for \$100 million drawn on its deposit account at the Manhattan Commercial Bank.
3. The Fed collects payment of this check from the Manhattan Commercial Bank by decreasing its reserves by \$100 million.

These actions decrease the reserves of the banking system. The Manhattan Commercial Bank is now short of reserves and must borrow in the federal funds market to meet its desired reserve ratio.

The changes in the balance sheets of the Fed and the banks that we've just described are not the end of the story about the effects of an open market operation; they are just the beginning.

■ The Multiplier Effect of an Open Market Operation

An open market purchase that increases bank reserves also increases the *monetary base* by the amount of the open market purchase. Regardless of whether the Fed buys securities from the banks or from the public, the quantity of bank reserves increases and gives the banks excess reserves that they then lend.

The following sequence of events takes place:

- An open market purchase creates excess reserves.
- Banks lend excess reserves.
- Bank deposits increase.
- The quantity of money increases.
- New money is used to make payments.
- Some of the new money is held as currency—a currency drain.
- Some of the new money remains in deposits in banks.
- Banks' desired reserves increase.
- Excess reserves decrease but remain positive.

The sequence described above repeats in a series of rounds, but each round begins with a smaller quantity of excess reserves than did the previous one. The process ends when there are no excess reserves. This situation arises when the

increase in the monetary base resulting from the open market operation is will-ingly held—when the increase in desired reserves plus the increase in desired cur-rency holding equals the increase in the monetary base. Figure 18.7 illustrates and summarizes the sequence of events in one round of the multiplier process.

An open market *sale* works similarly to an open market *purchase*, but the sale *decreases* the monetary base and sets off a multiplier process similar to that described in Figure 18.7. At the end of the process the quantity of money has decreased by an amount that lowers desired reserves and desired currency hold-ing by an amount equal to the decrease in the monetary base resulting from the open market sale. (Make your own version of Figure 18.7 to trace the multiplier process when the Fed *sells* and the banks or public *buys* securities.)

The magnitude of the change in the quantity of money brought about by an open market operation is determined by the money multiplier that we now explain.

■ The Money Multiplier

The **money multiplier** is the number by which a change in the monetary base is multiplied to find the resulting change in the quantity of money. It is also the ratio of the change in the quantity of money to the change in the monetary base.

The magnitude of the money multiplier depends on the desired reserve ratio and the currency drain ratio. The smaller are these two ratios, the larger is the money multiplier. Let's explore the money multiplier in more detail.

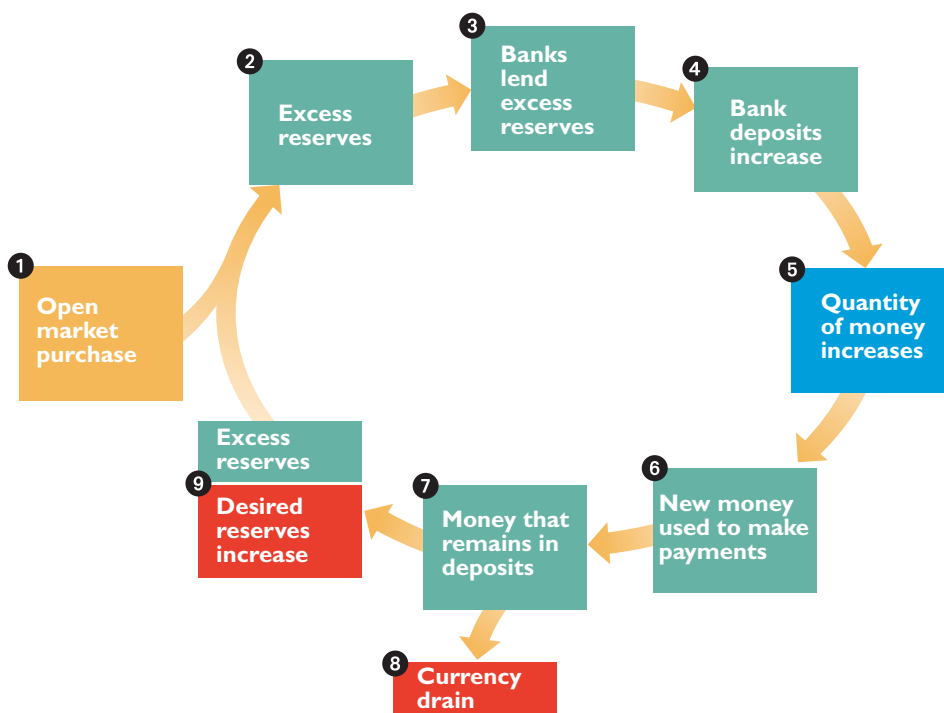
Money multiplier

The number by which a change in the monetary base is multiplied to find the resulting change in the quantity of money.

■ FIGURE 18.7

A Round in the Multiplier Process Following an Open Market Operation

MyEconLab Animation



- 1 An open market purchase increases bank reserves and
- 2 creates excess reserves.
- 3 Banks lend the excess reserves,
- 4 new deposits are created, and
- 5 the quantity of money increases.
- 6 New money is used to make pay-ments.
- 7 Households and firms receiving payments keep some on deposit in banks and
- 8 some in the form of currency—a currency drain.

The increase in bank deposits increases banks' reserves but also

- 9 increases banks' desired reserves.

Desired reserves increase by less than actual reserves, so the banks still have some excess reserves, but less than before. The process repeats until excess reserves have been eliminated.

To see how the desired reserve ratio and the currency drain ratio determine the size of the money multiplier, begin with two facts:

The quantity of money, M , is the sum of deposits, D , and currency, C , or $M = D + C$, and

The monetary base, MB , is the sum of reserves, R , and currency, C , or $MB = R + C$.

The money multiplier is equal to the quantity of money, M , divided by the monetary base, MB , that is:

$$\text{Money multiplier} = M/MB.$$

Because $M = D + C$ and $MB = R + C$ then:

$$\text{Money multiplier} = (D + C)/(R + C).$$



EYE on CREATING MONEY

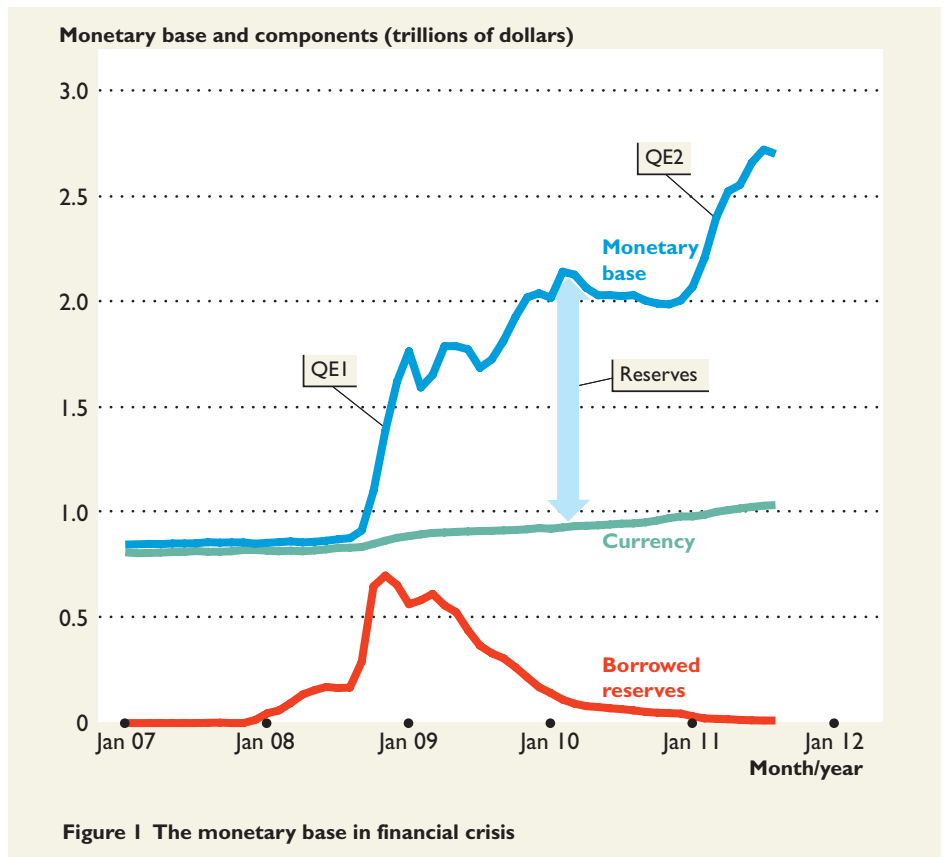
How Does the Fed Create Money and Regulate Its Quantity?

During the Great Depression, many banks failed, bank deposits were destroyed, and the quantity of money crashed by 25 percent. Most economists believe that it was these events that turned an ordinary recession in 1929 into a deep and decade-long depression.

Fed Chairman Ben Bernanke is one of the economists who has studied this tragic episode in U.S. economic history, and he had no intention of witnessing a similar event on his watch.

Figure 1 shows what the Fed did to pump reserves into the banking system. In the fall of 2008 in an episode called QE1 (see p. 489), the Fed doubled the monetary base. In 2010 and 2011, a more gradual but sustained QE2 took the monetary base to more than three times its pre-crisis level.

This extraordinary increase in the monetary base did not bring a



Now divide each item on the right-hand side of the previous equation by deposits, D , to get:

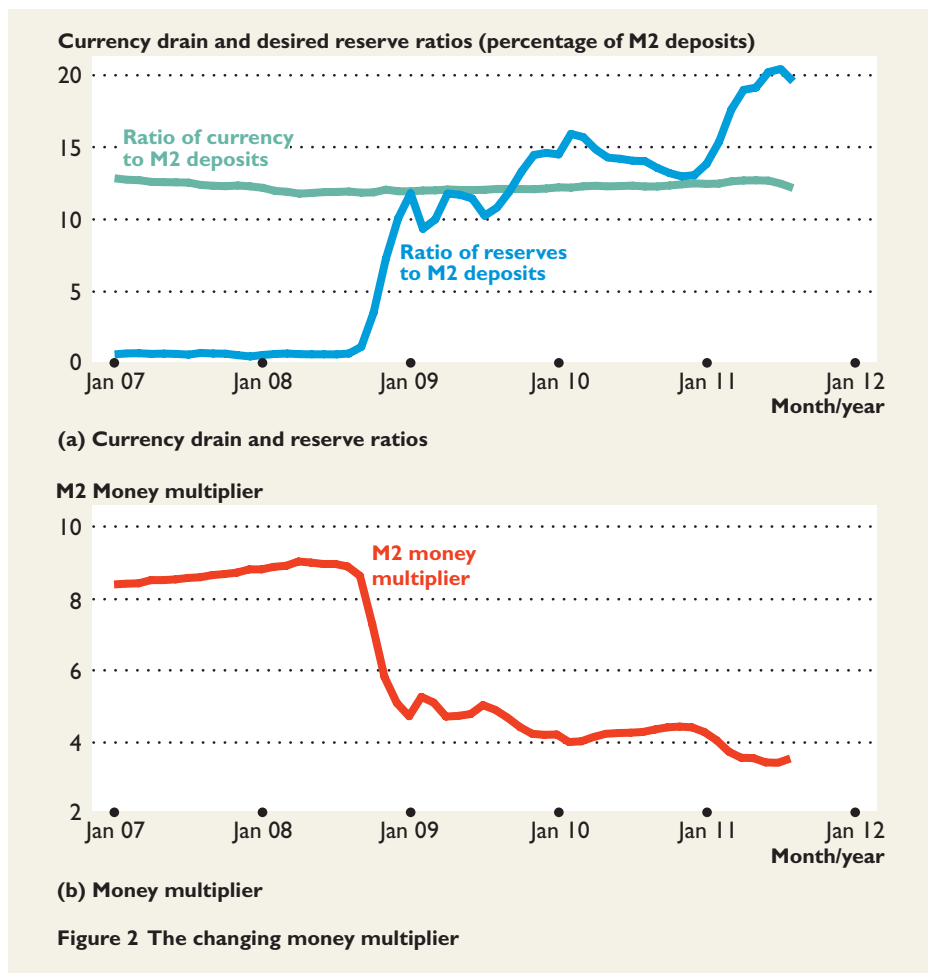
$$\text{Money multiplier} = (1 + C/D)/(R/D + C/D).$$

Notice the $D/D = 1$; C/D is the currency drain ratio, and R/D is the desired reserves ratio.

If the currency drain ratio is 50 percent, $C/D = 0.5$; and if the desired reserve ratio is 10 percent, $R/D = 0.1$ so the money multiplier is $1.5/0.6 = 2.5$.

The larger the reserve ratio and the larger the currency drain ratio, the smaller is the money multiplier.

The reserve ratio and the currency drain ratio that determine the magnitude of the money multiplier are not constant, so neither is the money multiplier constant. You can see in *Eye on Creating Money* below that the desired reserve ratio and money multiplier changed dramatically in 2008.



similar increase in the quantity of money. Figure 2 shows the reason.

In 2008, the banks' desired reserve ratio, in part (a), increased tenfold from its normal level of 1.2 percent to 12 percent. This increase brought a crash in the money multiplier, in part (b), from a normal value of 9 to an unusually low value of 5.

The surge in the desired reserve ratio is the sole reason for the collapse in the money multiplier. You can see, in part (a), that the other influence on the multiplier, the currency drain ratio, barely changed.

The failure of Lehman Brothers signalled to the banks that they faced an unusually high level of risk and this was the main source of the increase in the desired reserve ratio. As the risk faced by banks returns to normal, the desired reserve ratio will fall, and when this happens the Fed will decrease the monetary base or create an explosion in the quantity of money.

MyEconLab

You can work these problems in Study Plan 18.4 and get instant feedback.



CHECKPOINT 18.4

Explain how the banking system creates money and how the Fed controls the quantity of money.

Practice Problems

1. How do banks create new deposits by making loans, and what factors limit the amount of deposits and loans that they can create?
2. If the Fed makes an open market sale of \$1 million of securities, who can buy the securities? What initial changes occur if the Fed sells to a bank?
3. If the Fed makes an open market sale of \$1 million of securities, what is the process by which the quantity of money changes? What factors determine the change in the quantity of money?

In the News

Fed doubles monetary base

During the fourth quarter of 2008, the Fed doubled the monetary base but the quantity of money (M2) increased by only 5 percent.

Source: Federal Reserve

Why did M2 not increase by much more than 5 percent? What would have happened to the quantity of M2 if the Fed had kept the monetary base constant?

Solutions to Practice Problems

1. Banks can make loans when they have excess reserves. When a bank makes a loan, it creates a new deposit for the person who receives the loan. The amount of deposits created (loans made) is limited by the banks' excess reserves, its desired reserve ratio, and the currency drain ratio.
2. The Fed sells securities to banks or the public, but not the government. The initial change is a decrease in the monetary base of \$1 million. Ownership of the securities passes from the Fed to the bank, and the Fed's assets decrease by \$1 million. The bank pays for the securities by decreasing its reserves at the Fed by \$1 million. The Fed's liabilities decrease by \$1 million. The bank's total assets are unchanged, but it has \$1 million less in reserves and \$1 million more in securities.
3. When the Fed sells securities to a bank, the bank's reserves decrease by \$1 million. The bank's deposits do not change, so the bank is short of reserves. The bank calls in loans and deposits decrease by the same amount. The desired reserve ratio and the currency drain ratio determine the decrease in the quantity of money. The larger the desired reserve ratio or the currency drain ratio, the smaller is the decrease in the quantity of money.

Solution to In the News

M2 equals the money multiplier, $(1 + C/D)/(R/D + C/D)$, multiplied by the monetary base. (R/D is the banks' desired reserve ratio and C/D is the currency drain ratio). M2 didn't increase by more because the banks increased their desired reserve ratio, R/D , which decreased the money multiplier. If the Fed had kept the monetary base unchanged, M2 would have decreased because the money multiplier decreased.

CHAPTER SUMMARY

Key Points

1 Define money and describe its functions.

- Money is anything that serves as a generally accepted means of payment.
- Money functions as a medium of exchange, unit of account, and store of value.
- M1 consists of currency held by individuals and businesses, travelers' checks, and checkable deposits owned by individuals and businesses. M2 consists of M1 plus savings deposits, small time deposits, and money market funds.

2 Describe the functions of banks.

- The deposits of commercial banks and thrift institutions are money.
- Banks borrow short term and lend long term and make a profit on the spread between the interest rates that they pay and receive.

3 Describe the functions of the Federal Reserve System (the Fed).

- The Federal Reserve is the central bank of the United States.
- The Fed influences the economy by setting the required reserve ratio for banks, by setting the discount rate, by open market operations, and by taking extraordinary measures in a financial crisis.

4 Explain how the banking system creates money and how the Fed controls the quantity of money.

- Banks create money by making loans.
- The maximum quantity of deposits the banks can create is limited by the monetary base, the banks' desired reserves, and desired currency holding.
- When the Fed buys securities in an open market operation, it creates bank reserves. When the Fed sells securities in an open market operation, it destroys bank reserves.
- An open market operation has a multiplier effect on the quantity of money.

Key Terms

Banking system, 482
 Barter, 477
 Central bank, 487
 Commercial bank, 482
 Currency, 478
 Discount rate, 489
 Excess reserves, 492
 Federal funds rate, 484

Federal Open Market Committee, 488
 Federal Reserve System (the Fed), 487
 Fiat money, 478
 M1, 478
 M2, 478
 Means of payment, 476
 Medium of exchange, 477
 Monetary base, 489

Money, 476
 Money multiplier, 497
 Open market operation, 489
 Required reserve ratio, 483
 Reserves, 483
 Store of value, 477
 Unit of account, 477

MyEconLab

You can work these problems in Chapter 18 Study Plan and get instant feedback.

LIST 1

- Store coupons for noodles
- A \$100 Amazon.com gift certificate
- Frequent flier miles
- Credit available on your Visa card
- The dollar coins that a coin collector owns

TABLE 1

| Assets | | Liabilities | |
|-----------------------|-----|--------------------|-----|
| (millions of dollars) | | | |
| Reserves at the Fed | 20 | Checkable deposits | 80 |
| Cash in vault | 5 | Savings deposits | 120 |
| Securities | 75 | | |
| Loans | 100 | | |

CHAPTER CHECKPOINT

Study Plan Problems and Applications

1. What is money? Would you classify any of the items in List 1 as money?
2. What are the three functions that money performs? Which of the following items perform some but not all of these functions, and which perform all of these functions? Which of the items are money?
 - A checking account at the Bank of America
 - A dime
 - A debit card
3. Monica transfers \$10,000 from her savings account at the Bank of Alaska to her money market fund. What is the immediate change in M1 and M2?
4. Terry takes \$100 from his checking account and deposits the \$100 in his savings account. What is the immediate change in M1 and M2?
5. Suppose that banks had deposits of \$500 billion, a desired reserve ratio of 4 percent and no excess reserves. The banks had \$15 billion in notes and coins. Calculate the banks' reserves at the central bank.
6. Explain the Fed's policy tools and briefly describe how each works.
7. Table 1 shows a bank's balance sheet. The bank has no excess reserves and there is no currency drain. Calculate the bank's desired reserve ratio.
8. The Fed buys \$2 million of securities from AIG. If the desired reserve ratio is 0.1 and there is no currency drain, calculate the bank's excess reserves as soon as the open market purchase is made, the maximum amount of loans that the banking system can make, and the maximum amount of new money that the banking system can create.

Use the following information to work Problems 9 and 10.

If the desired reserve ratio is 5 percent, the currency drain ratio is 20 percent of deposits, and the central bank makes an open market purchase of \$1 million of securities, calculate the change in

9. The monetary base and the change in its components.
10. The quantity of money, and how much of the new money is currency and how much is bank deposits.

Use the following information to work Problems 11 and 12.

South Korea: Bank reserves raised

To rein in spending, the Bank of Korea raised the required reserve ratio to 7 percent from 5 percent—the first raise in almost 17 years. With higher required reserves, banks will have to cut the amount of loans they make.

Source: *The New York Times*, November 24, 2006

11. Explain why the higher required reserve ratio means that banks will have to cut the amount of loans they can make.
12. Assuming that the currency drain is zero and that the desired reserve ratio equals the required reserve ratio, calculate the change in the money multiplier that results from the increase in Korea's required reserve ratio.

Instructor Assignable Problems and Applications

Your instructor can assign these problems as homework, a quiz, or a test in [MyEconLab](#).

1. When the Fed increased the monetary base between 2008 and 2011, which component of the monetary base increased most: banks' reserves or currency? What happened to the reserves that banks borrowed from the Fed?
2. What happened to the money multiplier between 2008 and 2011? What would the money multiplier have been if the currency drain ratio had increased? What would the money multiplier have been if the banks' desired reserve ratio had not changed?
3. What are the three functions that money performs? Which of the items in List 1 perform some but not all of these functions and which of the items are money?
4. Naomi buys \$1,000 worth of American Express travelers' checks and charges the purchase to her American Express card. What is the immediate change in M1 and M2?
5. A bank has \$500 million in checkable deposits, \$600 million in savings deposits, \$400 million in small time deposits, \$950 million in loans to businesses, \$500 million in government securities, \$20 million in currency, and \$30 million in its reserve account at the Fed. Calculate the bank's deposits that are part of M1, deposits that are part of M2, the bank's loans, securities, and reserves.
6. What can the Fed do to increase the quantity of money and keep the monetary base constant? Explain why the Fed would or would not
 - Change the currency drain ratio.
 - Change the required reserve ratio.
 - Change the discount rate.
 - Conduct an open market operation.

Use Table 1, which shows a bank's balance sheet, to work Problems 7 and 8. The desired reserve ratio on all deposits is 5 percent and there is no currency drain.

7. Calculate the bank's excess reserves. If the bank uses all of these excess reserves to make a loan, what is the quantity of the loan and the quantity of total deposits after the bank has made the loan?
8. If there is no currency drain, what is the quantity of loans and the quantity of total deposits when the bank has no excess reserves?

Use the following information to work Problems 9 and 10.

Inflation triggers more bank tightening

To control inflation by limiting bank loans, the People's Bank announced that it would raise the required reserve ratio for commercial banks from 21 percent to 21.5 percent.

Source: *South China Morning Post*, June 15, 2011

9. Compare the required reserve ratio in China on June 15, 2011 and the required reserve ratio on checkable deposits in the United States today.
10. If the currency drain ratio in China and the United States is 10 percent of deposits, compare the money multipliers in the two countries.

LIST 1

- An antique clock
- An S&L savings deposit
- Your credit card
- The coins in the Fed's museum
- Government securities

TABLE 1

| Assets | | Liabilities | |
|-----------------------|-----|--------------------|-----|
| (millions of dollars) | | | |
| Reserves at the Fed | 25 | Checkable deposits | 90 |
| Cash in vault | 15 | Savings deposits | 110 |
| Securities | 60 | | |
| Loans | 100 | | |

MyEconLab

You can work this quiz in Chapter 18 Study Plan and get instant feedback.

Multiple Choice Quiz

- A commodity or token is money if it is _____.
 - generally accepted as means of payment
 - a store of value
 - used in a barter transaction
 - completely safe as a store of value
- Money in the United States today includes _____.
 - currency and deposits at both banks and the Fed
 - the currency in people's wallets, stores' tills, and the bank deposits that people and businesses own
 - currency in ATMs and people's bank deposits
 - the banks' reserves and bank deposits owned by individuals and businesses
- Rick withdraws \$500 from his savings account, keeps \$100 as currency, and deposits \$400 in his checking account.
 - M1 increases by \$400 and M2 decreases by \$500.
 - M1 does not change, but M2 decreases by \$500.
 - M1 does not change, but M2 decreases by \$400.
 - M1 increases by \$500 and M2 does not change.
- Commercial banks' assets include _____.
 - bank deposits of individuals and businesses and bank reserves
 - loans to individuals and businesses and government securities
 - bank reserves and the deposits in M2
 - government securities and borrowed funds
- The Fed's policy tools include all the following *except* _____.
 - required reserve ratio and open market operations
 - quantitative easing
 - discount rate
 - taxing banks' deposits at the Fed
- A commercial bank creates money when it does all the following *except* _____.
 - decreases its excess reserves
 - makes loans
 - creates deposits
 - puts cash in its ATMs
- An open market _____ of \$100 million of securities _____.
 - purchase; increases bank reserves
 - sale; increases bank reserves
 - purchase; decreases the Fed's liabilities
 - sale; increases the Fed's liabilities
- The money multiplier _____.
 - increases if banks increase their desired reserve ratio
 - increases if the currency drain ratio increases
 - is 1 if the desired reserve ratio equals the currency drain ratio
 - decreases if banks increase their desired reserve ratio



Why did the U.S. economy go into recession in 2008?

Aggregate Supply and Aggregate Demand

When you have completed your study of this chapter, you will be able to

- 1 Define and explain the influences on aggregate supply.
- 2 Define and explain the influences on aggregate demand.
- 3 Explain how trends and fluctuations in aggregate demand and aggregate supply bring economic growth, inflation, and the business cycle.



CHAPTER CHECKLIST

19.1 AGGREGATE SUPPLY

The purpose of the aggregate supply–aggregate demand model is to explain how real GDP and the price level are determined. The model uses similar ideas to those that you encountered in Chapter 4 where you learned how the quantity and price are determined in a competitive market. But the *aggregate supply–aggregate demand model* (*AS-AD model*) isn't just an application of the competitive market model. Some differences arise because the *AS-AD model* is a model of an imaginary market for the total of all the final goods and services that make up real GDP. The quantity in this “market” is real GDP and the price is the price level measured by the GDP price index.

The *quantity of real GDP supplied* is the total amount of final goods and services that firms in the United States plan to produce and it depends on the quantities of

- Labor employed
- Capital, human capital, and the state of technology
- Land and natural resources
- Entrepreneurial talent

You saw in Chapter 17 that at full employment, real GDP equals *potential GDP*. The quantities of land, capital and human capital, the state of technology, and the amount of entrepreneurial talent are fixed. Labor market equilibrium determines the quantity of labor employed, which is equal to the quantity of labor demanded and the quantity of labor supplied at the equilibrium real wage rate.

Over the business cycle, real GDP fluctuates around potential GDP because the quantity of labor employed fluctuates around its full employment level. The aggregate supply–aggregate demand model explains these fluctuations.

We begin on the supply side with the basics of aggregate supply.

■ Aggregate Supply Basics

Aggregate supply is the relationship between the quantity of real GDP supplied and the price level when all other influences on production plans remain the same. This relationship can be described as follows:

Other things remaining the same, the higher the price level, the greater is the quantity of real GDP supplied, and the lower the price level, the smaller is the quantity of real GDP supplied.

Figure 19.1 illustrates aggregate supply as an aggregate supply schedule and aggregate supply curve. The aggregate supply schedule lists the quantities of real GDP supplied at each price level, and the upward-sloping *AS* curve graphs these points.

The figure also shows potential GDP: \$13 trillion in the figure. When the price level is 110, the quantity of real GDP supplied is \$13 trillion, which equals potential GDP (at point C on the *AS* curve).

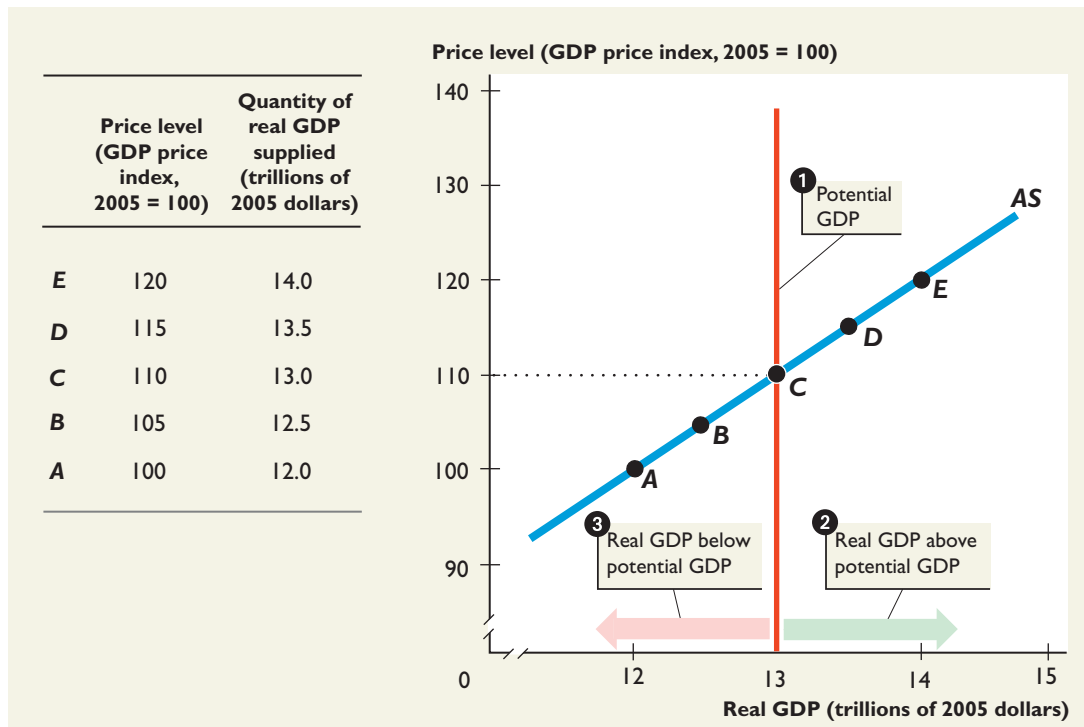
Along the aggregate supply curve, the price level is the only influence on production plans that changes. A rise in the price level brings an increase in the quantity of real GDP supplied and a movement up along the aggregate supply curve; a fall in the price level brings a decrease in the quantity of real GDP supplied and a movement down along the aggregate supply curve.

Aggregate supply

The relationship between the quantity of real GDP supplied and the price level when all other influences on production plans remain the same.

FIGURE 19.1
Aggregate Supply Schedule and Aggregate Supply Curve

MyEconLab Animation



The aggregate supply schedule and aggregate supply curve, AS, show the relationship between the quantity of real GDP supplied and the price level when all other influences on production plans remain the same. Each point A through E on the AS curve corresponds to the row identified by the same letter in the schedule.

- 1 Potential GDP is \$13 trillion, and when the price level is 110, real GDP equals potential GDP.
- 2 If the price level is above 110, real GDP exceeds potential GDP.
- 3 If the price level is below 110, real GDP is less than potential GDP.

Among the other influences on production plans that remain constant along the AS curve are

- The money wage rate
- The money prices of other resources

In contrast, along the potential GDP line, when the price level changes, the money wage rate and the money prices of other resources change by the same percentage as the change in the price level to keep the real wage rate (and other real prices) at the full-employment equilibrium level.

Why the AS Curve Slopes Upward

Why does the quantity of real GDP supplied increase when the price level rises and decrease when the price level falls? The answer is that a movement along the AS curve brings a change in the real wage rate (and changes in the real cost of other resources whose money prices are fixed). If the price level rises, the real wage rate falls, and if the price level falls, the real wage rate rises. When the real wage rate changes, firms change the quantity of labor employed and the level of production.

Think about a concrete example. A ketchup producer has a contract with its workers to pay them \$20 an hour. The firm sells ketchup for \$1 a bottle. The real wage rate of a ketchup bottling worker is 20 bottles of ketchup. That is, the firm

must sell 20 bottles of ketchup to buy one hour of labor. Now suppose the price of ketchup falls to 50 cents a bottle. The real wage rate of a bottling worker has increased to 40 bottles—the firm must now sell 40 bottles of ketchup to buy one hour of labor.

If the price of a bottle of ketchup increased, the real wage rate of a bottling worker would fall. For example, if the price increased to \$2 a bottle, the real wage rate would be 10 bottles per worker—the firm needs to sell only 10 bottles of ketchup to buy one hour of labor.

Firms respond to a change in the real wage rate by changing the quantity of labor employed and the quantity produced. For the economy as a whole, employment and real GDP change. There are three ways in which these changes occur:

- Firms change their output rate.
- Firms shut down temporarily or restart production.
- Firms go out of business or start up in business.

Change in Output Rate

To change its output rate, a firm must change the quantity of labor that it employs. It is profitable to hire more labor if the additional labor costs less than the revenue it generates. If the price level rises and the money wage rate doesn't change, an extra hour of labor that was previously unprofitable becomes profitable. So when the price level rises and the money wage rate doesn't change, the quantity of labor demanded and production increase. If the price level falls and the money wage rate doesn't change, an hour of labor that was previously profitable becomes unprofitable. So when the price level falls and the money wage rate doesn't change, the quantity of labor demanded and production decrease.

Temporary Shutdowns and Restarts

A firm that is incurring a loss might foresee a profit in the future. Such a firm might decide to shut down temporarily and lay off its workers.

The price level relative to the money wage rate influences temporary shutdown decisions. If the price level rises relative to wages, fewer firms decide to shut down temporarily; so more firms operate and the quantity of real GDP supplied increases. If the price level falls relative to wages, a larger number of firms find that they cannot earn enough revenue to pay the wage bill and so temporarily shut down. The quantity of real GDP supplied decreases.

Business Failure and Startup

People create businesses in the hope of earning a profit. When profits are squeezed or when losses arise, more firms fail, fewer new firms start up, and the number of firms decreases. When profits are generally high, fewer firms fail, more firms start up, and the number of firms increases.

The price level relative to the money wage rate influences the number of firms in business. If the price level rises relative to wages, profits increase, the number of firms in business increases, and the quantity of real GDP supplied increases. If the price level falls relative to wages, profits fall, the number of firms in business decreases, and the quantity of real GDP supplied decreases.

In a severe recession, business failure can be contagious. The failure of one firm puts pressure on both its suppliers and its customers and can bring a flood of failures and a large decrease in the quantity of real GDP supplied.

■ Changes in Aggregate Supply

Aggregate supply changes when any influence on production plans other than the price level changes. In particular, aggregate supply changes when

- Potential GDP changes.
- The money wage rate changes.
- The money prices of other resources change.

Change in Potential GDP

Anything that changes potential GDP changes aggregate supply and shifts the aggregate supply curve. Figure 19.2 illustrates such a shift. You can think of point C as an anchor point. The AS curve and potential GDP line are anchored at this point, and when potential GDP changes, aggregate supply changes along with it. When potential GDP increases from \$13 trillion to \$14 trillion, point C shifts to point C', and the AS curve and potential GDP line shift rightward together. The AS curve shifts from AS_0 to AS_1 .

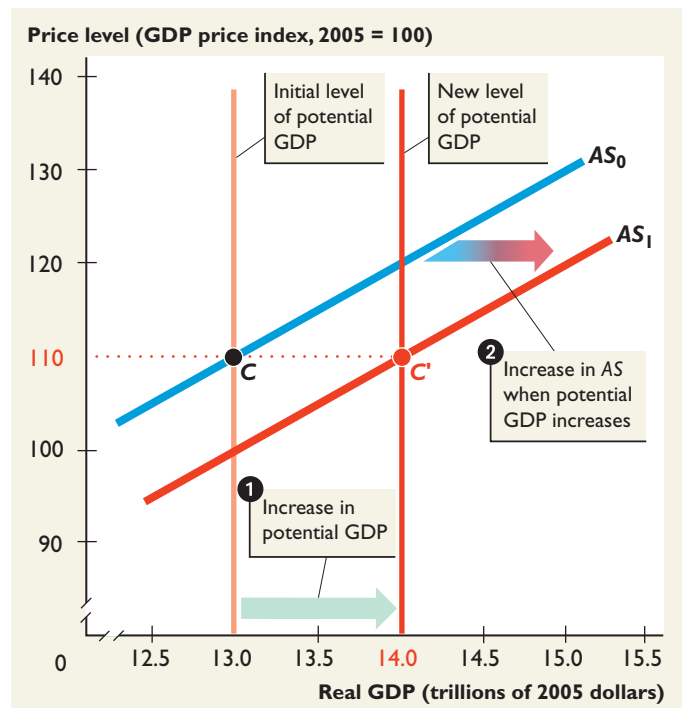
Change in Money Wage Rate

A change in the money wage rate changes aggregate supply because it changes firms' costs. The higher the money wage rate, the higher are firms' costs and the smaller is the quantity that firms are willing to supply at each price level. So an increase in the money wage rate decreases aggregate supply.

■ FIGURE 19.2

An Increase in Potential GDP

MyEconLab Animation



- 1 An increase in potential GDP increases aggregate supply.
- 2 When potential GDP increases from \$13 trillion to \$14 trillion, the aggregate supply curve shifts rightward from AS_0 to AS_1 .

Suppose that the money wage rate is \$33 an hour and the price level is 110. Then the real wage rate is \$30 an hour ($\$33 \times 100 \div 110 = \30)—see Chapter 16, p. 434. If the full-employment equilibrium real wage rate is \$30 an hour, the economy is at full employment and real GDP equals potential GDP. In Figure 19.3, the economy is at point C on the aggregate supply curve AS_0 . The money wage rate is \$33 an hour at all points on AS_0 .

Now suppose the money wage rate rises to \$36 an hour but the full-employment equilibrium real wage rate remains at \$30 an hour. Real GDP now equals potential GDP when the price level is 120, at point D on the aggregate supply curve AS_2 . (If the money wage rate is \$36 an hour and the price level is 120, the real wage rate is $\$36 \times 100 \div 120 = \30 an hour.) The money wage rate is \$36 an hour at all points on AS_2 . The rise in the money wage rate *decreases* aggregate supply and shifts the aggregate supply curve leftward from AS_0 to AS_2 .

A change in the money wage rate does not change potential GDP. The reason is that potential GDP depends only on the economy's real ability to produce and on the full-employment quantity of labor, which occurs at the equilibrium *real* wage rate. The equilibrium real wage rate can occur at any money wage rate.

Change in Money Prices of Other Resources

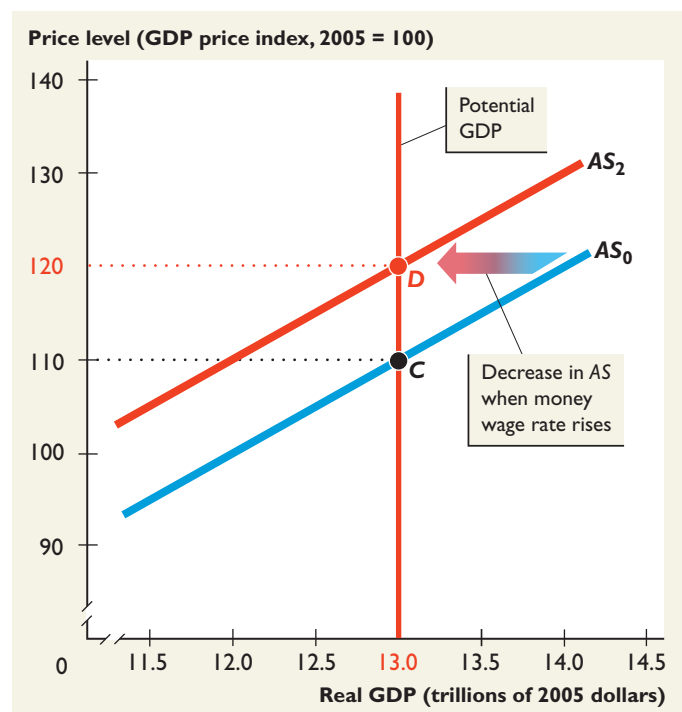
A change in the money prices of other resources has a similar effect on firms' production plans to a change in the money wage rate. It changes firms' costs. At each price level, firms' real costs change and the quantity that firms are willing to supply changes so aggregate supply changes.

FIGURE 19.3

A Change in the Money Wage Rate

MyEconLab Animation

A rise in the money wage rate decreases aggregate supply. The aggregate supply curve shifts leftward from AS_0 to AS_2 . A rise in the money wage rate does not change potential GDP.



CHECKPOINT 19.1

Define and explain the influences on aggregate supply.

Practice Problem

1. Explain the influence of each of the events in List 1 on the quantity of real GDP supplied and aggregate supply in India and use a graph to illustrate.

In the News

Minimum wage to rise in eight states

Colorado, Montana, Ohio, Washington, and Oregon recently announced their 2012 minimum wages, which contain rises ranging from 28 cents to 37 cents per hour. This translates into annual raises of between \$582 and \$770 for full-time workers.

Source: CNN Money, October 3, 2011

Explain how the rise in the minimum wage will influence aggregate supply.

Solution to Practice Problem

1. As fuel prices rise, the quantity of real GDP supplied at the current price level decreases. The AS curve shifts leftward (Figure 1).

As U.S. firms move their IT and data functions to India, real GDP supplied at the current price level increases. The AS curve shifts rightward (Figure 2).

As Wal-Mart and Starbucks open, the quantity of real GDP supplied at the current price level increases. The AS curve shifts rightward (Figure 2).

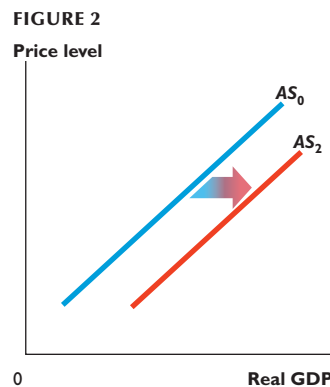
With more graduates, the number of skilled workers increases, and production increases at the current price level. The AS curve shifts rightward (Figure 2).

As the money wage rate rises, firms' costs increase and the quantity of real GDP supplied at the current price level decreases. The AS curve shifts leftward (Figure 1).

As the price level increases, other things remaining the same, businesses become more profitable and increase the quantity of real GDP supplied along the AS curve (Figure 3). The AS curve does not shift.

Solution to In the News

The rise in the money wage rate at the current price level increases the real wage rate and decreases aggregate supply. If the rise in the minimum wage increases the natural unemployment rate, potential GDP decreases and aggregate supply decreases further.



MyEconLab

You can work these problems in Study Plan 19.1 and get instant feedback.

LIST 1

- Fuel prices rise.
- U.S. firms move their IT and data functions to India.
- Wal-Mart and Starbucks open in India.
- Universities in India increase the number of engineering graduates.
- The money wage rate in India rises.
- The price level in India rises.

FIGURE 1
Price level

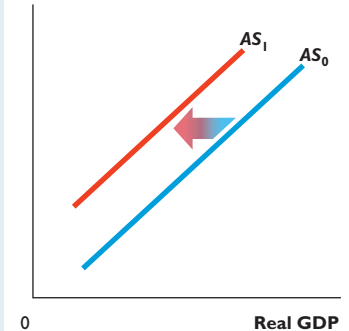
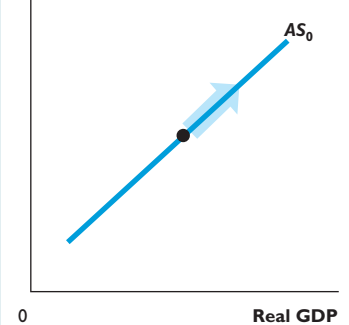


FIGURE 3
Price level



19.2 AGGREGATE DEMAND

The *quantity of real GDP demanded* (Y) is the total amount of final goods and services produced in the United States that people, businesses, governments, and foreigners plan to buy. This quantity is the sum of the real consumption expenditure (C), investment (I), government expenditure on goods and services (G), and exports (X) minus imports (M). That is,

$$Y = C + I + G + X - M.$$

Many factors influence expenditure plans. To study aggregate demand, we divide those factors into two parts: the price level and everything else. We'll first consider the influence of the price level on expenditure plans and then consider the other influences.

■ Aggregate Demand Basics

Aggregate demand

The relationship between the quantity of real GDP demanded and the price level when all other influences on expenditure plans remain the same.

Aggregate demand is the relationship between the quantity of real GDP demanded and the price level when all other influences on expenditure plans remain the same. This relationship can be described as follows:

Other things remaining the same, the higher the price level, the smaller is the quantity of real GDP demanded; and the lower the price level, the greater is the quantity of real GDP demanded.

Figure 19.4 illustrates aggregate demand by using an aggregate demand schedule and aggregate demand curve. The aggregate demand schedule lists the quantities of real GDP demanded at each price level, and the downward-sloping *AD* curve graphs these points.

Along the aggregate demand curve, the only influence on expenditure plans that changes is the price level. A rise in the price level decreases the quantity of real GDP demanded and brings a movement up along the aggregate demand curve; a fall in the price level increases the quantity of real GDP demanded and brings a movement down along the aggregate demand curve.

The price level influences the quantity of real GDP demanded because a change in the price level brings a change in

- The buying power of money
- The real interest rate
- The real prices of exports and imports

The Buying Power of Money

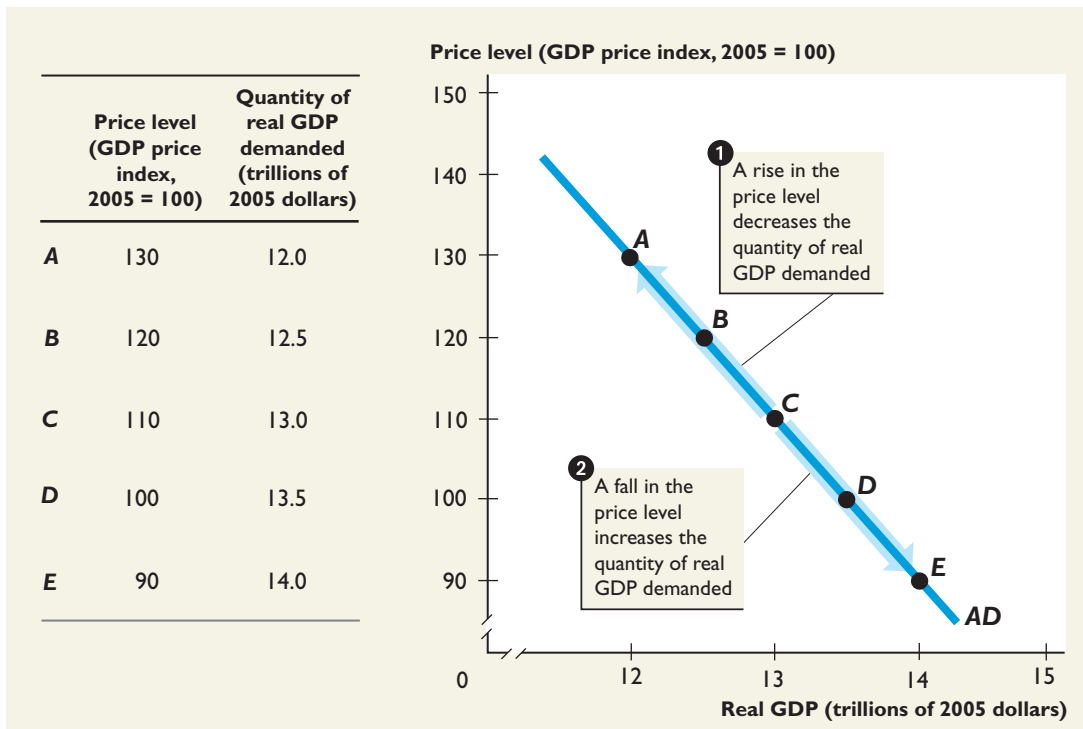
A rise in the price level lowers the buying power of money and decreases the quantity of real GDP demanded. To see why, think about the buying plans in two economies—Russia and Japan—where the price level has changed a lot in recent years.

Anna lives in Moscow, Russia. She has worked hard all summer and has saved 20,000 rubles (the ruble is the currency of Russia), which she plans to spend attending graduate school when she has earned her economics degree. So Anna's money holding is 20,000 rubles. Anna has a part-time job, and her income from this job pays her expenses. The price level in Russia rises by 100 percent. Anna needs 40,000 rubles to buy what 20,000 rubles once bought. To make up some of the fall in the buying power of her money, Anna slashes her spending.

FIGURE 19.4

Aggregate Demand Schedule and Aggregate Demand Curve

MyEconLab Animation



The aggregate demand schedule and aggregate demand curve, *AD*, show the relationship between the quantity of real GDP demanded and the price level when all other influences on expenditure plans remain the same. Each point *A* through *E* on the *AD* curve corresponds to the row identified by the same letter in the schedule.

The quantity of real GDP demanded

- ① decreases when the price level rises and
- ② increases when the price level falls.

Similarly, a fall in the price level, other things remaining the same, brings an increase in the quantity of real GDP demanded. To see why, think about the buying plans of Mika, who lives in Tokyo, Japan. She too has worked hard all summer and has saved 200,000 yen (the yen is the currency of Japan), which she plans to spend attending school next year. The price level in Japan falls by 10 percent; now Mika needs only 180,000 yen to buy what 200,000 yen once bought. With a rise in what her money buys, Mika decides to buy a DVD player.

The Real Interest Rate

When the price level rises, the real interest rate rises. An increase in the price level increases the amount of money that people want to hold—increases the demand for money. When the demand for money increases, the nominal interest rate rises. In the short run, the inflation rate does not change, so a rise in the nominal interest rate brings a rise in the real interest rate. Faced with a higher real interest rate, businesses and people delay plans to buy new capital and consumer durable goods and they cut back on spending. As the price level rises, the quantity of real GDP demanded decreases.

Anna and Mika Again Think about Anna and Mika again. Both of them want to buy a computer. In Moscow, a rise in the price level increases the demand for money and raises the real interest rate. At a real interest rate of 5 percent a year,

Anna was willing to borrow to buy the new computer. But at a real interest rate of 10 percent a year, she decides that the payments would be too high, so she delays buying it. The rise in the price level decreases the quantity of real GDP demanded.

In Tokyo, a fall in the price level lowers the real interest rate. At a real interest rate of 5 percent a year, Mika was willing to borrow to buy a low-performance computer. But at a real interest rate of close to zero, she decides to buy a fancier computer that costs more: The fall in the price level increases the quantity of real GDP demanded.

The Real Prices of Exports and Imports

When the U.S. price level rises and other things remain the same, the prices in other countries do not change. So a rise in the U.S. price level makes U.S.-made goods and services more expensive relative to foreign-made goods and services. This change in real prices encourages people to spend less on U.S.-made items and more on foreign-made items. For example, if the U.S. price level rises relative to the foreign price level, foreigners buy fewer U.S.-made cars (U.S. exports decrease) and Americans buy more foreign-made cars (U.S. imports increase).

Anna's and Mika's Imports In Moscow, Anna is buying some new shoes. With a sharp rise in the Russian price level, the Russian-made shoes that she planned to buy are too expensive, so she buys a less expensive pair imported from Brazil. In Tokyo, Mika is buying a DVD player. With the fall in the Japanese price level, a Sony DVD player made in Japan looks like a better buy than one made in Taiwan.

In the long run, when the price level changes by more in one country than in other countries, the exchange rate changes. The exchange rate change neutralizes the price level change, so this international price effect on buying plans is a short-run effect only. But in the short run, it is a powerful effect.

■ Changes in Aggregate Demand

A change in any factor that influences expenditure plans other than the price level brings a change in aggregate demand. When aggregate demand increases, the aggregate demand curve shifts rightward, which Figure 19.5 illustrates as the rightward shift of the AD curve from AD_0 to AD_1 . When aggregate demand decreases, the aggregate demand curve shifts leftward, which Figure 19.5 illustrates as the leftward shift of the AD curve from AD_0 to AD_2 . The factors that change aggregate demand are

- Expectations about the future
- Fiscal policy and monetary policy
- The state of the world economy

Expectations

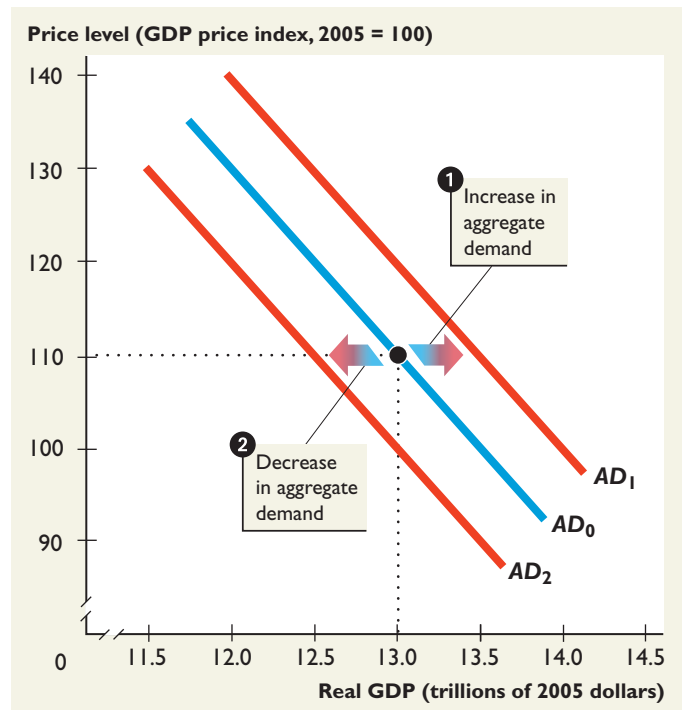
An increase in expected future income increases the amount of consumption goods (especially big-ticket items such as cars) that people plan to buy now. Aggregate demand increases. An increase in expected future inflation increases aggregate demand because people decide to buy more goods and services now before their prices rise. An increase in expected future profit increases the investment that firms plan to undertake now. Aggregate demand increases.

A decrease in expected future income, future inflation, or future profit has the opposite effect and decreases aggregate demand.

FIGURE 19.5

Change in Aggregate Demand

MyEconLab Animation



- 1 Aggregate demand *increases* if
 - Expected future income, inflation, or profits increase.
 - The government or the Federal Reserve takes steps that increase planned expenditure.
 - The exchange rate falls or the global economy expands.
- 2 Aggregate demand *decreases* if
 - Expected future income, inflation, or profits decrease.
 - The government or the Federal Reserve takes steps that decrease planned expenditure.
 - The exchange rate rises or the global economy contracts.

Fiscal Policy and Monetary Policy

We study the effects of policy actions on aggregate demand in Chapter 20. Here, we'll just briefly note that the government can use **fiscal policy**—changing taxes, transfer payments, and government expenditure on goods and services—to influence aggregate demand. The Federal Reserve can use **monetary policy**—changing the quantity of money and the interest rate—to influence aggregate demand. A tax cut or an increase in either transfer payments or government expenditure on goods and services increases aggregate demand. A cut in the interest rate or an increase in the quantity of money increases aggregate demand.

Fiscal policy

Changing taxes, transfer payments, and government expenditure on goods and services.

Monetary policy

Changing the quantity of money and the interest rate.

The World Economy

Two main influences that the world economy has on aggregate demand are the foreign exchange rate and foreign income. The foreign exchange rate is the amount of a foreign currency that you can buy with a U.S. dollar. Other things remaining the same, a rise in the foreign exchange rate decreases aggregate demand.

To see how the foreign exchange rate influences aggregate demand, suppose that \$1 exchanges for 100 Japanese yen. A Fujitsu phone made in Japan costs 12,500 yen, and an equivalent Motorola phone made in the United States costs \$110. In U.S. dollars, the Fujitsu phone costs \$125, so people around the world buy the cheaper U.S. phone. Now suppose the exchange rate rises to 125 yen per dollar. At 125 yen per dollar, the Fujitsu phone costs \$100 and is now cheaper than the Motorola phone. People will switch from the U.S. phone to the Japanese phone.

U.S. exports will decrease and U.S. imports will increase, so U.S. aggregate demand will decrease.

An increase in foreign income increases U.S. exports and increases U.S. aggregate demand. For example, an increase in income in Japan and Germany increases Japanese and German consumers' and producers' planned expenditures on U.S.-made goods and services.

■ The Aggregate Demand Multiplier

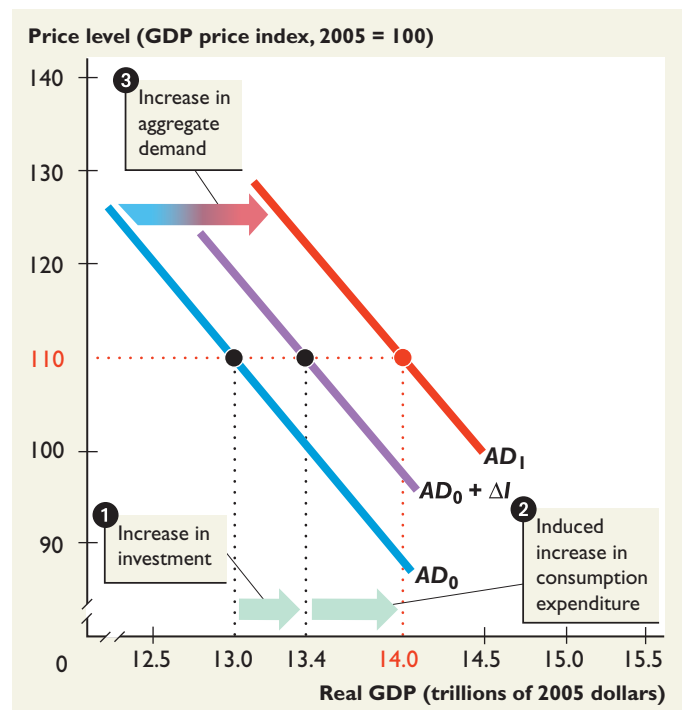
The aggregate demand multiplier is an effect that magnifies changes in expenditure plans and brings potentially large fluctuations in aggregate demand. When any influence on aggregate demand changes expenditure plans, the change in expenditure changes income; and the change in income induces a change in consumption expenditure. The increase in aggregate demand is the initial increase in expenditure plus the induced increase in consumption expenditure.

Suppose that an increase in expenditure induces an increase in consumption expenditure that is 1.5 times the initial increase in expenditure. Figure 19.6 illustrates the change in aggregate demand that occurs when investment increases by \$0.4 trillion. Initially, the aggregate demand curve is AD_0 . Investment then increases by \$0.4 trillion (ΔI) and the purple curve $AD_0 + \Delta I$ now describes aggregate spending plans at each price level. An increase in income induces an increase in consumption expenditure of \$0.6 trillion, and the aggregate demand curve shifts rightward to AD_1 .

FIGURE 19.6
The Aggregate Demand Multiplier

MyEconLab Animation

- 1 An increase in investment increases aggregate demand and increases income.
- 2 The increase in income induces an increase in consumption expenditure, so 3 aggregate demand increases by more than the initial increase in investment.



CHECKPOINT 19.2

Define and explain the influences on aggregate demand.

Practice Problems

- Mexico trades with the United States. Explain the effect of each of the following events on Mexico's aggregate demand.
 - The government of Mexico cuts income taxes.
 - The United States experiences strong economic growth.
 - Mexico sets new environmental standards that require factories to upgrade their production facilities.
- Explain the effect of each of the following events on the quantity of real GDP demanded and aggregate demand in Mexico.
 - Europe trades with Mexico and goes into a recession.
 - The price level in Mexico rises.
 - Mexico increases the quantity of money.

In the News

Durable goods orders fall, new-homes sales pick up

The BEA announced that demand for durable goods fell 5.3%, while new-home sales rose 4.2% in the second quarter of 2011. U.S. exports increased 3.6%.

Source: Bureau of Economic Analysis, September 29, 2011

Explain how the items in the news clip influence U.S. aggregate demand.

Solutions to Practice Problems

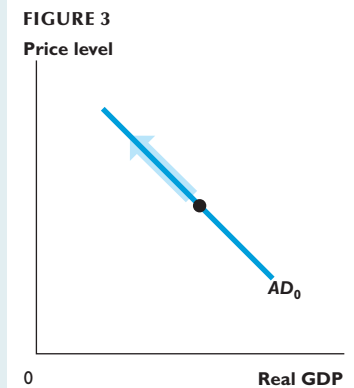
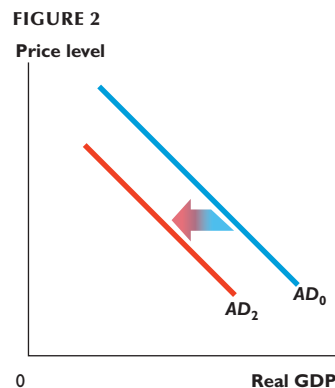
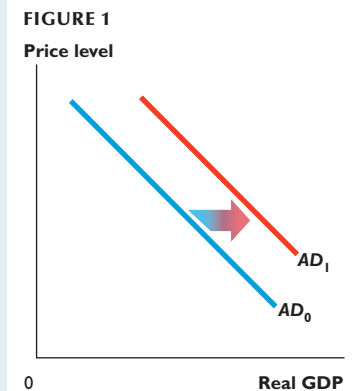
- A tax cut increases disposable income, which increases consumption expenditure, which increases aggregate demand. Strong U.S. growth increases the demand for Mexican-produced goods, which increases Mexico's aggregate demand. As factories upgrade their facilities, investment increases. Aggregate demand increases. In each case, the AD curve shifts rightward (Figure 1).
- A recession in Europe decreases the demand for Mexico's exports, so aggregate demand decreases. The AD curve shifts leftward (Figure 2). A rise in the price level decreases the quantity of real GDP demanded along the AD curve, but the AD curve does not shift (Figure 3). An increase in the quantity of money increases aggregate demand, and the AD curve shifts rightward (Figure 1).

Solution to In the News

The purchase of durable goods and new homes is investment. A decrease in durable good sales decreases aggregate demand, while the increase in new-home sales increased aggregate demand. The rise in U.S. exports is an increase in the demand for U.S.-produced goods and services, so it increased U.S. aggregate demand.

MyEconLab

You can work these problems in Study Plan 19.2 and get instant feedback.



19.3 EXPLAINING ECONOMIC TRENDS AND FLUCTUATIONS

The main purpose of the *AS-AD* model is to explain business cycle fluctuations in real GDP and the price level. But the model also helps our understanding of economic growth and inflation trends that we've studied in earlier chapters. The first step toward explaining economic trends and fluctuations is to combine aggregate supply and aggregate demand and determine macroeconomic equilibrium.

■ Macroeconomic Equilibrium

Macroeconomic equilibrium

When the quantity of real GDP demanded equals the quantity of real GDP supplied at the point of intersection of the *AD* curve and the *AS* curve.

Aggregate supply and aggregate demand determine real GDP and the price level. **Macroeconomic equilibrium** occurs when the quantity of real GDP demanded equals the quantity of real GDP supplied at the point of intersection of the *AD* curve and the *AS* curve. Figure 19.7 shows such an equilibrium at a price level of 110 and real GDP of \$13 trillion.

To see why this position is the equilibrium, think about what happens if the price level is something other than 110. Suppose the price level is 100 and real GDP is \$12 trillion (point *A* on the *AS* curve). The quantity of real GDP demanded exceeds the quantity supplied, so firms are unable to meet the demand for their output. Inventories decrease, and customers clamor for goods and services. In this situation, firms increase production and raise prices. Eventually they can meet demand when real GDP is \$13 trillion and the price level is 110.

Now suppose that the price level is 120 and that real GDP is \$14 trillion (point *B* on the *AS* curve). The quantity of real GDP demanded is less than \$14 trillion, so firms are unable to sell all their output. Unwanted inventories pile up. Firms cut production and lower prices until they can sell all their output, which occurs when real GDP is \$13 trillion and the price level is 110.

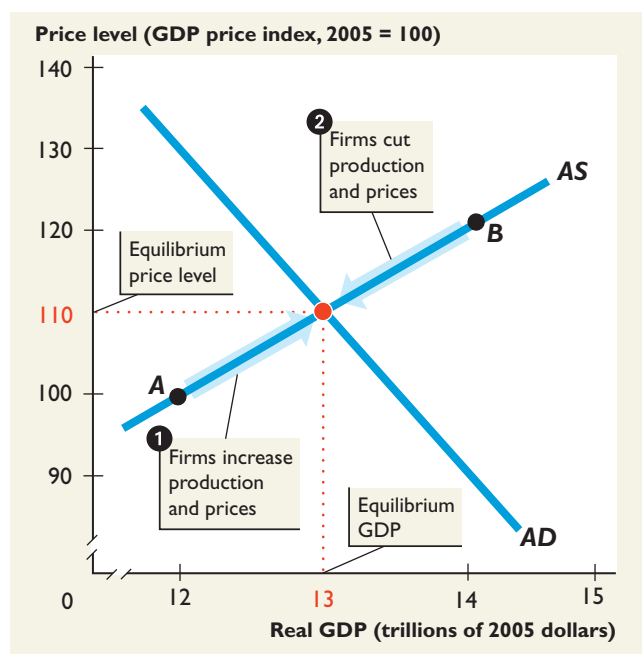
FIGURE 19.7
Macroeconomic Equilibrium

MyEconLab Animation

Macroeconomic equilibrium occurs when the quantity of real GDP supplied on the *AS* curve equals the quantity of real GDP demanded on the *AD* curve.

- At a price level of 100, the quantity of real GDP supplied is \$12 trillion at point *A*. The quantity of real GDP demanded exceeds the quantity supplied, so firms increase production and raise prices.
- At a price level of 120, the quantity of real GDP supplied is \$14 trillion at point *B*. The quantity of real GDP demanded is less than the quantity supplied, so firms cut production and lower prices.

At a price level of 110, the quantity of real GDP supplied equals the quantity of real GDP demanded in macroeconomic equilibrium.



Economic Growth and Inflation Trends

Economic growth results from a growing labor force and increasing labor productivity, which together make potential GDP grow. Inflation results from a growing quantity of money that outpaces the growth of potential GDP.

The AS-AD model can be used to understand economic growth and inflation trends. In the AS-AD model, economic growth is increasing potential GDP—a persistent rightward shift in the potential GDP line. Inflation arises from a persistent increase in aggregate demand at a faster pace than that of the increase in potential GDP—a persistent rightward shift of the AD curve at a faster pace than the growth of potential GDP. *Eye on the U.S. Economy* below shows how the AS-AD model explains U.S. economic growth and inflation trends.



EYE on the U.S. ECONOMY

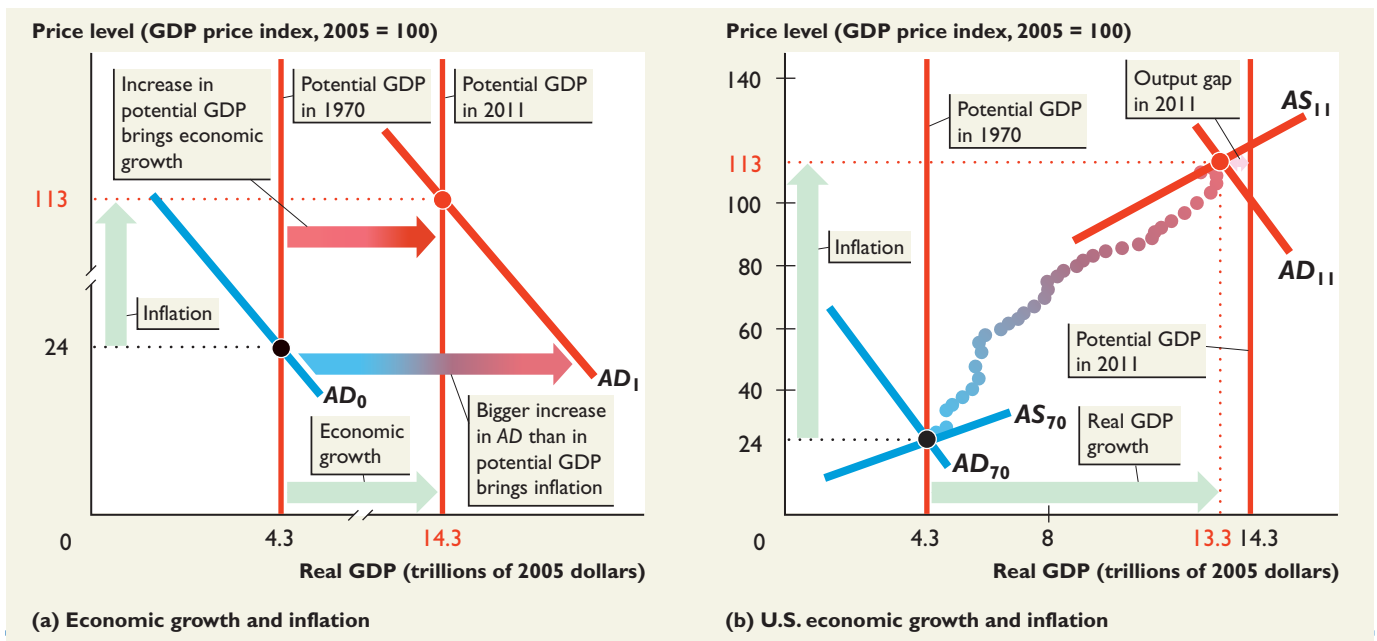
U.S. Economic Growth, Inflation, and the Business Cycle

U.S. economic growth, inflation, and the business cycle result from changes in aggregate supply and aggregate demand. A rightward movement in the U.S. potential GDP line brings economic growth and a greater rightward movement of the U.S. AD curve brings inflation. Part (a) shows the shifting curves that generate growth and inflation.

Part (b) shows the history of U.S. real GDP growth and inflation from 1970 to 2011. Each dot represents the the real GDP and price level in a year—the black dot 1970 and the red dot 2011. The rightward movement of the dots is economic growth and the upward movement is a rising price level—inflation.

When the dots follow a path that is gently rising, as during the 1990s, the inflation rate is low and real GDP growth is quite rapid. When the dots follow a path that is steep, as during the 1970s, inflation is rapid and economic growth is slow.

Notice that the dots move rightward and upward in waves and occa-



■ The Business Cycle

The business cycle results from fluctuations in aggregate supply and aggregate demand. Aggregate supply fluctuates because labor productivity grows at a variable pace, which brings fluctuations in the growth rate of potential GDP. The resulting cycle is called a **real business cycle**. But aggregate demand fluctuations are the main source of the business cycle. The key reason is that the swings in aggregate demand occur more quickly than changes in the money wage rate that change aggregate supply. The result is that the economy swings from inflationary gap to full employment to recessionary gap and back again.

Eye on the U.S. Economy below shows the most recent cycle interpreted as driven by aggregate demand fluctuations. But in the 2008–2009 recession, both aggregate demand and aggregate supply were at work as you can see on p. 525.

Real business cycle

A cycle that results from fluctuations in the pace of growth of labor productivity and potential GDP.

sionally leftward. The pattern shows the business cycle expansions and recessions.

By comparing the dots with potential GDP, we can see that the economy was at full employment in 1970, and that the recessionary gap during the 2008–2009 recession was large.

Part (c) shows how aggregate demand changes bring the business cycle, and part (d) shows the most recent cycle

from 2000 to 2011.

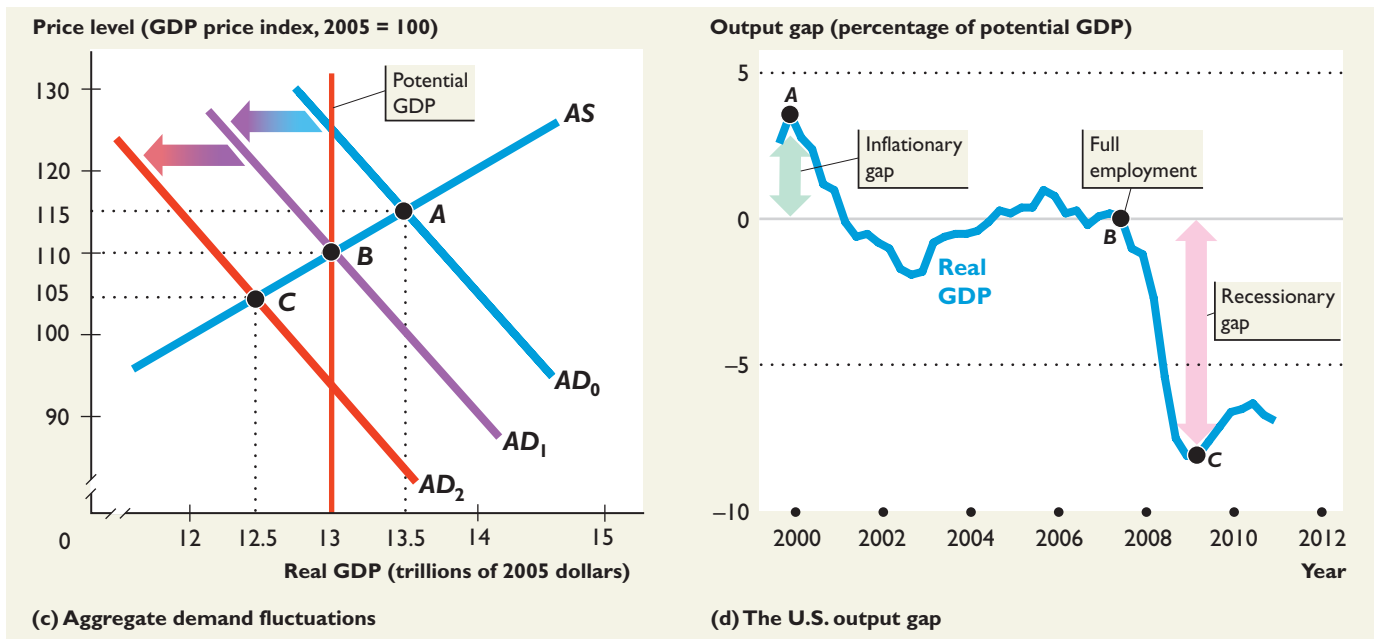
When the AD curve is AD_0 in part (c), the economy is at point A and there is an inflationary gap. Part (d) identifies the actual gap in 2000 as A.

A decrease in aggregate demand to AD_1 lowers real GDP to potential GDP and the economy moves to point B in parts (c) and (d).

A further decrease in aggregate

demand to AD_2 lowers real GDP to below potential GDP and opens up a recessionary gap at point C in both parts (c) and (d).

In reality, AD doesn't decrease. It increases at a slower pace than the increase in potential GDP, but the relative positions of the AD curve and the potential GDP line are like those shown in part (c).



SOURCES OF DATA: Bureau of Labor Statistics, Bureau of Economic Analysis, and Congressional Budget Office.

■ Inflation Cycles

You've seen that inflation occurs if aggregate demand grows faster than potential GDP. But just as there are cycles in real GDP, there are also cycles in the inflation rate. And the two cycles are related. To study the interaction of real GDP and inflation cycles, we distinguish between two sources of inflation:

- Demand-pull inflation
- Cost-push inflation

Demand-Pull Inflation

Demand-pull inflation

Inflation that starts because aggregate demand increases is called **demand-pull inflation**.

Inflation that starts because aggregate demand increases is called **demand-pull inflation**. Demand-pull inflation can be kicked off by any of the factors that change aggregate demand but the only thing that can sustain it is growth in the quantity of money.

Figure 19.9 illustrates the process of demand-pull inflation. Potential GDP is \$13 trillion. Initially, the aggregate demand curve is AD_0 , the aggregate supply curve is AS_0 , and real GDP equals potential GDP. Aggregate demand increases, shifting the aggregate demand curve to AD_1 . Real GDP increases and the price level rises. There is now an *inflationary gap*. A shortage of labor brings a rise in the money wage rate, which shifts the aggregate supply curve to AS_1 . The price level rises further and real GDP returns to potential GDP.

The quantity of money increases again, and the aggregate demand curve shifts rightward to AD_2 . The price level rises further, and real GDP again exceeds potential GDP. Yet again, the money wage rate rises and decreases aggregate supply. The AS curve shifts to AS_2 , and the price level rises further. As the quantity of money continues to grow, aggregate demand increases and the price level rises in an ongoing demand-pull inflation spiral.

■ FIGURE 19.9

A Demand-Pull Inflation

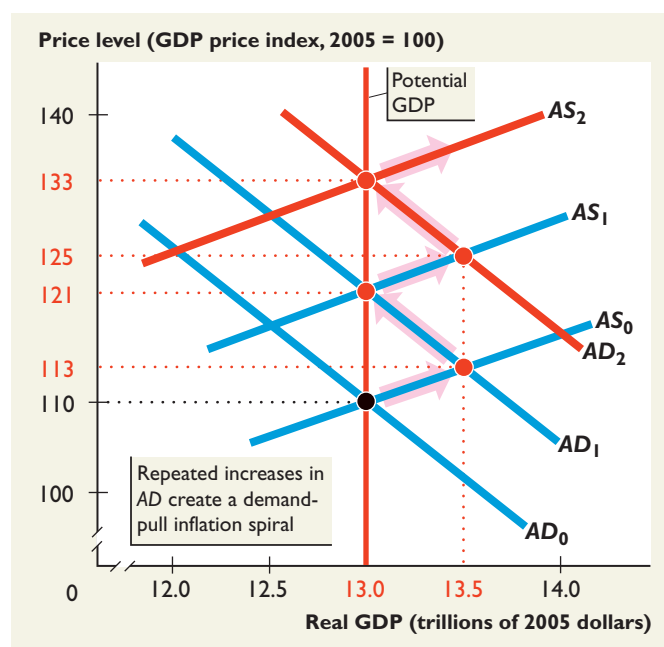
MyEconLab Animation

Each time the quantity of money increases, aggregate demand increases and the aggregate demand curve shifts rightward from AD_0 to AD_1 to AD_2 , and so on.

Each time real GDP increases above potential GDP, the money wage rate rises and the aggregate supply curve shifts leftward from AS_0 to AS_1 to AS_2 , and so on.

The price level rises from 110 to 113, 121, 125, 133, and so on.

A demand-pull inflation spiral results with real GDP fluctuating between \$13 trillion and \$13.5 trillion.



Cost-Push Inflation

Inflation that begins with an increase in cost is called **cost-push inflation**. The two main sources of cost increases are increases in the money wage rate and increases in the money prices of raw materials such as oil.

Cost-push inflation can be kicked off by an increase in costs but the only thing that can sustain it is growth in the quantity of money.

Figure 19.10 illustrates cost-push inflation. The aggregate demand curve is AD_0 , the aggregate supply curve is AS_0 , and real GDP equals potential GDP. The world price of oil rises, which decreases aggregate supply. The aggregate supply curve shifts leftward to AS_1 , the price level rises, and real GDP decreases so there is a *recessionary gap*.

When real GDP decreases, unemployment rises above its natural rate and the Fed increases the quantity of money to restore full employment. Aggregate demand increases and the AD curve shifts rightward to AD_1 . Real GDP returns to potential GDP but the price level rises further.

Oil producers now see the prices of everything they buy rising so they raise the price of oil again to restore its new higher relative price. The AS curve now shifts to AS_2 , the price level rises again and real GDP decreases again.

If the Fed responds yet again with an increase in the quantity of money, aggregate demand increases and the AD curve shifts to AD_2 . The price level rises even higher and full employment is again restored. A cost-push inflation spiral results.

The combination of a decreasing real GDP and a rising price level is called **stagflation**. You can see that stagflation poses a dilemma for the Fed. If the Fed does not respond when producers raise the oil price, the economy remains below full employment. If the Fed increases the quantity of money to restore full employment, it invites another oil price hike that will call forth yet a further increase in the quantity of money.

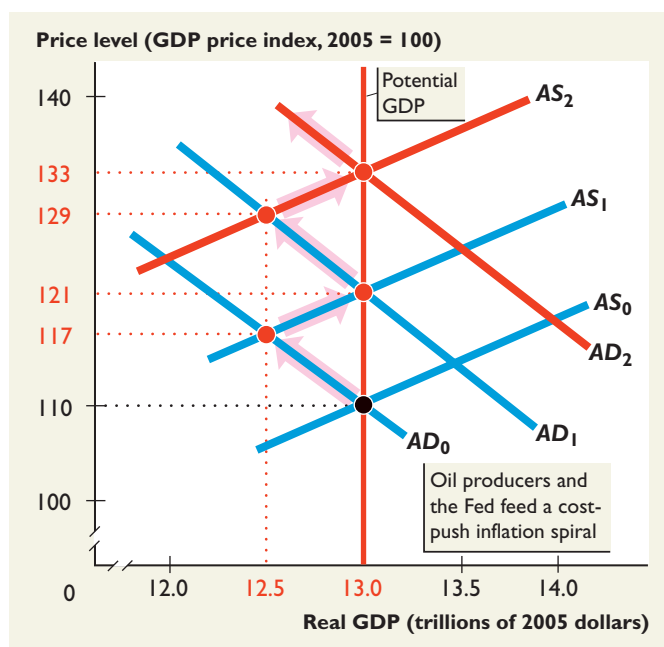
Cost-push inflation

An inflation that begins with an increase in cost.

Stagflation

The combination of recession (decreasing real GDP) and inflation (rising price level).

FIGURE 19.10
A Cost-Push Inflation



Each time a cost increase occurs, the aggregate supply curve shifts leftward from AS_0 to AS_1 to AS_2 , and so on.

Each time real GDP decreases below potential GDP, the Fed increases the quantity of money and the aggregate demand curve shifts rightward from AD_0 to AD_1 to AD_2 , and so on.

The price level rises from 110 to 117, 121, 129, 133, and so on.

A cost-push inflation spiral results with real GDP fluctuating between \$13 trillion and \$12.5 trillion.

■ Deflation and the Great Depression

When a financial crisis hit the United States in October 2008, many people feared a repeat of the dreadful events of the 1930s. From 1929 through 1933, the United States and most of the world experienced deflation and depression—the *Great Depression*. The price level fell by 22 percent and real GDP fell by 31 percent.

The recession of 2008–2009 turned out to be much less severe than the Great Depression. Real GDP fell by less than 4 percent and the price level continued to rise, although at a slower pace. Why was the Great Depression so bad and why was 2008–2009 so mild in comparison? You can answer these questions with what you’ve learned in this chapter.

During the Great Depression, banks failed and the quantity of money contracted by 25 percent. The Fed stood by and took no action to counteract the collapse of buying power, so aggregate demand also collapsed. Because the money wage rate didn’t fall immediately, the decrease in aggregate demand brought a large fall in real GDP. The money wage rate and price level fell eventually, but not until employment and real GDP had shrunk to 75 percent of their 1929 levels.

In contrast, during the 2008 financial crisis, the Fed bailed out troubled financial institutions and doubled the monetary base. The quantity of money kept growing. Also, the government increased its own expenditures, which added to aggregate demand. The combined effects of continued growth in the quantity of money and increased government expenditure limited the fall in aggregate demand and prevented a large decrease in real GDP.

The challenge that now lies ahead is to unwind the monetary and fiscal stimulus as the components of private expenditure—consumption expenditure, investment, and exports—begin to increase and return to more normal levels and so bring an increase in aggregate demand. Too much stimulus will bring an inflationary gap and faster inflation. Too little stimulus will leave a recessionary gap.

You will explore these monetary and fiscal policy actions and their effects in Chapter 20.



EYE on YOUR LIFE

Using the AS-AD Model

Using all the knowledge that you have accumulated over the term, and by watching or reading the current news, try to figure out where the U.S. economy is in its business cycle right now.

First, can you determine if real GDP is currently above, below, or at potential GDP? Second, can you determine if real GDP is expanding or contracting in a recession?

Next, try to form a view about where the U.S. economy is heading. What do you see as the main pressures on aggregate supply and aggregate demand, and in which directions are they pushing or pulling the economy?

Do you think that real GDP will expand more quickly or more slowly over the coming months? Do you think the gap between real GDP and potential GDP will widen or narrow?

How do you expect the labor market to be affected by the changes in aggregate supply and aggregate demand that you are expecting? Do you expect the unemployment rate to rise, fall, or remain constant?

Talk to your friends in class about where they see the U.S. economy right now and where it is heading. Is there a consensus or is there a wide range of opinion?



EYE on the BUSINESS CYCLE

Why Did the U.S. Economy Go into Recession in 2008?

What causes the business cycle and what caused the 2008–2009 recession?

Business Cycle Theory

The mainstream business cycle theory is that potential GDP grows at a steady rate while aggregate demand grows at a fluctuating rate.

Because the money wage rate is slow to change, if aggregate demand grows more quickly than potential GDP, real GDP moves above potential GDP and an inflationary gap emerges. The inflation rate rises and real GDP is pulled back toward potential GDP.

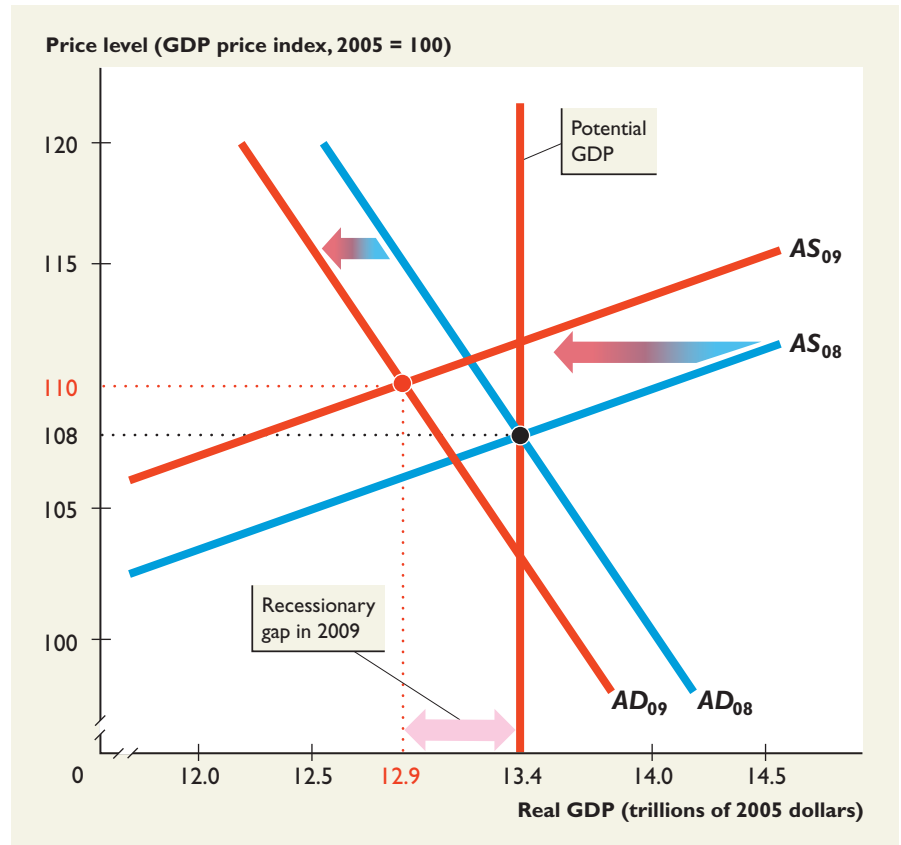
If aggregate demand grows more slowly than potential GDP, real GDP moves below potential GDP and a recessionary gap emerges. The inflation rate slows. Because the money wage rate responds very slowly to the recessionary gap, real GDP does not return to potential GDP until another increase in aggregate demand occurs.

Fluctuations in investment are the main source of fluctuations in aggregate demand. Consumption expenditure responds to changes in income.

A recession can also occur if aggregate supply decreases to bring stagflation. And a recession might occur because both aggregate demand and aggregate supply decrease.

The 2008–2009 Recession

The 2008–2009 recession is an example of a recession caused by a decrease in both aggregate demand and aggregate supply. The figure illustrates these two contributing forces.



SOURCES OF DATA: Bureau of Economic Analysis and Congressional Budget Office.

At the peak in 2008, real GDP was \$13.4 trillion and the price level was 108. In the second quarter of 2009, real GDP had fallen to \$12.9 trillion and the price level had risen to 110.

The financial crisis that began in 2007 and intensified in 2008 decreased the supply of loanable funds and investment fell. In particular, construction investment collapsed.

Recession in the global economy decreased the demand for U.S. exports, so this component of aggregate demand also decreased.

The decrease in aggregate demand was moderated by a large injection of spending by the U.S. government, but this move was not enough to stop aggregate demand from decreasing.

We cannot account for the combination of a rise in the price level and a decrease in real GDP with a decrease in aggregate demand alone. Aggregate supply must also have decreased. The rise in oil prices in 2007 and a rise in the money wage rate were the two factors that brought about the decrease in aggregate supply.

MyEconLab

You can work these problems in Study Plan 19.3 and get instant feedback.

CHECKPOINT 19.3

Explain how trends and fluctuations in aggregate demand and aggregate supply bring economic growth, inflation, and the business cycle.

Practice Problems

The U.S. economy is at full employment when the following events occur:

- A deep recession hits the world economy.
- The world oil price rises by a large amount.
- U.S. businesses expect future profits to fall.

1. Explain the effect of each event separately on aggregate demand and aggregate supply. How will real GDP and the price level change in the short run?
2. Explain the combined effect of these events on real GDP and the price level.
3. Which event, if any, brings stagflation?

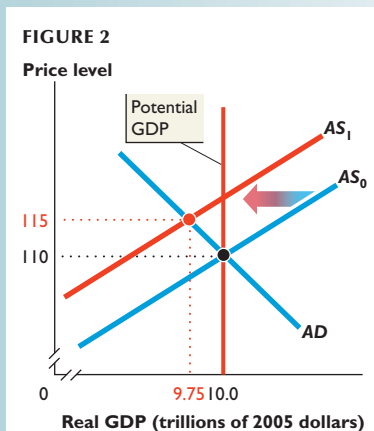
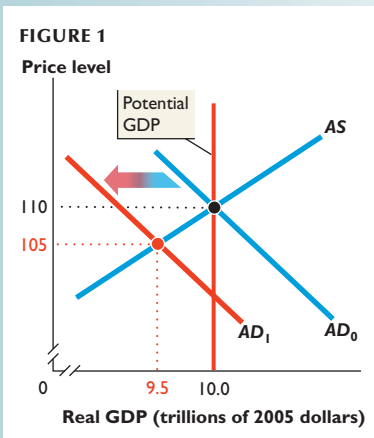
In the News

U.S. incomes fall for first time in 2 years

Consumer spending rose 0.2 percent in August, down from 0.7 percent in July. Incomes fell 0.1 percent—the first decline since October 2009. Consumer spending accounts for 70 percent of economic activity.

Source: Associated Press, September 30, 2011

Explain the effect of these events in terms of the *AS-AD* model.



Solutions to Practice Problems

1. A deep recession in the world economy decreases U.S. aggregate demand. The *AD* curve shifts leftward. In the short run, U.S. real GDP decreases and the price level falls (Figure 1). A rise in the world oil price decreases U.S. aggregate supply. The *AS* curve shifts leftward. In the short run, U.S. real GDP decreases and the price level rises (Figure 2). A fall in expected future profits decreases U.S. aggregate demand. The *AD* curve shifts leftward. In the short run, U.S. real GDP decreases and the price level falls (Figure 1).
2. All three events decrease U.S. real GDP (Figures 1 and 2). The deep world recession and the fall in expected future profits decrease the price level (Figure 1). The rise in the world oil price increases the price level (Figure 2). So the combined effect on the price level is ambiguous.
3. Stagflation is a rising price level and a decreasing real GDP together. The rise in the world oil price brings stagflation because it decreases aggregate supply, decreases real GDP, and raises the price level (Figure 2).

Solution to In the News

The news clip gives no information about aggregate supply. Consumption expenditure is 70 percent of aggregate demand, so an increase in consumption expenditure would increase aggregate demand, GDP, and aggregate incomes. But incomes fell, so the other components of aggregate demand (investment, government expenditure, net exports) must have decreased, moving the economy down along the *AS* curve. Or aggregate supply must have decreased, moving the economy up along the *AD* curve.

CHAPTER SUMMARY

Key Points

1 Define and explain the influences on aggregate supply.

- Aggregate supply is the relationship between the quantity of real GDP supplied and the price level when all other influences on production plans remain the same.
- The *AS* curve slopes upward because with a given money wage rate, a rise in the price level lowers the real wage rate, increases the quantity of labor demanded, and increases the quantity of real GDP supplied.
- A change in potential GDP, a change in the money wage rate, or a change in the money price of other resources changes aggregate supply.

2 Define and explain the influences on aggregate demand.

- Aggregate demand is the relationship between the quantity of real GDP demanded and the price level when all other influences on expenditure plans remain the same.
- The *AD* curve slopes downward because a rise in the price level decreases the buying power of money, raises the real interest rate, raises the real price of domestic goods compared with foreign goods, and decreases the quantity of real GDP demanded.
- A change in expected future income, inflation, and profits; a change in fiscal policy and monetary policy; and a change in the foreign exchange rate and foreign real GDP all change aggregate demand—the aggregate demand curve shifts.

3 Explain how trends and fluctuations in aggregate demand and aggregate supply bring economic growth, inflation, and the business cycle.

- Aggregate demand and aggregate supply determine real GDP and the price level in macroeconomic equilibrium, which can occur at full employment or above or below full employment.
- Away from full employment, gradual changes in the money wage rate move real GDP toward potential GDP.
- Economic growth is a persistent increase in potential GDP and inflation occurs when aggregate demand grows at a faster rate than potential GDP.
- Business cycles occur because aggregate demand and aggregate supply fluctuate.
- Demand-pull and cost-push forces bring inflation and real GDP cycles.

Key Terms

Aggregate demand, 512
 Aggregate supply, 506
 Cost-push inflation, 523
 Demand-pull inflation, 522

Fiscal policy, 515
 Full-employment equilibrium, 519
 Inflationary gap, 519
 Macroeconomic equilibrium, 518

Monetary policy, 515
 Real business cycle, 521
 Recessionary gap, 519
 Stagflation, 523

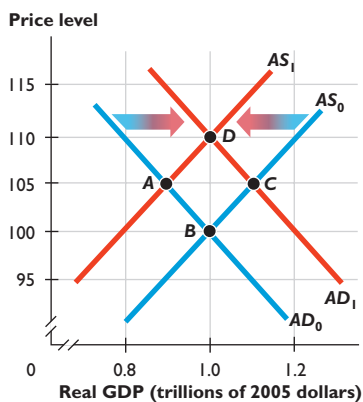
MyEconLab

You can work these problems in Chapter 19 Study Plan and get instant feedback.

TABLE 1

| Price level (GDP price index) | Real GDP demanded (billions of 2005 dollars) | Real GDP supplied (billions of 2005 dollars) |
|-------------------------------|--|--|
| 90 | 900 | 600 |
| 100 | 850 | 700 |
| 110 | 800 | 800 |
| 120 | 750 | 900 |
| 130 | 700 | 1,000 |

FIGURE 1



CHAPTER CHECKPOINT

Study Plan Problems and Applications

- As more people in India have access to higher education, explain how potential GDP and aggregate supply will change in the long run.
- Explain the effect of each of the following events on the quantity of U.S. real GDP demanded and the demand for U.S. real GDP:
 - The world economy goes into a strong expansion.
 - The U.S. price level rises.
 - Congress raises income taxes.
- The United States is at full employment when the Fed cuts the quantity of money, and all other things remain the same. Explain the effect of the cut in the quantity of money on aggregate demand in the short run.
- Table 1 sets out an economy's aggregate demand and aggregate supply schedules. What is the macroeconomic equilibrium? If potential GDP is \$600 billion, what is the type of macroeconomic equilibrium? Explain how real GDP and the price level will adjust in the long run.
- Suppose that the U.S. economy has a recessionary gap and the world economy goes into an expansion. Explain the effect of the expansion on U.S. real GDP and unemployment in the short run.
- Suppose that the Fed increases the quantity of money. On an *AS-AD* graph show the effect of the increased quantity of money on the macroeconomic equilibrium in the short run. Explain the adjustment process that restores the economy to full employment.

Use Figure 1 and the fact that initially, the aggregate supply curve is AS_0 and the aggregate demand curve is AD_0 to work Problems 7 to 9.

- Some events shifted the aggregate demand curve from AD_0 to AD_1 . Describe two events that could have created this change in aggregate demand. What is the equilibrium after aggregate demand changed? If potential GDP is \$1 trillion, the economy is at what type of macroeconomic equilibrium?
- Some events shifted the aggregate supply curve from AS_0 to AS_1 . Describe two events that could have created this change in aggregate supply. What is the equilibrium after aggregate supply changed? If potential GDP is \$1 trillion, is there an inflationary gap, a recessionary gap, or no output gap?
- Some events changed aggregate demand from AD_0 to AD_1 and aggregate supply from AS_0 to AS_1 . What is the new macroeconomic equilibrium?
- Japan economic recovery under way as deflation eases**
Consumer prices excluding fresh food declined 0.4 percent from a year earlier—the smallest drop since 2009. The unemployment rate unexpectedly fell to 4.9 percent from 5.1 percent—the first decrease since September. The economy will emerge from its slump “soon.”

Source: Bloomberg, January 27, 2011

On an *AS-AD* graph show the macroeconomic equilibrium in Japan in 2010. Show why economic recovery is under way and deflation easing.

Instructor Assignable Problems and Applications

Your instructor can assign these problems as homework, a quiz, or a test in [MyEconLab](#).

1. What, according to the mainstream theory of the business cycle, is the most common source of recession: a decrease in aggregate demand, a decrease in aggregate supply, or both? Which is the most likely component of aggregate demand to start a recession? How does the aggregate demand multiplier influence a recession?
2. Suppose that the United States is at full employment. Explain the effect of each of the following events on aggregate supply:
 - Union wage settlements push the money wage rate up by 10 percent.
 - The price level increases.
 - Potential GDP increases.
3. Suppose that the United States is at full employment. Then the federal government cuts taxes, and all other influences on aggregate demand remain the same. Explain the effect of the tax cut on aggregate demand in the short run.

Use the following information to work Problems 4 and 5.

Because fluctuations in the world oil price make the U.S. short-run macroeconomic equilibrium fluctuate, someone suggests that the government should vary the tax rate on oil, lowering the tax when the world oil price rises and increasing the tax when the world oil price falls, to stabilize the oil price in the U.S. market.

4. How would such an action influence aggregate demand?
5. How would such an action influence aggregate supply?
6. Table 1 sets out the aggregate demand and aggregate supply schedules in Japan. Potential GDP is 600 trillion yen. What is the short-run macroeconomic equilibrium? Does Japan have an inflationary gap or a recessionary gap and what is its magnitude?
7. Suppose that the world price of oil rises. On an *AS-AD* graph, show the effect of the world oil price rise on U.S. macroeconomic equilibrium in the short run. Explain the adjustment process that restores the economy to full employment.
8. Explain the effects of a global recession on the U.S. macroeconomic equilibrium in the short run. Explain the adjustment process that restores the economy to full employment.

Use the following information to work Problems 9 and 10.

House GOP changes course on infrastructure

House Republicans abandoned plans to slash U.S. infrastructure spending and now say they are trying to find ways to pay for a multiyear highway-construction program, which will exceed \$300 billion.

Source: *The Wall Street Journal*, September 30, 2011

9. Explain the effect of the government's increased expenditure on infrastructure on U.S. aggregate demand and aggregate supply.
10. The United States in 2011 has a recessionary gap. Use the *AS-AD* model to show the effect on U.S. real GDP as the new infrastructure is completed.

TABLE 1

| Price level (GDP price index) | Real GDP demanded | Real GDP supplied |
|-------------------------------------|-------------------------|----------------------|
| | (trillions of 2000 yen) | |
| 75 | 600 | 400 |
| 85 | 550 | 450 |
| 95 | 500 | 500 |
| 105 | 450 | 550 |
| 115 | 400 | 600 |
| 125 | 350 | 650 |
| 135 | 300 | 700 |

MyEconLab

You can work this quiz in Chapter 19 Study Plan and get instant feedback.

Multiple Choice Quiz

- Aggregate supply increases when _____.
 - the price level rises
 - the money wage rate falls
 - consumption increases
 - the money price of oil increases
- When potential GDP increases, _____.
 - aggregate demand increases
 - aggregate supply increases
 - both aggregate demand and aggregate supply increase
 - the price level rises
- The quantity of real GDP demanded increases if _____.
 - the buying power of money increases
 - the money wage rate rises
 - the price level falls
 - the nominal interest rate falls
- An increase in expected future income increases _____.
 - consumption expenditure, which increases current aggregate demand
 - investment, which increases current aggregate supply
 - the demand for money, which decreases current aggregate demand
 - future consumption expenditure and has no effect on current aggregate demand
- Macroeconomic equilibrium occurs when the quantity of real GDP _____ equals the quantity of _____.
 - demanded; real GDP supplied
 - demanded; potential GDP
 - supplied; potential GDP
 - demanded; real GDP supplied and potential GDP
- If the economy is at full employment and the Fed increases the quantity of money, _____.
 - aggregate demand increases, a recessionary gap appears, and the money wage rate starts to rise
 - aggregate supply increases, the price level starts to fall, and an expansion begins
 - aggregate demand increases, an inflationary gap appears, and the money wage rate starts to rise
 - potential GDP and aggregate supply increase together and the price level does not change
- Over the past decade, the demand for goods produced in China has brought a sustained increase in demand for China's exports that has outstripped the growth of supply. As a result, China has experienced a _____.
 - period of stable prices and sustained economic growth
 - rising price level and demand-pull inflation
 - rising price level and cost-push inflation
 - rising price level and a falling real wage rate



Can fiscal stimulus end a recession?
Did the Fed save us from another
Great Depression?

Fiscal Policy and Monetary Policy

When you have completed your study of this chapter,
you will be able to

- 1 Describe the federal budget process and explain the effects of fiscal policy.
- 2 Describe the Federal Reserve's monetary policy process and explain the effects of monetary policy.



CHAPTER CHECKLIST

20.1 THE FEDERAL BUDGET AND FISCAL POLICY

Fiscal policy

The use of the federal budget to achieve the macroeconomic objectives of high and sustained economic growth and full employment.

Federal budget

An annual statement of the tax revenues, outlays, and surplus or deficit of the government of the United States.

Balanced budget

The budget balance when tax revenues equal outlays.

Budget surplus

The budget balance when tax revenues exceed outlays.

Budget deficit

The budget balance when outlays exceed tax revenues.

Fiscal policy is the use of the federal budget to achieve the macroeconomic objectives of high and sustained economic growth and full employment. What is the federal budget and how is it made?

■ The Federal Budget

The **federal budget** is an annual statement of the tax revenues, outlays and surplus or deficit of the government of the United States.

Budget Time Line

The President and Congress make the federal budget on the time line shown in Figure 20.1. The President proposes and approves the budget, but Congress makes the tough decisions on spending and taxes. The House of Representatives and the Senate develop their ideas in their respective budget committees, and conferences between the two houses resolve differences and draft the bills that become the Budget Act.

Budget Balance: Surplus or Deficit

The government's budget balance is equal to tax revenues minus outlays. That is,

$$\text{Budget balance} = \text{Tax revenues} - \text{Outlays.}$$

If tax revenues equal outlays, the government has a **balanced budget**. The government has a **budget surplus** if tax revenues exceed outlays. The government has a **budget deficit** if outlays exceed tax revenues. Table 20.1 shows the revenue, outlay, and budget balance projection for the 2012 fiscal year.

Surplus, Deficit, and Debt

To finance a budget deficit, the government borrows, and it repays debt when it has a surplus. The amount of debt outstanding that has arisen from past budget

■ TABLE 20.1

The Federal Budget in Fiscal 2012

| Item | Projections (billions of dollars) |
|-----------------------------------|--------------------------------------|
| Tax Revenues | 2,850 |
| Personal income taxes | 1,118 |
| Social Security taxes | 1,025 |
| Corporate income taxes | 421 |
| Indirect taxes | 286 |
| Outlays | 4,091 |
| Transfer payments | 2,566 |
| Expenditure on goods and services | 1,165 |
| Debt interest | 360 |
| Balance | -1,241 |

The federal budget for 2012 was expected to be in a large deficit. Tax revenues of \$2,850 billion were expected to be \$1,241 billion less than outlays of \$4,091 billion.

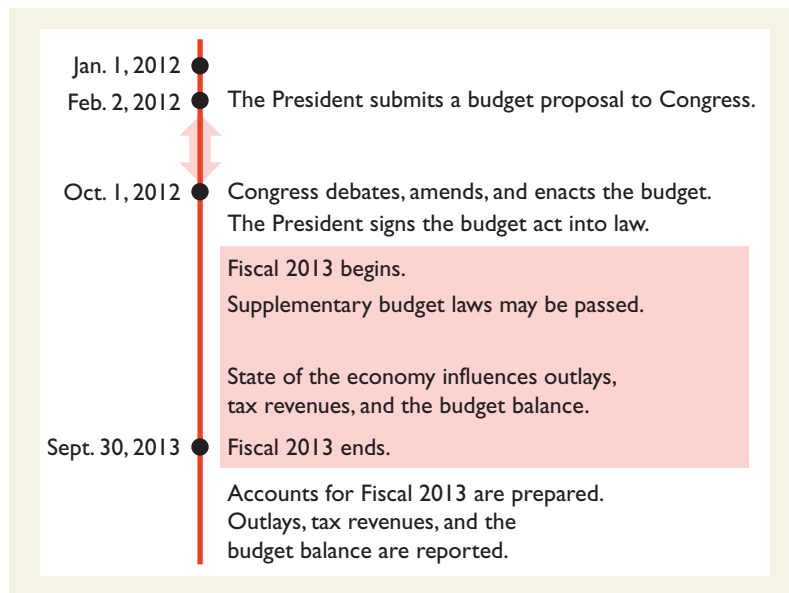
Personal income taxes are the largest revenue source and transfer payments are the largest outlay.

SOURCE OF DATA: *Budget of the United States Government, Fiscal Year 2012*, Table 14.1.

FIGURE 20.1

The Federal Budget Time Line for Fiscal 2013

MyEconLab Animation



The U.S. fiscal year runs from October 1 to September 30 in the next calendar year. Fiscal 2013 is the fiscal year that begins on October 1, 2012.

The federal budget process begins with the President's proposals in February. Congress debates and amends these proposals and enacts a budget before the start of the fiscal year on October 1. The President signs the budget act into law. Throughout the fiscal year, Congress might pass supplementary budget laws. The budget outcome is calculated after the end of the fiscal year.

deficits is called **national debt**. The national debt at the end of a fiscal year equals the national debt at the end of the previous fiscal year plus the budget deficit or minus the budget surplus. For example,

$$\text{Debt at the end of 2013} = \text{Debt at the end of 2012} + \text{Budget deficit in 2013}$$

Eye on the Past on p. 534 shows the history of the U.S. budget deficit and debt.

A Personal Analogy

The government's budget and debt are like your budget and debt, only bigger. If you take a student loan each year to go to school, you have a budget deficit and a growing debt. After graduating, if you have a job and repay some of your loan each year, you have a budget surplus and a shrinking debt.

Types of Fiscal Policy

Fiscal policy actions can be

- Discretionary fiscal policy
- Automatic fiscal policy

Discretionary Fiscal Policy A fiscal action that is initiated by an act of Congress is called **discretionary fiscal policy**. It requires a change in a spending program or in a tax law. For example, an increase in defense spending or a cut in the income tax rate is a discretionary fiscal policy.

Automatic Fiscal Policy A fiscal action that is triggered by the state of the economy is called **automatic fiscal policy**. For example, an increase in unemployment induces an increase in payments to the unemployed. A fall in incomes induces a decrease in tax revenues.

National debt

The amount of government debt outstanding—debt that has arisen from past budget deficits.

Discretionary fiscal policy

A fiscal policy action that is initiated by an act of Congress.

Automatic fiscal policy

A fiscal policy action that is triggered by the state of the economy.



EYE on the PAST

Federal Revenues, Outlays, Deficits, and Debt

In 1940, in the first year of World War II, for every dollar earned, the federal government collected 6.5 cents in taxes and spent 9.3 cents. By 1943, at the depth of the most terrible war in history, the government was spending 40 cents of every dollar earned and collecting 12 cents in taxes. The government deficit in 1943 and 1944 was almost 30 percent of GDP.

The result of these enormous deficits was a mushrooming government debt. By 1946, when the debt-to-GDP ratio (debt as a percentage of GDP) peaked, the government owed more than a year's GDP.

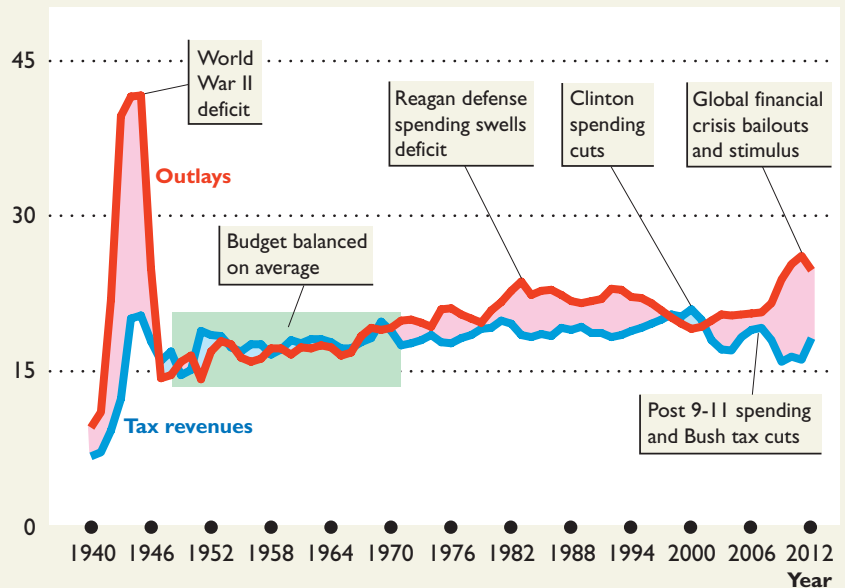
During the 1950s and 1960s, the government's debt-to-GDP ratio tumbled as balanced budgets combined with rapid real GDP growth. By 1974, the debt-to-GDP ratio had fallen to a low of 23 percent.

Budget deficits returned during the 1980s as the defense budget swelled and some tax rates were cut. The result was a growing debt-to-GDP ratio that climbed to almost 50 percent by 1995.

Expenditure restraint combined with sustained real GDP growth lowered the debt-to-GDP ratio during the 1990s, but a surge in expenditures on defense and homeland security, further tax cuts, and a spending surge in 2009 and 2010 to fight global financial crisis and recession, all combined to swell the debt-to-GDP ratio again.

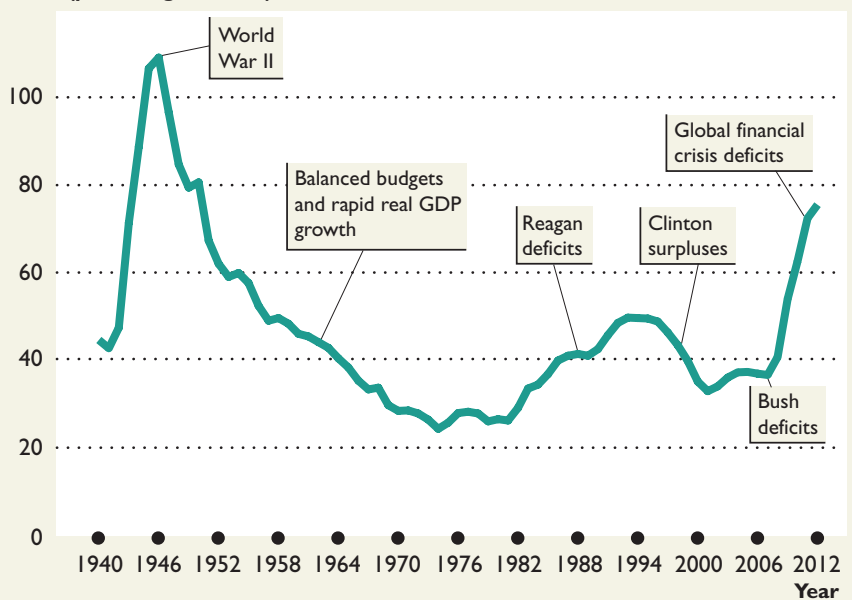
SOURCE OF DATA: *Budget of the U.S. Government, Fiscal Year 2012, Historical Tables, Tables 7.1 and 14.1.*

Tax revenues and outlays (percentage of GDP)



(a) Tax revenues, outlays, and deficits

Debt (percentage of GDP)



(b) Debt

■ Discretionary Fiscal Policy: Demand-Side Effects

Discretionary fiscal policy influences both aggregate demand and aggregate supply. We'll look first at the demand-side effects. Changes in government expenditure and changes in taxes have multiplier effects on aggregate demand similar to the multiplier effect that you met in Chapter 19.

The Government Expenditure Multiplier

The **government expenditure multiplier** is the effect of a change in government expenditure on goods and services on aggregate demand. Government expenditure is a component of aggregate expenditure, so when government expenditure increases, aggregate demand increases. Real GDP increases and induces an increase in consumption expenditure, which brings a further increase in aggregate expenditure. A multiplier process like the one described in Chapter 19 (p. 516) ensues.

Government expenditure multiplier

The effect of a change in government expenditure on goods and services on aggregate demand.

The Tax Multiplier

The **tax multiplier** is the magnification effect of a change in taxes on aggregate demand. A *decrease* in taxes *increases* disposable income, which increases consumption expenditure. A decrease in taxes works like an increase in government expenditure. But the magnitude of the tax multiplier is smaller than the government expenditure multiplier because a \$1 tax cut generates *less than* \$1 of additional expenditure. The marginal propensity to consume determines the initial increase in expenditure induced by a tax cut and the magnitude of the tax multiplier. For example, if the marginal propensity to consume is 0.75, then the initial increase in consumption expenditure induced by a \$1 tax cut is only 75 cents. In this case, the tax multiplier is 0.75 times the magnitude of the government expenditure multiplier.

Tax multiplier

The effect of a change in taxes on aggregate demand.

The Transfer Payments Multiplier

The **transfer payments multiplier** is the effect of a change in transfer payments on aggregate demand. This multiplier works like the tax multiplier but in the opposite direction. An *increase* in transfer payments *increases* disposable income, which *increases* consumption expenditure. The magnitude of the transfer payments multiplier is similar to that of the tax multiplier. Just as a \$1 tax cut generates *less than* \$1 of additional expenditure, so also does a \$1 increase in transfer payments. Again, it is the marginal propensity to consume that determines the increase in expenditure induced by an increase in transfer payments.

Transfer payments multiplier

The effect of a change in transfer payments on aggregate demand.

The Balanced Budget Multiplier

The **balanced budget multiplier** is the magnification effect on aggregate demand of a *simultaneous* change in government expenditure and taxes that leaves the budget balance unchanged. The balanced budget multiplier is not zero. It is greater than zero because a \$1 increase in government expenditure injects a dollar more into aggregate demand while a \$1 tax rise (or decrease in transfer payments) takes less than \$1 from aggregate demand. So when both government expenditure and taxes increase by \$1, aggregate demand increases.

Balanced budget multiplier

The effect on aggregate demand of a *simultaneous* change in government expenditure and taxes that leaves the budget balance unchanged.

The magnitudes of the multiplier effects that we've just described are the subject of debate and disagreement among economists and we look at the range of views in *Eye on Fiscal Stimulus* on p. 542. For now, we will sidestep that debate and see how a successful discretionary fiscal policy works.

Fiscal stimulus

An increase in government outlays or a decrease in tax revenues designed to boost real GDP and create or save jobs.



Cash for Clunkers stimulated aggregate demand.

A Successful Fiscal Stimulus

Fiscal stimulus is achieved by increasing government outlays or decreasing tax revenues when real GDP is below potential GDP and the government wants to boost real GDP and create or save jobs. Figure 20.2 shows us how a successful stimulus package increases aggregate demand.

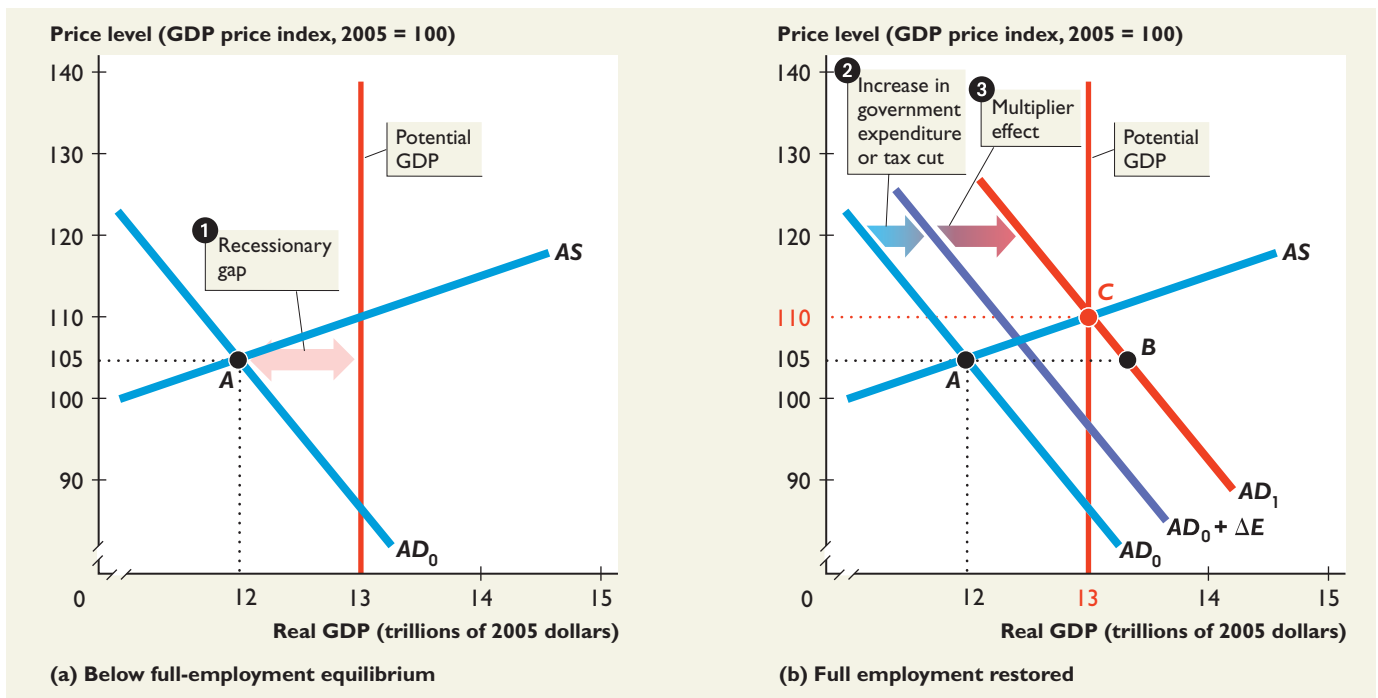
In Figure 20.2(a), potential GDP is \$13 trillion but real GDP is only \$12 trillion. The economy is at point *A* and there is a *recessionary gap* (see Chapter 19, p. 519).

To eliminate the recessionary gap and restore full employment, the government introduces a fiscal stimulus. An increase in government expenditure or a tax cut increases aggregate expenditure by ΔE . If this were the only change in spending plans, the *AD* curve would become $AD_0 + \Delta E$ in Figure 20.2(b). But the initial increase in government expenditure sets off a multiplier process, which increases consumption expenditure. As the multiplier process plays out, aggregate demand increases and the *AD* curve shifts rightward to AD_1 .

With no change in the price level, the economy would move from the initial point *A* to point *B* on AD_1 . But the increase in aggregate demand combined with the upward-sloping aggregate supply curve brings a rise in the price level, and the economy moves to a new equilibrium at point *C*. The price level rises to 110, real GDP increases to \$13 trillion, and the economy returns to full employment.

FIGURE 20.2
Fiscal Stimulus

MyEconLab Animation



Potential GDP is \$13 trillion. At point *A*, real GDP is \$12 trillion, and ① there is a \$1 trillion recessionary gap. ② An increase in government expenditure or a tax cut increases expenditure by ΔE .

③ The multiplier increases induced expenditure. The *AD* curve shifts rightward to AD_1 , the price level rises to 110, real GDP increases to \$13 trillion, and the recessionary gap is eliminated.

■ Discretionary Fiscal Policy: Supply-Side Effects

Both government expenditure and taxes influence aggregate supply, and we now look at the supply-side effects of fiscal policy.

Supply-Side Effects of Government Expenditure

Government provides services such as law and order, public education, and public health that increase production possibilities. For example, one of the reasons why we are more productive than are the citizens of the poor developing countries is that we are better educated and healthier than they are. Government also provides social infrastructure capital such as highways, bridges, tunnels, and dams that increase our production possibilities.

Government services and capital could be overprovided to the point at which they no longer increase production possibilities. But it is unlikely that we have reached such a point.

An *increase* in government expenditure that increases the quantities of productive services and capital increases potential GDP and increases aggregate supply.

The construction of the Hoover Dam during the 1930s and the interstate highway system that was begun during the 1950s are two of the most spectacular examples of an increase in productive government expenditures. The Hoover Dam increased the production of electricity, improved water management, and brought expanded recreation facilities. The interstate highway system improved transportation services, increased the productivity of truck drivers and other road users, and provided the foundation for the development of suburban shopping malls and entertainment centers.

Supply-Side Effects of Taxes

To pay for the productive services and capital that the government provides, it collects taxes. All taxes create disincentives to work, save, and provide entrepreneurial services.

Taxes on labor income decrease the supply of labor. A smaller supply of labor means a higher equilibrium real wage rate and a smaller equilibrium quantity of labor employed. With a smaller quantity of labor employed, potential GDP and aggregate supply are smaller than they would otherwise be.

Taxes on the income from capital decrease saving and decrease the supply of capital. A smaller supply of capital means a higher equilibrium real interest rate and a smaller equilibrium quantity of investment and capital employed. With a smaller quantity of capital, potential GDP and aggregate supply are smaller than they would otherwise be.

Taxes on the incomes of entrepreneurs weaken the incentive to take risks and create new businesses. With a smaller number of firms, the quantities of labor and capital employed are lower and potential GDP and aggregate supply are smaller than they would otherwise be.

An *increase* in taxes strengthens the disincentive effects that we've just described. It decreases the supply of labor, capital, and entrepreneurial services; decreases potential GDP; and decreases aggregate supply. And a tax cut has the opposite effects. It strengthens the incentives to work, save, and provide entrepreneurial services. So a tax cut increases potential GDP and increases aggregate supply.

Scale of Government Supply-Side Effects

If both government expenditure and taxes increase, the scale of government grows. More productive government expenditure increases potential GDP, but higher taxes to pay for the expenditure decreases potential GDP. So an increase in the scale of government might increase or decrease potential GDP and aggregate supply depending on which effect is stronger. Some economists (and politicians) believe that a larger scale of government increases potential GDP and aggregate supply despite the weakened incentives from higher tax rates. Others believe that the incentive effects are so powerful that smaller government is more productive and brings a greater potential GDP and aggregate supply.

Supply-Side Effects on Potential GDP

Figure 20.3 illustrates the effects of fiscal policy on potential GDP. Initially, the production function is PF_0 , the full employment quantity of labor is 250 billion hours, and potential GDP is \$13 trillion (see Chapter 17, pp. 452–453).

A tax cut strengthens the incentive to work, which increases the supply of labor and increases the equilibrium level of employment at full employment. In Figure 20.3, employment increases to 260 billion hours a year. The tax cut also strengthens the incentive to save and invest, which increases the quantity of capital. With more capital per worker, labor productivity increases and the production function shifts upward to PF_1 .

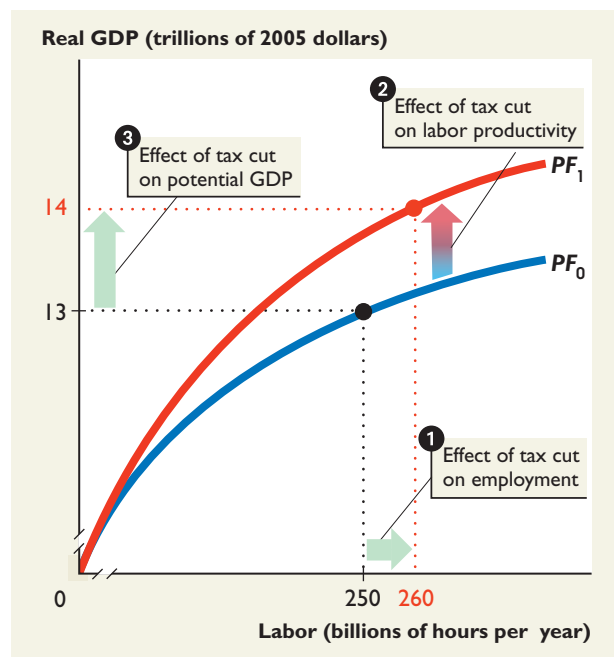
At the increased level of employment and on the new higher production function, potential GDP is \$14 trillion. An increase in potential GDP increases aggregate supply, which also increases actual real GDP.

FIGURE 20.3

The Effects of Fiscal Policy on Aggregate Supply

MyEconLab Animation

- 1 A tax cut strengthens the incentive to work, increases the supply of labor, and increases employment.
- 2 A tax cut strengthens the incentive to save and invest, which increases the quantity of capital and increases labor productivity.
- 3 The combined effect of a tax cut on employment and labor productivity increases potential GDP.



■ Limitations of Discretionary Fiscal Policy

Discretionary fiscal stabilization policy is hampered by four problems:

- Law-making time lag
- Shrinking area of discretion
- Estimating potential GDP
- Economic forecasting

Law-Making Time Lag

The law-making time lag is the amount of time it takes Congress to pass the laws needed to change taxes or spending. The economy might benefit from fiscal stimulation today, but by the time Congress acts, a different fiscal medicine might be needed.

Shrinking Area of Discretion

During the 2000s, federal spending increased faster than in any other peacetime period. An increased security threat brought increased expenditure on the military and homeland security, and an aging population brought increased expenditure on entitlement programs such as Social Security and Medicare.

The growth of entitlement programs has not only shrunk the area of discretionary spending. It has also created a time bomb that has a potentially devastating effect on economic growth and future fiscal policy. (See *Eye on the U.S. Economy* below.)

Today, 80 percent of the federal budget is effectively off limits for discretionary policy action, and the remaining 20 percent of items are very hard to cut.



EYE on the U.S. ECONOMY

A Social Security and Medicare Time Bomb

The age distribution of the U.S. population today is dominated by the surge in the birth rate after World War II that created what is called the “baby boom generation.” There are 77 million “baby boomers” and the first of them started collecting Social Security pensions in 2008 and became eligible for Medicare benefits in 2011. By 2030, all the baby boomers will be supported by Social Security and Medicare and benefit payments will have doubled.

The government’s Social Security and Medicare obligations are a debt and are just as real as the bonds that the government issues to finance its current budget deficit.

How big is this debt? Economists Jagadeesh Gokhale and Kent Smetters estimate that it was \$80 trillion in 2010 and that it grows by \$2 trillion a year. To put \$80 trillion in perspective, U.S. GDP in 2012 was \$14 trillion. So the fiscal imbalance was 5.7 times the value of one year’s production.

The time-bomb points to a catastrophic future. How can the federal government meet its Social Security and Medicare obligations? There are four alternatives:

- Raise income taxes
- Raise Social Security taxes
- Cut Social Security benefits
- Cut other government spending

Gokhale and Smetters estimate that income taxes would need to be raised by 69 percent, or Social Security taxes raised by 95 percent, or Social Security benefits cut by 56 percent. Even if the government stopped all other spending, including that on national defense, it would not be able to pay its bills. By combining the four measures, the pain from each could be lessened, but the pain would still be severe.

Congress appointed a “Super Committee” to find ways of trimming the federal budget by \$1.5 trillion, but it failed to reach an agreement on how to make this spending cut. Some tough fiscal policy choices lie ahead.

Estimating Potential GDP

Potential GDP is hard to estimate and sometimes we don't even get the sign of the output gap right. Because it is not always possible to tell whether real GDP is below, above, or at potential GDP, a discretionary fiscal action might move real GDP *away* from potential GDP instead of toward it.

Economic Forecasting

Fiscal policy changes take a long time to become effective. So fiscal policy must target forecasts of where the economy will be in the future. Economic forecasting is inexact and subject to error and might mislead Congress.

These four limitations of discretionary fiscal policy do not affect automatic fiscal policy, which we now describe.

■ Automatic Fiscal Policy

Automatic fiscal policy is a consequence of tax revenues and outlays that fluctuate with real GDP. These features of fiscal policy are called **automatic stabilizers** because they stabilize real GDP without explicit action by the government.

On the revenue side of the budget, tax laws define tax *rates*, not tax *dollars*. Tax dollars paid depend on tax rates and incomes. But incomes vary with real GDP, so tax revenues depend on real GDP. Taxes that vary with real GDP are called **induced taxes**. When real GDP increases in an expansion, wages and profits rise, so the taxes on these incomes—induced taxes—rise. When real GDP decreases in a recession, wages and profits fall, so the induced taxes on these incomes fall.

On the expenditure side of the budget, the government creates programs that entitle suitably qualified people and businesses to receive benefits. The spending on such programs is called **needs-tested spending**, and it results in transfer payments that depend on the economic state of individual citizens and businesses. When the economy is in a recession, the number of people experiencing unemployment and economic hardship increases, but needs-tested spending on unemployment benefits and food stamps increases. When the economy expands, the number of people experiencing unemployment and economic hardship decreases, and needs-tested spending decreases.

Automatic stabilizers give rise to cyclical fluctuations in the the budget balance that we distinguish from structural changes in the budget.

■ Cyclical and Structural Budget Balances

To identify the government budget deficit that arises from the business cycle, we distinguish between the structural and cyclical budget balances. The **structural surplus or deficit** is the budget balance that would occur if the economy were at full employment. That is, the structural balance is the balance that the full-employment level of real GDP would generate given the spending programs and tax laws that Congress has created. The **cyclical surplus or deficit** is the budget balance that arises purely because revenues and outlays are not at their full-employment levels. That is, the cyclical balance is the balance that arises because revenues rise and outlays fall in an inflationary gap and revenues fall and outlays rise in a recessionary gap. The *actual* budget balance equals the sum of the structural balance and cyclical balance. A cyclical deficit corrects itself when full employment returns. A structural deficit requires action by Congress. *Eye on the U.S. Economy* on p. 541 looks at the recent history of the U.S. structural and cyclical balances.

Automatic stabilizers

Features of fiscal policy that stabilize real GDP without explicit action by the government.

Induced taxes

Taxes that vary with real GDP.

Needs-tested spending

Spending on programs that entitle suitably qualified people and businesses to receive transfer payments that vary with need and with the state of the economy.

Structural surplus or deficit

The budget balance that would occur if the economy were at full-employment.

Cyclical surplus or deficit

The budget balance that arises because revenues and outlays are not at their full-employment levels.



EYE on the U.S. ECONOMY

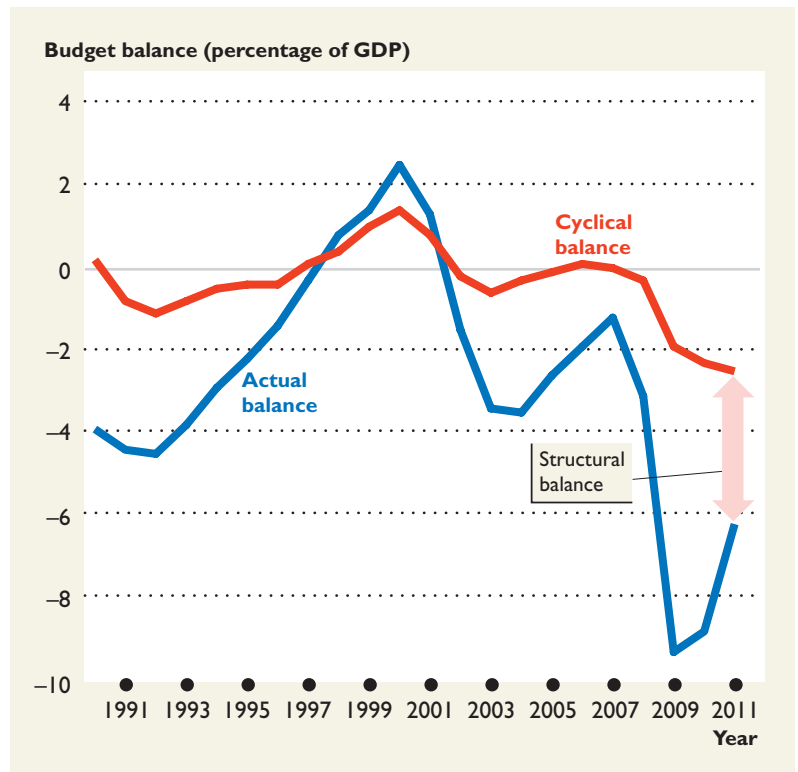
The U.S. Structural and Cyclical Budget Balances

The U.S. federal budget in 2011 was in deficit at \$1.4 trillion and the recessionary gap was close to \$1 trillion. With a large recessionary gap, you would expect some of the deficit to be cyclical. But how much of the 2011 deficit was cyclical and how much was structural?

According to the Congressional Budget Office (CBO), the cyclical deficit in 2011 was \$0.4 trillion and the structural deficit was \$1 trillion. The figure shows the cyclical and structural deficit between 1991 and 2011.

You can see that the *structural* deficit was small in 2007, increased in 2008, and exploded in 2009. The 2009 fiscal stimulus package created most of this structural deficit.

When full employment returns, which the CBO says will be in 2014, the cyclical deficit will vanish. But the structural deficit must be addressed by further acts of Congress. No one knows the discretionary measures that will be taken to reduce the structural deficit and this awkward fact creates enormous uncertainty.



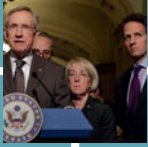
SOURCE OF DATA: Congressional Budget Office.

Schools of Thought and Cracks in Today's Consensus

The macroeconomic events of 2008 and 2009 have created cracks in the consensus among economists about the effects of fiscal policy.

Keynesians such as the 2008 Nobel Prize Winner Paul Krugman (Princeton University) and President Obama's former chief economic adviser Christina Romer (on leave from University of California, Berkeley) say that fiscal stimulus boosts real GDP and employment with a large multiplier effect.

Mainstream economists such as Robert J. Barro (Harvard University), the 1995 Nobel Prize Winner Robert E. Lucas Jr. (University of Chicago), and John B. Taylor (Stanford University) say that Keynesians over-estimate the multiplier effects of fiscal stimulus, which "crowds out" private consumption expenditure and investment. The durable results of a fiscal stimulus, these economists say, are bigger government, lower potential GDP, a slower real GDP growth rate, and a greater burden of government debt on future generations.



EYE on FISCAL STIMULUS

Can Fiscal Stimulus End a Recession?

In February 2009, in the depths of the 2008–2009 recession, Congress passed the American Recovery and Reinvestment Act, a \$787 billion fiscal stimulus package that the President signed at an economic forum in Denver.

This Act of Congress is an example of discretionary fiscal policy. Did this action by Congress contribute to ending the 2008–2009 recession and making the recession less severe than it might have been?

The Obama Administration economists are confident that the answer is yes: The stimulus package made a significant contribution to easing and ending the recession.

But many, and perhaps most, economists think that the stimulus package played a small role and that the truly big story is not discretionary fiscal policy but the role played by automatic stabilizers.

Let's take a closer look at the fiscal policy actions and their likely effects.

Discretionary Fiscal Policy

In a number of speeches, President Obama promised that fiscal stimulus would save or create 650,000 jobs by the end of the 2009 summer. In October 2009, the Administration economists declared the promise fulfilled. Fiscal stimulus had saved or created the promised 650,000 jobs.

This claim of success might be correct but it isn't startling and it isn't a huge claim. To see why, start by asking

how much GDP 650,000 people would produce. In 2009, each employed person produced \$100,000 of real GDP on average. So 650,000 people would produce \$65 billion of GDP.

Although the fiscal stimulus passed by Congress totalled \$787 billion, by October 2009 only 20 percent of the stimulus had been spent (or taken in tax breaks). So the stimulus was about \$160 billion.

If government outlays of \$160 billion created \$65 billion of GDP, the multiplier was 0.4 ($65/160 = 0.4$).

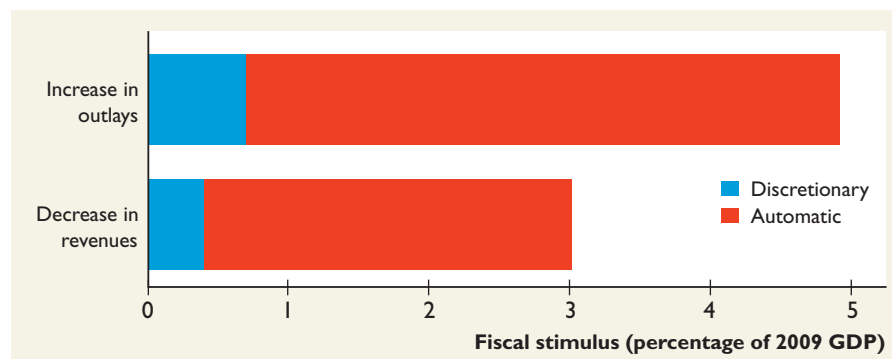
This multiplier is much smaller than the 1.6 that the Obama economists say will eventually occur. They believe, like Keynes, that the multiplier starts out small and gets larger over time as spending plans respond to rising incomes. An initial increase in expenditure increases aggregate expenditure. But the increase in aggregate expenditure generates higher incomes, which in turn induces greater consumption expenditure.

Automatic Fiscal Policy

Government revenue is sensitive to the state of the economy. When personal incomes and corporate profits fall, income tax revenues fall too. When unemployment increases, outlays on unemployment benefits and other social welfare benefits increase. These fiscal policy changes are automatic. They occur with speed and without help from Congress.

The scale of automatic fiscal policy changes depends on the depth of recession. In 2009, real GDP sank to 6 percent below potential GDP—a recessionary gap of \$800 billion.

Responding to this deep recession, tax revenues crashed and transfer payments skyrocketed. The figure below shows the magnitudes as percentages of GDP. You can see that the automatic stabilizers were much bigger than the discretionary actions—six times as large. This automatic action, not the stimulus package, played the major role in limiting job losses.



SOURCES OF DATA: Budget of the United States, 2010, Bureau of Economic Analysis, and White House press releases.

CHECKPOINT 20.1

Describe the federal budget process and explain the effects of fiscal policy.

MyEconLab

You can work these problems in Study Plan 20.1 and get instant feedback.

Practice Problems

- Classify the following items as automatic fiscal policy, discretionary fiscal policy, or not part of fiscal policy.
 - A decrease in tax revenues in a recession
 - Additional government expenditure to upgrade highways
 - An increase in the public education budget
 - A cut in infrastructure expenditure during a boom
- Explain how aggregate demand changes when government expenditure on national defense increases by \$100 billion.
- Explain how aggregate demand changes when the government increases taxes by \$100 billion.
- Explain how aggregate demand changes when the government increases both expenditure on goods and services and taxes by \$100 billion.

In the News

How to curb the deficit

Senator Evan Bayh, Democrat of Indiana, noted that Democrats want to spend more than we can afford; Republicans tend to want to cut taxes more than we can afford. So we are stuck with large deficits.

Source: *The New York Times*, October 31, 2009

What policy will change aggregate demand the most: Democrats agreeing to cut the budget outlays or Republicans agreeing to raise taxes?

Solutions to Practice Problems

- A decrease in tax revenues in a recession is an automatic fiscal policy. Expenditure to upgrade highways is a discretionary fiscal policy. An increase in the public education budget is a discretionary fiscal policy. A cut in infrastructure expenditure is a discretionary fiscal policy.
- Aggregate demand increases by more than \$100 billion because government expenditure increases induced expenditure.
- Aggregate demand decreases by more than \$100 billion because the tax increase has a multiplier effect that decreases induced expenditure.
- An increase in government expenditure of \$100 billion increases aggregate demand by more than \$100 billion. An increase in taxes of \$100 billion decreases aggregate demand by more than \$100 billion. The increase is greater than the decrease, so together aggregate demand increases.

Solution to In the News

The effect of a cut in budget outlays on aggregate demand depends on whether the items cut are expenditures on goods and services (government expenditure multiplier) or transfer payments (transfer payments multiplier). An increase in taxes will decrease aggregate demand (tax multiplier). The magnitude of the government expenditure multiplier exceeds the other two multipliers, so a cut in government expenditure will decrease aggregate demand the most.

20.2 THE FEDERAL RESERVE AND MONETARY POLICY

Monetary policy

The adjustment of interest rates and the quantity of money to achieve the dual objectives of price stability and full employment.

Beige Book

A report that summarizes current economic conditions in each Federal Reserve district and each sector of the economy.

Monetary policy is the adjustment of interest rates and the quantity of money to achieve the dual objective of price stability and full employment. The Board of Governors of the Federal Reserve System (the Fed) conducts monetary policy independently of the government but under the terms of the Federal Reserve Act of 1913 and its subsequent amendments, the most recent of which was passed in 2000. The Act defines the Fed's goals as the attainment of "maximum employment" and "stable prices," goals known as the *Fed's dual mandate*.

■ The Monetary Policy Process

The Fed makes monetary policy in a process that has three elements:

- Monitoring economic conditions
- Decisions of the Federal Open Market Committee (FOMC)
- Monetary Policy Report to Congress

Monitoring Economic Conditions

Each Federal Reserve Bank monitors its district by talking with business leaders, economists, market experts, and others. The Fed summarizes the state of the economy in the **Beige Book**, which the Federal Open Market Committee uses in its deliberations.

The Beige Book is available on the Fed's Web site and is a good source of current information on the current state of the economy.

Decisions of the Federal Open Market Committee (FOMC)

The FOMC, which meets eight times a year, makes the monetary policy decisions. The FOMC's first and fourth meetings of the year run for two days (the other six meetings run for one day) and are opportunities for the committee to assess the longer-term outlook as well as the current period's open market operations.

After each meeting, the FOMC announces its decisions and describes its view of the likelihood that its goals of price stability and full employment will be achieved. The FOMC publishes the minutes of its meetings after they have been confirmed as a correct record of the meeting at the next scheduled meeting. For example, the minutes of the first meeting of the year are published after the second meeting of the year.

Full transcripts of FOMC meetings are published with a five-year time lag. This delay enables the members of the FOMC to have a frank exchange of views without worrying about how their discussions might be interpreted by the traders in financial markets. The eventual publication of the transcripts permits a detailed public scrutiny of the FOMC's decision-making process.

Monetary Policy Report to Congress

Twice a year, in February and July, the Fed prepares a Monetary Policy Report to Congress, and the Fed chairman testifies before the House of Representatives Committee on Financial Services. The report and the chairman's testimony review the monetary policy and economic developments of the past year and the economic outlook for the coming year.

■ The Federal Funds Rate Target

Following each FOMC meeting, the Fed announces its monetary policy decision as a target for the federal funds rate. Figure 20.4 shows the federal funds rate since 2000.

You can see that the federal funds rate was 5.5 percent a year at the beginning of 2000 and during 2000 and 2001, the Fed increased the rate to 6.5 percent a year. The Fed raised the interest rate to this high level to lower the inflation rate.

Between 2002 and 2004, the federal funds rate was set at historically low levels. The reason is that with inflation well anchored at close to 2 percent a year, the Fed was less concerned about inflation than it was about recession so it wanted to lean in the direction of avoiding recession.

From mid-2004 through early 2006, the Fed was increasingly concerned about the build-up of inflation pressures and it raised the federal funds rate target on 17 occasions to take it to 5.25 percent a year, a level it held until September 2007.

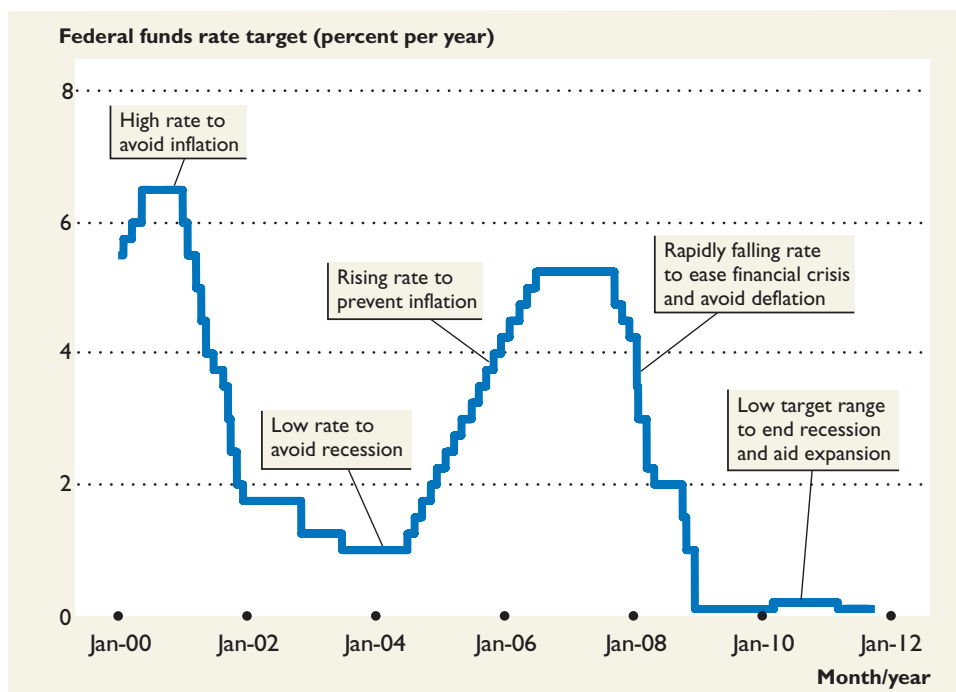
When the global financial crisis began, the Fed acted cautiously in cutting the federal funds rate target. But as the crisis intensified, rate cuts became more frequent and larger, ending in December 2008 with an interest rate close to zero. The normal changes of a quarter of a percentage point (also called *25 basis points*) were abandoned as the Fed slashed the rate, first by an unusual 50 basis points and finally, in December 2008, by an unprecedented 100 basis points. Since the end of 2008, the federal funds rate has been close to zero.

To hit its target for the federal funds rate, the FOMC instructs the New York Fed to conduct open market operations to adjust the banking system's reserves to the level that makes banks want to make loans to each other at the target rate.

■ FIGURE 20.4

The Fed's Key Monetary Policy Instrument: The Federal Funds Rate

MyEconLab Animation



The Fed sets a target for the federal funds rate and then takes actions to keep the rate close to the target.

When the Fed wants to slow inflation, it raises the federal funds rate target.

When the inflation rate is below target and the Fed wants to avoid recession, it lowers the federal funds rate target.

When the Fed focused on restoring financial stability, it cut the federal funds rate target aggressively to almost zero.

SOURCE OF DATA: Board of Governors of the Federal Reserve System.

■ The Ripple Effects of the Fed's Actions

When the Fed changes the federal funds rate, it sets up a ripple effect that runs all the way to a change in real GDP and the price level. Figure 20.5 provides a schematic summary of these effects, which stretch out over a period of between one and two years. Let's look at each stage in the transmission process.

Other Interest Rates Change

The first effect of a change in the federal funds rate is a change in other short-term interest rates. This effect occurs quickly and predictably. The reason is that an overnight loan to another bank is a close substitute for short-term securities such as Treasury bills so the interest rates on these very similar assets keep close to each other.

The Exchange Rate Changes

A rise in the U.S. interest rate relative to the interest rate in other countries brings funds into the United States from other countries to take advantage of the higher interest rate. When people move funds into the United States, they buy dollars, the demand for dollars rises and the exchange rate rises.

The Quantity of Money and Bank Loans Change

When the federal funds rate changes, it is because the Fed has changed the quantity of bank reserves in the opposite direction. With a change in reserves, banks change their volume of loans, which changes deposits and the quantity of money. When the Fed cuts the federal funds rate, the quantity of money and loans increases.

The Long-Term Real Interest Rate

A fall in the federal funds rate that increases the supply of bank loans increases the supply of funds and lowers the equilibrium real interest rate. A rise in the federal funds rate that decreases the supply of bank loans decreases the supply of funds and raises the equilibrium real interest rate.

Consumption Expenditure, Investment, and Net Exports Change

The interest rate influences people's spending decisions. Other things remaining the same, the lower the real interest rate, the greater is the amount of consumption expenditure and the smaller is the amount of saving. Also, other things remaining the same, the lower the real interest rate, the greater is the amount of investment.

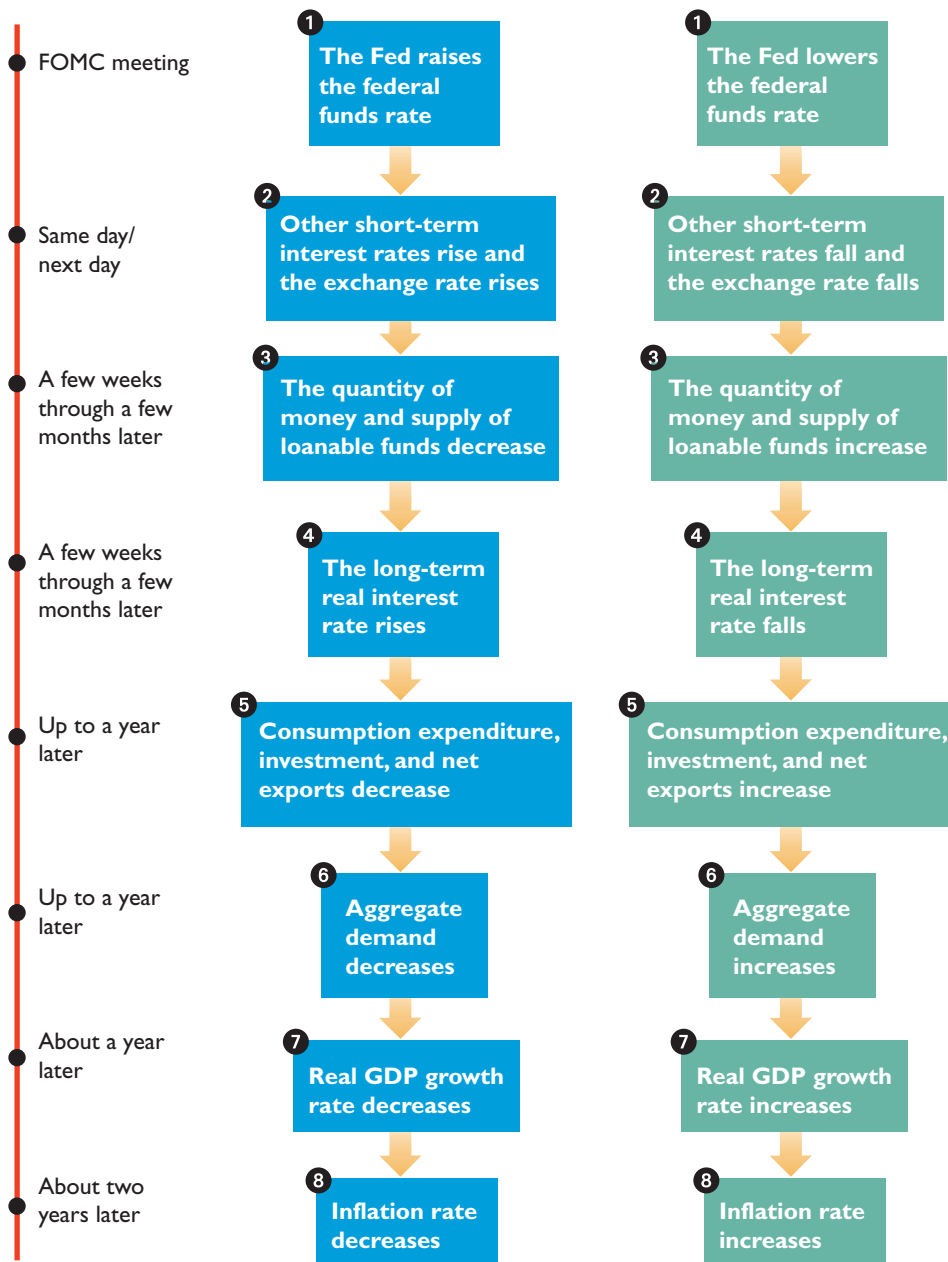
A fall in the interest rate lowers the exchange rate. The lower price of the dollar means that foreigners now pay less for U.S.-made goods and services, so U.S. exports increase.

Aggregate Demand Changes

Consumption expenditure, investment, and net exports are all components of aggregate demand. So when these items change, aggregate demand also changes, and in the same direction. But aggregate demand changes by more than the change in these items because of the multiplier effect. A change in expenditure changes income, and the change in income induces a change in consumption expenditure.

FIGURE 20.5
Ripple Effects of the Fed's Actions

MyEconLab Animation



The Fed changes its interest rate target and conducts open market operations to **1** change the federal funds rate. The same day **2** other short-term interest rates change and so does the exchange rate. A few weeks through a few months after the FOMC meeting, **3** the quantity of money and supply of loanable funds changes, which **4** changes the long-term real interest rate.

Up to a year after the FOMC meeting, **5** consumption, investment, and net exports change, so **6** aggregate demand changes. Eventually, the change in the federal funds rate has ripple effects that **7** change real GDP and about two years after the FOMC meeting, **8** the inflation rate changes.

(a) The Fed tightens

(b) The Fed eases

■ Monetary Stabilization in the AS–AD Model

We've described the broad outline of how the Fed's actions influence the economy. Let's now see how monetary policy might be used to stabilize real GDP.

■ The Fed Eases to Fight Recession

Figure 20.6(a) shows investment demand. Think of investment demand as representing all the interest-sensitive components of aggregate expenditure. Also, assume that there is no inflation, so the interest rate is the real interest rate as well as the nominal interest rate. The interest rate is 5 percent a year, and the quantity of investment demanded is \$2 trillion. In Figure 20.6(b), aggregate demand is AD_0 , aggregate supply is AS , and equilibrium real GDP is \$12 trillion, which is less than potential GDP. There is a recessionary gap.

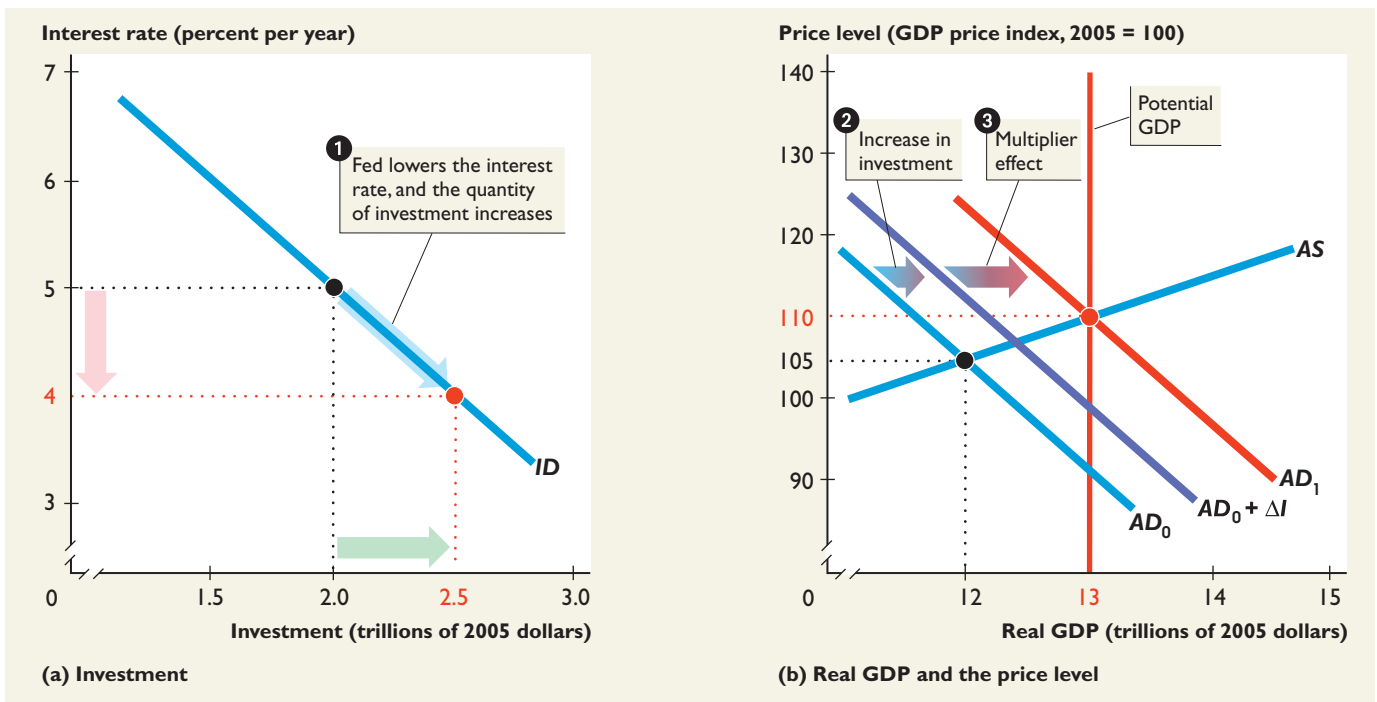
The Fed now conducts an open market purchase that lowers the interest rate to 4 percent a year. The quantity of investment increases to \$2.5 trillion. Other interest-sensitive expenditure items (not shown in the figure) also increase. If this were the only change, aggregate demand would increase to $AD_0 + \Delta I$.

The multiplier increases aggregate expenditure further and the aggregate demand curve shifts to AD_1 . The Fed's actions have eliminated a recession and brought real GDP to equal potential GDP at \$13 trillion and the price level to 110.

■ FIGURE 20.6

Monetary Stabilization: Avoiding Recession

MyEconLab Animation



Real GDP is less than potential GDP (part b). To avoid recession, **1** the Fed lowers the interest rate (part a). **2** Expenditure increases by ΔI and **3** the multiplier induces additional

expenditure. The aggregate demand curve shifts rightward to AD_1 . Real GDP increases to potential GDP, and recession is avoided.

The Fed Tightens to Fight Inflation

In Figure 20.7(a) the interest rate is 5 percent a year and the quantity of investment is \$2 trillion. At this level of investment, aggregate demand is AD_0 in Figure 20.7(b). The aggregate supply curve is AS , so equilibrium real GDP is \$14 trillion, which exceeds potential GDP. There is an inflationary gap.

The Fed now conducts an open market sale that increases the interest rate to 6 percent a year. The quantity of investment demand decreases to \$1.5 trillion. If this were the only change in aggregate expenditure, aggregate demand would be $AD_0 - \Delta I$. But the multiplier decreases aggregate expenditure further, and the aggregate demand curve shifts leftward to AD_1 .

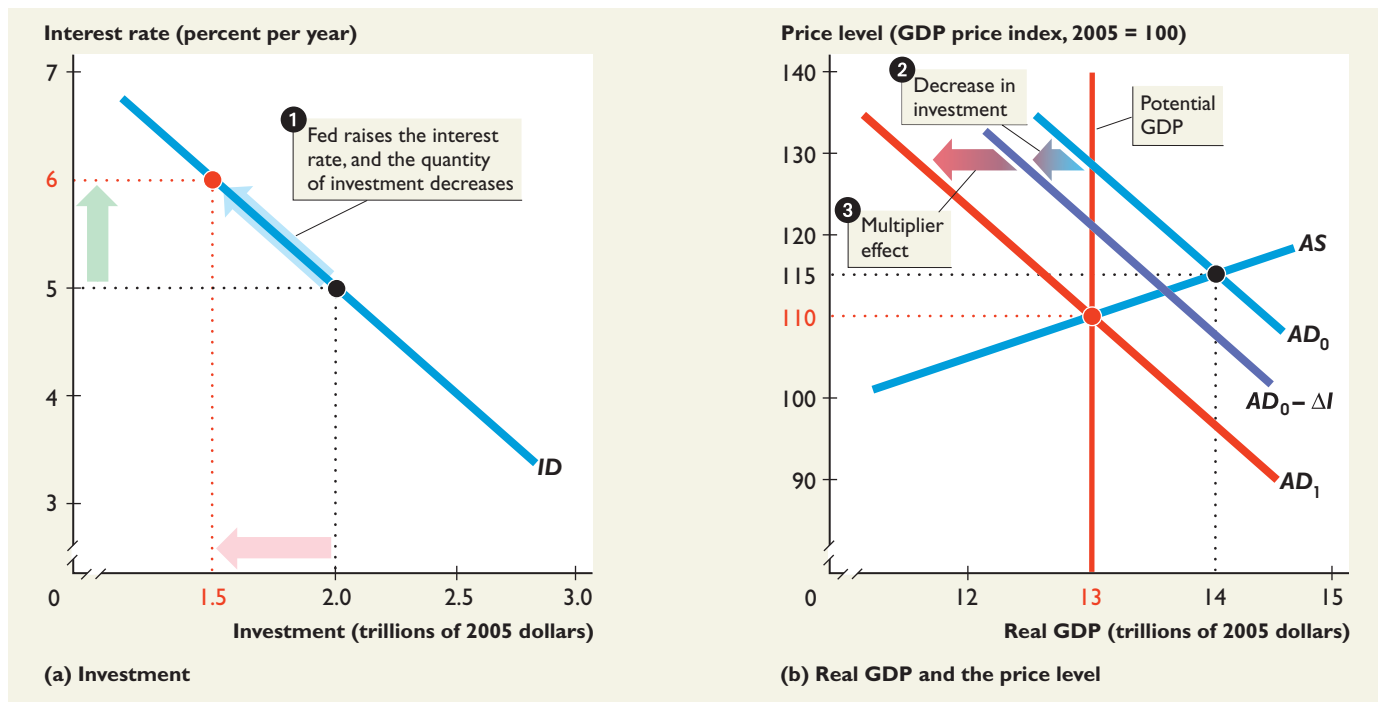
The Fed's actions have eliminated an inflation threat and brought real GDP to equal potential GDP.

The Size of the Multiplier Effect

The size of the multiplier effect of monetary policy depends on the sensitivity of expenditure plans to the interest rate. The larger the effect of a change in the interest rate on aggregate expenditure, the greater is the multiplier effect and the smaller is the change in the interest rate that achieves the Fed's objective.

FIGURE 20.7
Monetary Stabilization: Avoiding Inflation

MyEconLab Animation



Real GDP exceeds potential GDP in part (b). To avoid inflation, **1** the Fed raises the interest rate in part (a). **2** Expenditure decreases by ΔI , and **3** the multiplier induces additional

expenditure cuts. The aggregate demand curve shifts leftward to AD_1 . Real GDP decreases to potential GDP, and inflation is avoided.



EYE on the FED IN A CRISIS

Did the Fed Save Us From Another Great Depression?

The story of the Great Depression is complex and even today, after almost 80 years of research, economists are not in full agreement on its causes. But one part of the story is clear and it is told by Milton Friedman and Anna J. Schwartz: The Fed got it wrong.

An increase in financial risk drove the banks to increase their holdings of reserves and everyone else to lower their bank deposits and hold more currency.

Between 1929 and 1933, (Figure 1) the banks' desired reserve ratio increased from 8 percent to 12 percent and the currency drain ratio increased from 9 percent to 19 percent.

The money multiplier (Figure 2) fell from 6.5 to 3.8.

The quantity of money (Figure 3) crashed by 35 percent.

This massive contraction in the quantity of money was accompanied by a similar contraction of bank loans and by the failure of a large number of banks.

Friedman and Schwartz say that this contraction of money and bank loans and failure of banks could (and should) have been avoided by a more alert and wise Fed.

The Fed could have injected reserves into the banks to

accommodate their desire for greater security by holding more reserves and to offset the rise in currency holdings as people switched out of bank deposits.

Ben Bernanke's Fed did almost exactly what Friedman and Schwartz said the Fed needed to do in the Great Depression.

At the end of 2008, when the banks faced increased financial risk, the Fed flooded them with the reserves that they wanted to hold (Figure 1).

The money multiplier fell from 9.1 in 2008 to 4.6 in 2009 (Figure 2)—much more than it had fallen between 1929 and 1933—but there was no contraction of the quantity of money (Figure 3). Rather, the quantity of M2 increased by 8 percent in the year to August 2009.

We can't be sure that the Fed averted a Great Depression in 2009, but we can be confident that the Fed's actions helped to limit the depth and duration of the 2008–2009 recession.

In 2011, the “dual mandate” put the Fed in a dilemma. The economic recovery was not going well and unemployment was not falling. There were signs, too, that inflation might rise. The FOMC was divided on what the Fed's next move should be.



Milton Friedman and Anna J. Schwartz, authors of *A Monetary History of the United States*, who say the Fed turned an ordinary recession into the Great Depression.

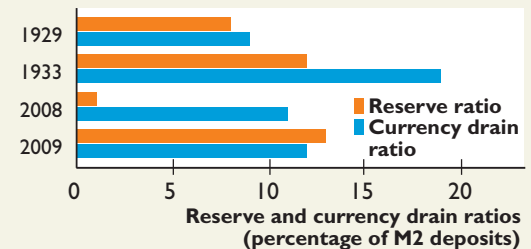


Figure 1 The flight to safety: Reserve and currency ratios increase

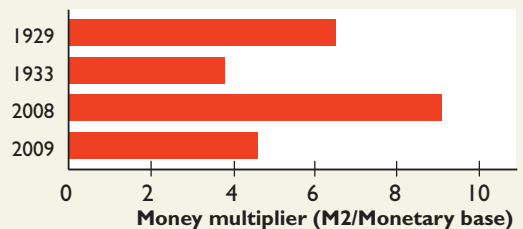


Figure 2 The collapsing money multiplier

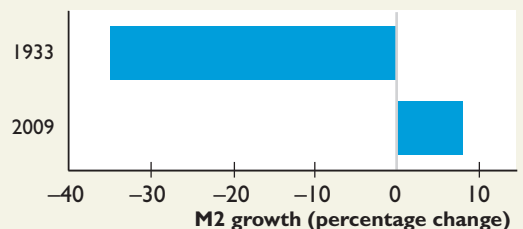


Figure 3 Money contraction versus growth

SOURCE OF DATA: Federal Reserve Board.

■ Limitations of Monetary Stabilization Policy

Monetary policy has an advantage over fiscal policy because it cuts out the law-making time lags. The FOMC meets eight times a year and can conduct telephone meetings between its scheduled meetings if the need arises. And the actual actions that change the quantity of money are daily actions taken by the New York Fed operating under the guidelines decided by the FOMC. So monetary policy is a continuous policy process and is not subject to the long decision lag and the need to create a broad political consensus that confronts fiscal policy.

But monetary policy shares the other two limitations of fiscal policy: Estimating potential GDP is hard, and economic forecasting is error-prone. Monetary policy suffers an additional limitation: Its effects are indirect and depend on how private decisions respond to a change in the interest rate. These responses are themselves hard to forecast and vary from one situation to another in unpredictable ways. A related problem is that the time lags in the operation of monetary policy are longer than those for fiscal policy, so the forecasting horizon must be longer.



EYE on YOUR LIFE

Fiscal and Monetary Policy and How They Affect You

Consider the U.S. economy right now. Using all the knowledge that you have accumulated during your course and by reading or watching the current news, try to determine the macroeconomic policy issues that face the U.S. economy today.

Do we have a cyclical problem? Is the economy at full employment or do we have a recessionary gap or an inflationary gap?

In light of your assessment of the current state of the U.S. economy, what type of fiscal policy would you recommend and vote for? What type of monetary policy would you recommend?

Are you concerned about the size of the federal deficit? If so, how would you propose lowering it?

Consider recent changes in fiscal policy that you have seen reported in

the media. What do you think these changes say about the federal government's views of the state of the economy? Do these views agree with yours?

Thinking further about recent changes in fiscal policy, how do you expect these changes to affect you? How might your spending, saving, and labor supply decisions change?

Using your own responses to fiscal policy changes as an example, are these policy changes influencing aggregate supply, aggregate demand, or both? How do you think they will change real GDP?

By reading or watching the current news, try to determine the monetary policy issues that face the U.S. economy today.

What is the greater monetary policy risk: inflation or recession? If the

risk is inflation, what action do you expect the Fed to take? If the risk is recession, what do you expect the Fed to do? Which of these problems, inflation or recession, do you care most about? Do you want the Fed to be more cautious about inflation and keep the interest rate high, or more cautious about recession and keep the interest rate low?

When Ben Bernanke was an economics professor at Princeton, he studied inflation targeting and found that it works well.

Do you think the United States should join the ranks of inflation targeters? Should the Fed announce an inflation target? Watch the media for commentary on the Fed's interest rate decisions and evolving monetary policy strategy.

MyEconLab

You can work these problems in Study Plan 20.2 and get instant feedback.

CHECKPOINT 20.2

Describe the Federal Reserve's monetary policy process and explain the effects of monetary policy.

Practice Problems

1. List the sequence of events in the transmission process from a rise in the federal funds rate to a change in the inflation rate.

The economy has slipped into recession and the Fed takes actions to lessen its severity. Use this information to work Problems 2 and 3.

2. What action does the Fed take? Explain the effects of the Fed's actions in the money market and the market for loans.
3. Explain how the Fed's actions change aggregate demand and real GDP. Use a graph to illustrate your answer.

In the News

The Fed's tricky balancing act

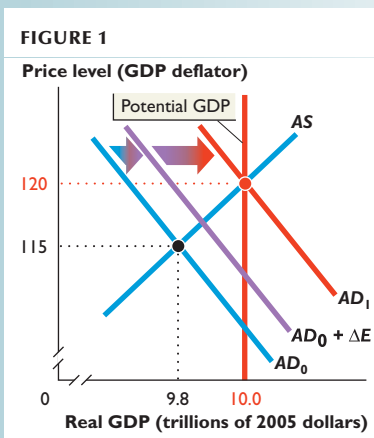
The FOMC was a bit more optimistic about the economy recovering, but said that policy tightening was not going to happen any time soon.

Source: *Business Week*, June 6, 2009

What are the ripple effects and time lags that the Fed must consider in deciding when to start raising the federal funds rate?

Solutions to Practice Problems

1. When the Fed raises the federal funds rate, other short-term interest rates rise and the exchange rate rises; the quantity of money and supply of loanable funds decrease and the long-term real interest rate rises; consumption, investment, and net exports decrease, aggregate demand decreases, and eventually the real GDP growth rate and the inflation rate decrease.
2. The Fed lowers the federal funds rate, which lowers other short-term interest rates, and increases the supply of money. The increase in the supply of money increases the supply of bank loans and the real interest rate falls.
3. A lower real interest rate (and lower exchange rate) and greater quantity of money and loans increases investment (and other expenditures), which increases aggregate expenditure. Aggregate demand increases and the AD curve shifts to $AD_0 + \Delta E$. A multiplier effect increases aggregate demand and the AD curve shifts rightward to AD_1 . Real GDP increases and recession is avoided (Figure 1).



Solution to In the News

Figure 20.5 (p. 547) describes the ripple effects and the time lags. The Fed can influence interest rates quickly but several months pass before the quantity of money and loans respond, up to a year before expenditure plans respond, and up to two years before the inflation rate responds to the Fed's interest rate actions.

CHAPTER SUMMARY

Key Points

1 Describe the federal budget process and explain the effects of fiscal policy.

- The federal budget is an annual statement of the expenditures, tax receipts, and surplus or deficit of the government of the United States.
- Fiscal policy is the use of the federal budget to finance the federal government and to stabilize the economy.
- Fiscal policy can be either discretionary or automatic.
- Changes in government expenditure and changes in taxes have multiplier effects on aggregate demand and can be used to try to keep real GDP at potential GDP.
- In practice, law-making time lags, the difficulty of estimating potential GDP, and the limitations of economic forecasting seriously hamper discretionary fiscal policy.
- Automatic stabilizers arise because tax receipts and expenditures fluctuate with real GDP.

2 Describe the Federal Reserve's monetary policy process and explain the effects of monetary policy.

- The Fed makes monetary policy in an open and transparent process that involves three main elements: the Beige Book, meetings of the Federal Open Market Committee, and the Monetary Policy Report to Congress.
- When the FOMC announces a policy change, it is in terms of a target for the federal funds rate.
- When the Fed changes the interest rate, the effects ripple through the economy by changing aggregate demand.
- The size of the multiplier effect of monetary policy depends on the sensitivity of expenditure plans to the interest rate.
- Monetary policy has no law-making time lag, but its effects are indirect and depend on how the interest rate influences private decisions.

Key Terms

Automatic fiscal policy, 533

Automatic stabilizers, 540

Balanced budget, 532

Balanced budget multiplier, 535

Beige Book, 544

Budget deficit, 532

Budget surplus, 532

Cyclical surplus or deficit, 540

Discretionary fiscal policy, 533

Federal budget, 532

Fiscal policy, 532

Fiscal stimulus, 536

Government expenditure multiplier, 535

Induced taxes, 540

Monetary policy, 544

National debt, 533

Needs-tested spending, 540

Structural surplus or deficit, 540

Tax multiplier, 535

Transfer payments multiplier, 535

MyEconLab

You can work these problems in Chapter 20 Study Plan and get instant feedback.

CHAPTER CHECKPOINT

Study Plan Problems and Applications

- Suppose that in an economy, investment is \$400 billion, saving is \$400 billion, tax revenues are \$500 billion, exports are \$300 billion, and imports are \$200 billion. Calculate government expenditure and the budget balance.
- Classify the following items as automatic fiscal policy actions, discretionary fiscal policy actions, or neither.
 - An increase in expenditure on homeland security
 - An increase in unemployment benefits paid during a recession
 - Decreased expenditures on national defense during peace time
 - An increase in Medicaid expenditure brought about by a flu epidemic
 - A cut in farm subsidies
- The U.S. economy is in recession and has a large recessionary gap. Describe what automatic fiscal policy might occur. Describe a fiscal stimulus that could be used that would not increase the budget deficit.

Use the following information to work Problems 4 and 5.

IMF: World economy enters “dangerous new phase”

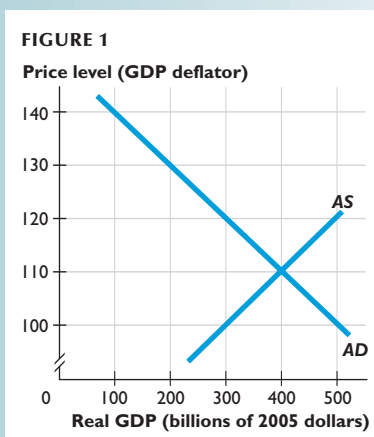
The IMF expects the U.S. economy to grow just 1.5% this year and 1.8% in 2012. That’s down from its June forecast of 2.5% in 2011 and 2.7% next year. Olivier Blanchard, the IMF’s chief economist, said that the recovery has weakened considerably and that strong fiscal policies are needed to improve the outlook.

Source: *USA Today*, September 20, 2011

- Explain the effects of strong fiscal stimulus if it is implemented well.
- The Canadian Prime Minister Stephen Harper warned on November 6, 2008 that if policy makers adopt too strong a fiscal stimulus then long-term growth might be jeopardized. Explain what he meant.

Use the following information to work Problems 6 to 8.

Figure 1 shows the aggregate demand curve, *AD*, and the short-run aggregate supply curve, *AS*, in the economy of Artica. Potential GDP is \$300 billion.



- What are the price level and real GDP? Does Artica have an unemployment problem or an inflation problem? Why?
- What do you predict will happen if the central bank takes no monetary policy actions? What monetary policy action would you advise the central bank to take and what do you predict will be the effect of that action?
- Suppose that a drought decreases potential GDP in Artica to \$250 billion. Explain what happens if the central bank lowers the federal funds rate. Do you recommend that the central bank lower the interest rate? Why?
- Many ways to blow up an economy**

Excessive stimulus could bring inflation in the United States in the long term, but for now, inflation is falling. Bond interest rates reflect inflation expectations that are within the Fed’s long-term target levels.

Source: *Australian Financial Review*, May 9, 2009

Explain why inflation was falling in 2009 and how excessive stimulus could bring inflation in the long term.

Instructor Assignable Problems and Applications

Your instructor can assign these problems as homework, a quiz, or a test in [MyEconLab](#).

1. From the peak in 1929 to the Great Depression trough in 1933, government tax revenues fell by 1.9 percent of GDP and government expenditure increased by 0.3 percent. Real GDP fell by 25 percent. Compare and contrast this experience with the fiscal policy that accompanied the 2008–2009 recession. What did fiscal policy do to moderate the last recession that was largely absent during the Great Depression?
2. In which episode, the Great Depression or the 2008–2009 recession, did the banks' desired reserve ratio and the currency drain ratio increase by the larger amount and the money multiplier fall by the larger amount?
3. Suppose that the U.S. government increases its expenditure on highways and bridges by \$100 billion. Explain the effect that this expenditure would have on aggregate demand and real GDP.
4. Suppose that the U.S. government increases its expenditure on highways and bridges by \$100 billion. Explain the effect that this expenditure would have on needs-tested spending and the government's budget surplus.
5. Describe the supply-side effects of a fiscal stimulus and explain how a tax cut will influence potential GDP.
6. Use an aggregate supply–aggregate demand graph to illustrate the effects on real GDP and the price level of a fiscal stimulus when the economy is in recession.

Use the following information to work Problems 7 and 8.

CBO estimates \$1.3 trillion deficit for 2011

The Congressional Budget Office (CBO) predicts that the federal budget hit a near-record \$1.3 trillion in the just-completed fiscal year. The 2011 deficit equaled 8.6% of GDP, a slight drop from the 8.9% of GDP in 2010. It'll take some combination of new revenues and major spending cuts to get the deficit down to about 3% of GDP, the level that many analysts say is sustainable.

Source: *USA Today*, October 8, 2011

7. If the plan to reduce the deficit includes a cut in transfer payments and a rise in taxes of the same amount, how will this policy influence the budget deficit and real GDP?
8. If the plan to reduce the deficit includes an increase in taxes on the wealthy, explain how this policy might have serious supply-side consequences for both potential GDP and the growth rate of real GDP.
9. Suppose that inflation is rising toward 5 percent a year, and the Fed, Congress, and the White House are discussing ways of containing inflation without damaging employment and output. The President wants to cut aggregate demand but to do so in a way that will give the best chance of keeping investment high to encourage long-term economic growth. Explain the Fed's best action for meeting the President's objectives.
10. Compare and contrast the Fed's monetary policy response to the surge in desired reserves and currency holdings in the Great Depression and the 2008–2009 recession.

MyEconLab

You can work this quiz in Chapter 20 Study Plan and get instant feedback.

Multiple Choice Quiz

- The federal government's major outlay in its budget is _____ and its major source of revenue is _____.
 - debt interest; sales of government bonds
 - expenditure on goods and services; taxes on goods and services
 - Social Security and other benefits; personal income taxes
 - subsidies to farmers; corporate taxes
- U.S. national debt _____ when the federal government's _____.
 - increases; outlays exceed tax revenue
 - decreases; outlays exceed tax revenue
 - increases; tax revenue rises faster than outlays
 - decreases; tax revenue rises faster than outlays
- Discretionary fiscal policy to stimulate the economy includes _____.
 - lowering the tax rate paid by households with middle incomes
 - raising the tax on gasoline
 - the fall in tax revenue as the economy goes into recession
 - the rise in tax revenue collected from businesses as their profits increase
- Automatic fiscal policy _____.
 - requires an action of the government
 - is weak unless the government cuts its outlays to reduce the deficit
 - operates as the economy moves along its business cycle
 - reduces the deficit as the economy goes into recession
- The Fed's "dual mandate" is to achieve _____.
 - a government budget surplus and low interest rates
 - low inflation and maximum employment
 - a stable quantity of money and stable prices
 - zero unemployment and a stable means of payment
- When the Fed lowers the federal funds rate _____.
 - aggregate demand increases the same day
 - investment increases, but only after the economy's growth rate rises
 - the quantity of money and loans increase in the short term
 - the inflation rate increases about two years later
- The Fed fights inflation by _____.
 - lowering the federal funds rate, which lowers interest rates and decreases aggregate demand
 - raising the federal funds rate, which raises interest rates and decreases aggregate demand
 - decreasing the monetary base, which raises the interest rate and increases saving
 - lowering the long-term real interest rate, which increases investment and spurs economic growth
- To fight unemployment and close a recessionary gap, the Fed _____.
 - stimulates aggregate demand by lowering the federal funds rate, which increases the quantity of money
 - stimulates aggregate supply by lowering the federal funds rate, which increases potential GDP
 - increases employment, which increases real GDP
 - increases bank reserves, which banks use to make new loans to businesses, which increases aggregate supply

Glossary

Above full-employment equilibrium When equilibrium real GDP exceeds potential GDP. (p. 519)

Absolute advantage When one person (or nation) is more productive than another—needs fewer inputs or takes less time to produce a good or perform a production task. (p. 73)

Aggregate demand The relationship between the quantity of real GDP demanded and the price level when all other influences on expenditure plans remain the same. (p. 512)

Aggregate supply The relationship between the quantity of real GDP supplied and the price level when all other influences on production plans remain the same. (p. 506)

Allocative efficiency A situation in which the quantities of goods and services produced are those that people *value most highly*—it is not possible to produce more of a good or service without giving up some of another good that people *value more highly*. (p. 141)

Automatic fiscal policy A fiscal policy action that is triggered by the state of the economy. (p. 533)

Automatic stabilizers Features of fiscal policy that stabilize real GDP without explicit action by the government. (p. 540)

Average cost pricing rule A rule that sets price equal to average total cost to enable a regulated firm to avoid economic loss. (p. 328)

Average fixed cost Total fixed cost per unit of output. (p. 263)

Average product Total product divided by the quantity of a factor of production. The average product of labor is total product divided by the quantity of labor employed. (p. 358)

Average total cost Total cost per unit of output, which equals average fixed cost plus average variable cost. (p. 263)

Average variable cost Total variable cost per unit of output. (p. 263)

Balanced budget The budget balance when tax revenues equal outlays. (p. 532)

Balanced budget multiplier The magnification effect on aggregate demand of a *simultaneous* change in government expenditure and taxes that leaves the budget balanced unchanged. (p. 535)

Banking system The Federal Reserve and the banks and other institutions that accept deposits and provide the services that enable people and businesses to make and receive payments. (p. 482)

Barrier to entry Any constraint that protects a firm from competitors. (p. 306)

Barter The direct exchange of goods and services for other goods and services, which requires a double coincidence of wants. (p. 477)

Beige book A report that summarizes current economic conditions in each Federal Reserve district and each sector of the economy. (p. 544)

Below full-employment equilibrium When potential

GDP exceeds equilibrium real GDP. (p. 519)

Benefit The benefit of something is the gain or pleasure that it brings. (p. 9)

Big tradeoff A tradeoff between efficiency and fairness that recognizes the cost of making income transfers. (p. 159)

Black market An illegal market that operates alongside a government-regulated market. (p. 177)

Budget deficit The budget balance when outlays exceed tax revenues. (p. 532)

Budget surplus The budget balance when tax revenues exceed outlays. (p. 532)

Business cycle A periodic but irregular up-and-down movement of total production and other measures of economic activity. (p. 382)

Capital Tools, instruments, machines, buildings, and other items that have been produced in the past and that businesses now use to produce goods and services. (p. 35)

Capital goods Goods that are bought by businesses to increase their productive resources. (p. 32)

Capture theory The theory that regulation serves the self-interest of the producer and results in maximum profit, underproduction, and deadweight loss. (p. 326)

Cartel A group of firms acting together to limit output, raise price, and increase economic profit. (p. 350)

Central bank A public authority that provides banking

services to banks and regulates financial institutions and markets. (p. 487)

Ceteris paribus Other things remaining the same (often abbreviated as *cet. par.*). (p. 15)

Chained-dollar real GDP The measure of real GDP calculated by the Bureau of Economic Analysis. (p. 393)

Change in demand A change in the quantity that people plan to buy when any influence on buying plans other than the price of the good changes. (p. 88)

Change in the quantity demanded A change in the quantity of a good that people plan to buy that results from a change in the price of the good with all other influences on buying plans remaining the same. (p. 90)

Change in the quantity supplied A change in the quantity of a good that suppliers plan to sell that results from a change in the price of the good with all other influences on selling plans remaining the same. (p. 97)

Change in supply A change in the quantity that suppliers plan to sell when any influence on selling plans other than the price of the good changes. (p. 95)

Circular flow model A model of the economy that shows the circular flow of expenditures and incomes that result from decision makers' choices and the way those choices interact to determine what, how, and for whom goods and services are produced. (p. 46)

Classical macroeconomics The view that the market economy works well, that aggregate fluctuations are a natural consequence of an expanding economy, and that government

intervention cannot improve the efficiency of the market economy. (p. 444)

Coase theorem The proposition that if property rights exist, only a small number of parties are involved, and transactions costs are low, then private transactions are efficient and the outcome is not affected by who is assigned the property right. (p. 230)

Command system A system that allocates resources by the order of someone in authority. (p. 139)

Commercial bank A firm that is chartered by the Comptroller of the Currency in the U.S. Treasury (or by a state agency) to accept deposits and make loans. (p. 482)

Comparative advantage The ability of a person to perform an activity or produce a good or service at a lower opportunity cost than anyone else. (p. 74)

Complement A good that is consumed with another good. (p. 88)

Complement in production A good that is produced along with another good. (p. 95)

Constant returns to scale A condition in which, when a firm increases its plant size and labor employed by the same percentage, its output increases by that same percentage and its average total cost remains constant. (p. 270)

Consumer Price Index A measure of the average of the prices paid by urban consumers for a fixed market basket of consumption goods and services. (p. 420)

Consumer surplus The marginal benefit from a good or service in excess of the price paid for it, summed over the quantity consumed. (p. 147)

Consumption expenditure The expenditure by households on consumption goods and services. (p. 369)

Consumption goods and services Goods and services that are bought by individuals and used to provide personal enjoyment and contribute to a person's quality of life. (p. 32)

Core inflation rate The annual percentage increases in the PCE price index excluding the price of food and energy. (p. 429)

Correlation The tendency for the values of two variables to move together in a predictable and related way. (p. 12)

Cost of living index A measure of the change in the amount of money that people would need to spend to achieve a given standard of living. (p. 426)

Cost-push inflation Inflation that begins with an increase in costs. (p. 524)

Cross elasticity of demand A measure of the responsiveness of the demand for a good to a change in the price of a substitute or complement when other things remain the same. (p. 129)

Cross-section graph A graph that shows the values of an economic variable for different groups in a population at a point in time. (p. 22)

Currency Notes (dollar bills) and coins. (p. 478)

Cyclical surplus or deficit The budget balance that arises because tax revenues and outlays are not at their full-employment levels. (p. 540)

Cyclical unemployment The fluctuating unemployment over the business cycle that increases during a recession and decreases during an expansion. (p. 412)

Deadweight loss The decrease in total surplus that results from an inefficient underproduction or overproduction. (p. 155)

Decreasing marginal returns When the marginal product of an additional worker is less than the marginal product of the previous worker. (p. 256)

Deflation A situation in which the price level is *falling* and the inflation rate is *negative*. (p. 423)

Demand The relationship between the quantity demanded and the price of a good when all other influences on buying plans remain the same. (p. 85)

Demand curve A graph of the relationship between the quantity demanded of a good and its price when all the other influences on buying plans remain the same. (p. 86)

Demand for labor The relationship between the quantity of labor demanded and the real wage rate when all other influences on firms' hiring plans remain the same. (p. 449)

Demand-pull inflation Inflation that starts because aggregate demand increases. (p. 524)

Demand schedule A list of the quantities demanded at each different price when all the other influences on buying plans remain the same. (p. 86)

Depreciation The decrease in the value of capital that results from its use and from obsolescence. (p. 376)

Deregulation The process of removing regulation of prices, quantities, entry, and other aspects of economic activity in a firm or an industry. (p. 326)

Diminishing returns The tendency for each additional hour of labor employed to produce a

successively smaller additional amount of real GDP. (p. 448)

Direct relationship A relationship between two variables that move in the same direction. (p. 24)

Discount rate The interest rate at which the Fed stands ready to lend reserves to commercial banks. (p. 489)

Discouraged worker A marginally attached worker who has not made specific efforts to find a job within the past four weeks because previous unsuccessful attempts to find a job were discouraging. (p. 400)

Discretionary fiscal policy A fiscal policy action that is initiated by an act of Congress. (p. 533)

Diseconomies of scale A condition in which, when a firm increases its plant size and labor employed by the same percentage, its output increases by a smaller percentage and its average total cost increases. (p. 270)

Disposable personal income Income received by households minus personal income taxes paid. (p. 377)

Duopoly A market with only two firms. (p. 350)

Dumping When a foreign firm sells its exports at a lower price than its cost of production. (p. 214)

Earnings sharing regulation A regulation that requires firms to make refunds to customers when profits rise above a target level. (p. 331)

Economic depreciation An opportunity cost of a firm using capital that it owns—measured as the change in the *market value* of capital over a given period. (p. 251)

Economic freedom A condition in which people are able to make

personal choices, their private property is protected by the rule of law, and they are free to buy and sell in markets. (p. 467)

Economic growth The sustained expansion of production possibilities. (pp. 71, 456)

Economic growth rate The annual percentage change of real GDP. (p. 456)

Economic model A description of some feature of the economic world that includes only those features assumed necessary to explain the observed facts. (p. 12)

Economic profit A firm's total revenue minus total cost. (p. 251)

Economics The social science that studies the choices that individuals, businesses, government, and entire societies make as they cope with *scarcity*, the *incentives* that influence those choices, and the arrangements that coordinate them. (p. 2)

Economies of scale A condition in which, when a firm increases its plant size and labor employed by the same percentage, its output increases by a larger percentage and its average total cost decreases. (p. 269)

Efficient scale The quantity at which average total cost is a minimum. (p. 343)

Elastic demand When the percentage change in the quantity demanded exceeds the percentage change in price. (p. 114)

Elastic supply When the percentage change in the quantity supplied exceeds the percentage change in price. (p. 124)

Entrepreneurship The human resource that organizes labor, land, and capital to produce goods and services. (p. 36)

Equilibrium price The price at which the quantity demanded equals the quantity supplied. (p. 99)

Equilibrium quantity The quantity bought and sold at the equilibrium price. (p. 99)

Excess burden The amount by which the burden of a tax exceeds the tax revenue received by the government—the deadweight loss from a tax. (p. 172)

Excess capacity The amount by which the efficient scale exceeds the quantity that the firm produces. (p. 343)

Excess reserves A bank's actual reserves minus its desired reserves. (p. 492)

Explicit cost A cost paid in money. (p. 251)

Export goods and services Goods and services that are produced in one country and sold in other countries. (p. 32)

Exports The goods and services that firms in one country sell to households and firms in other countries. (p. 196)

Exports of goods and services Items that firms in the United States produce and sell to the rest of the world. (p. 370)

Externality A cost or a benefit that arises from production and that falls on someone other than the producer; or a cost or benefit that arises from consumption and that falls on someone other than the consumer. (p. 224)

Factor markets Markets in which the services of factors of production are bought and sold. (p. 46)

Factors of production The productive resources that are used to produce goods and services—land,

labor, capital, and entrepreneurship. (p. 34)

Federal budget An annual statement of the outlays, tax revenues, and surplus or deficit of the government of the United States. (p. 532)

Federal funds rate The interest rate at which banks can borrow and lend reserves (interbank loans) in the federal funds market. (p. 484)

Federal Open Market Committee The Fed's main policy-making committee. (p. 488)

Federal Reserve System (the Fed) The central bank of the United States. (p. 487)

Fiat money Objects that are money because the law decrees or orders them to be money. (p. 478)

Final good or service A good or service that is produced for its final user and not as a component of another good or service. (p. 368)

Firms The institutions that organize the production of goods and services. (p. 48)

Fiscal policy Changing taxes, transfer payments, and government expenditure on goods and services. (p. 515) The use of the federal budget to achieve the macroeconomic objectives of high and sustained economic growth and full employment. (p. 532)

Fiscal stimulus An increase in government outlays or a decrease in tax revenues designed to boost real GDP and create or save jobs. (p. 536)

Four-firm concentration ratio The percentage of the total revenue in an industry accounted for by the four largest firms in the industry. (p. 339)

Frictional unemployment The unemployment that arises from

normal labor turnover—from people entering and leaving the labor force and from the ongoing creation and destruction of jobs. (p. 411)

Full employment When there is no cyclical unemployment or, equivalently, when all the unemployment is frictional, structural, or seasonal. (p. 413)

Full-employment equilibrium When equilibrium real GDP equals potential GDP. (p. 519)

Full-time workers People who usually work 35 hours or more a week. (p. 401)

Game theory The tool that economists use to analyze *strategic behavior*—behavior that recognizes mutual interdependence and takes account of the expected behavior of others. (p. 359)

GDP price index An average of the current prices of all the goods and services included in GDP expressed as a percentage of base-year prices. (p. 429)

Goods and services The objects (goods) and the actions (services) that people value and produce to satisfy human wants. (p. 3)

Goods markets Markets in which goods and services are bought and sold. (p. 46)

Government goods and services Goods and services that are bought by governments. (p. 32)

Government expenditure multiplier The effect of a change in government expenditure on goods and services on aggregate demand. (p. 535)

Government expenditure on goods and services The expenditure by all levels of government on goods and services. (p. 370)

Great Depression A period of high unemployment, low incomes, and extreme economic hardship that lasted from 1929 to 1939. (p. 403)

Gross domestic product (GDP) The market value of all the final goods and services produced within a country in a given time period. (p. 368)

Gross national product (GNP) The market value of all the final goods and services produced anywhere in the world in a given time period by the factors of production supplied by the residents of the country. (p. 377)

Herfindahl-Hirschman Index The square of the percentage market share of each firm summed over the 50 largest firms (or summed over all the firms if there are fewer than 50) in a market. (p. 339)

Households Individuals or groups of people living together. (p. 46)

Household production The production of goods and services in the home. (p. 385)

Human capital The knowledge and skill that people obtain from education, on-the-job training, and work experience. (p. 35)

Implicit cost An opportunity cost incurred by a firm when it uses a factor of production for which it does not make a direct money payment. (p. 251)

Import quota A quantitative restriction on the import of a good that limits the maximum quantity of a good that may be imported in a given period. (p. 209)

Imports The goods and services that households and firms in one

country buy from firms in other countries. (p. 196)

Imports of goods and services Items that households, firms, and governments in the United States buy from the rest of the world. (p. 370)

Incentive A reward or a penalty—a “carrot” or a “stick”—that encourages or discourages an action. (p. 11)

Income elasticity of demand A measure of the responsiveness of the demand for a good to a change in income when other things remain the same. (p. 130)

Increasing marginal returns When the marginal product of an additional worker exceeds the marginal product of the previous worker. (p. 256)

Induced taxes Taxes that vary with real GDP. (p. 540)

Inelastic demand When the percentage change in the quantity demanded is less than the percentage change in price. (p. 114)

Inelastic supply When the percentage change in the quantity supplied is less than the percentage change in price. (p. 124)

Infant-industry argument The argument that it is necessary to protect a new industry to enable it to grow into a mature industry that can compete in world markets. (p. 213)

Inferior good A good for which demand decreases when income increases and demand increases when income decreases. (p. 89)

Inflationary gap A gap that exists when real GDP exceeds potential GDP and that brings a rising price level. (p. 520)

Inflation rate The percentage change in the price level from one year to the next. (p. 423)

Interest Income paid for the use of capital. (p. 37)

Intermediate good or service A good or service that is used as a component of a final good or service. (p. 368)

Inverse relationship A relationship between two variables that move in opposite directions. (p. 25)

Investment The purchase of new *capital goods* (tools, instruments, machines, buildings, and other constructions) and additions to inventories. (p. 369)

Keynesian macroeconomics The view that the market economy is inherently unstable and needs active government intervention to achieve full employment and sustained economic growth. (p. 444)

Labor The work time and work effort that people devote to producing goods and services. (p. 35)

Labor force The number of people employed plus the number unemployed. (p. 398)

Labor force participation rate The percentage of the working-age population who are members of the labor force. (p. 400)

Labor productivity The quantity of real GDP produced by one hour of labor. (p. 460)

Land The “gifts of nature,” or *natural resources*, that we use to produce goods and services. (p. 34)

Law of decreasing returns As a firm uses more of a variable input, with a given quantity of fixed inputs, the marginal product of the variable input eventually decreases. (p. 258)

Law of diminishing marginal returns If the quantity of capital is small, an increase in capital

brings a large increase in production; and if the quantity of capital is large, an increase in capital brings a small increase in production. (p. 461)

Law of demand Other things remaining the same, if the price of a good rises, the quantity demanded of that good decreases; and if the price of a good falls, the quantity demanded of that good increases. (p. 85)

Law of market forces When there is a surplus, the price falls; when there is a shortage, the price rises. (p. 99)

Law of supply Other things remaining the same, if the price of a good rises, the quantity supplied of that good increases; and if the price of a good falls, the quantity supplied of that good decreases. (p. 92)

Legal monopoly A market in which competition and entry are restricted by the granting of a public franchise, government license, patent, or copyright. (p. 307)

Linear relationship A relationship that graphs as a straight line. (p. 24)

Long run The time frame in which the quantities of *all* resources can be varied. (p. 254)

Long-run average cost curve A curve that shows the lowest average cost at which it is possible to produce each output when the firm has had sufficient time to change both its plant size and labor employed. (p. 270)

Loss Income earned by an entrepreneur for running a business when that income is negative. (p. 37)

M1 Currency held by individuals and firms, traveler's checks, and checkable deposits owned by individuals and businesses. (p. 478)

M2 M1 plus savings deposits and small time deposits, money market funds, and other deposits. (p. 478)

Macroeconomic equilibrium When the quantity of real GDP demanded equals the quantity of real GDP supplied at the point of intersection of the *AD* curve and the *AS* curve. (p. 518)

Macroeconomics The study of the aggregate (or total) effects on the national economy and the global economy of the choices that individuals, businesses, and governments make. (p. 2)

Margin A choice on the margin is a choice that is made by comparing *all* the relevant alternatives systematically and incrementally. (p. 10)

Marginal benefit The benefit that arises from a one-unit increase in an activity. The marginal benefit of something is measured by what you *are willing to* give up to get *one additional* unit of it. (p. 10)

Marginal cost The opportunity cost that arises from a one-unit increase in an activity. The marginal cost of something is what you *must* give up to get one additional unit of it. (p. 10) The marginal cost of producing a good is the change in total cost that results from a one-unit increase in output. (p. 262)

Marginal cost pricing rule A rule that sets price equal to marginal cost to achieve an efficient output. (p. 326)

Marginal external benefit The benefit from an additional unit of a good or service that people other than the consumer of the good or service enjoy. (p. 236)

Marginal external cost The cost of producing an additional unit of a good or service that falls on

people other than the producer. (p. 226)

Marginally attached worker A person who does not have a job, is available and willing to work, has not made specific efforts to find a job within the previous four weeks, but has looked for work sometime in the recent past. (p. 400)

Marginal private benefit The benefit from an additional unit of a good or service that the consumer of that good or service receives. (p. 236)

Marginal private cost The cost of producing an additional unit of a good or service that is borne by the producer of that good or service. (p. 226)

Marginal product The change in total product that results from a one-unit increase in the quantity of labor employed. (p. 256)

Marginal revenue The change in total revenue that results from a one-unit increase in the quantity sold. (p. 279)

Marginal social benefit The marginal benefit enjoyed by society—by the consumer of a good or service and by everyone else who benefits from it. It is the sum of marginal private benefit and marginal external benefit. (p. 236)

Marginal social cost The marginal cost incurred by the entire society—by the producer and by everyone else on whom the cost falls. It is the sum of marginal private cost and marginal external cost. (p. 226)

Market Any arrangement that brings buyers and sellers together and enables them to get information and do business with each other. (p. 46)

Market demand The sum of the demands of all the buyers in a market. (p. 87)

Market equilibrium When the quantity demanded equals the quantity supplied—buyers' and sellers' plans are in balance. (p. 99)

Market failure A situation in which the market delivers an inefficient outcome. (p. 155)

Market supply The sum of the supplies of all the sellers in the market. (p. 94)

Means of payment A method of settling a debt. (p. 476)

Medium of exchange An object that is generally accepted in return for goods and services. (p. 477)

Microeconomics The study of the choices that individuals and businesses make and the way these choices interact and are influenced by governments. (p. 2)

Minimum wage law A government regulation that makes hiring labor services for less than a specified wage illegal. (p. 183)

Monetarist macroeconomics The view that the market economy works well, that aggregate fluctuations are the natural consequence of an expanding economy, but that fluctuations in the quantity of money also bring the business cycle. (p. 445)

Monetary base The sum of coins, Federal Reserve notes, and banks' reserves at the Fed. (p. 489)

Monetary policy Changing the quantity of money and the interest rate. (p. 515) The adjustment of interest rates and the quantity of money to achieve the dual objectives of price stability and full employment. (p. 544)

Money Any commodity or token that is generally accepted as a means of payment. (p. 476)

Money multiplier The number by which a change in the monetary

base is multiplied to find the resulting change in the quantity of money. (p. 497)

Monopolistic competition A market in which a large number of firms compete by making similar but slightly different products. (p. 278)

Monopoly A market in which one firm sells a good or service that has no close substitutes and a barrier blocks the entry of new firms. (pp. 278, 306)

Nash equilibrium An equilibrium in which each player takes the best possible action given the action of the other player. (p. 356)

National debt The total amount that the federal government has borrowed to make expenditures that exceed tax revenue. The amount of government debt outstanding—debt that has arisen from past budget deficits. (pp. 50, 533)

Natural monopoly A monopoly that arises because one firm can meet the entire market demand at a lower average total cost than two or more firms could. (p. 306)

Natural unemployment rate The unemployment rate when the economy is at full employment. (p. 413)

Needs-tested spending Spending on programs that entitle suitably qualified people and businesses to receive benefits—benefits that vary with need and with the state of the economy. (p. 540)

Negative externality A production or consumption activity that imposes an external cost. (p. 224)

Negative relationship A relationship between two variables that move in opposite directions. (p. 25)

Net domestic product at factor cost The sum of wages, interest, rent, and profit. (p. 375)

Net exports of goods and services The value of exports of goods and services minus the value of imports of goods and services. (p. 370)

Net taxes Taxes paid minus cash benefits received from governments. (p. 370)

Nominal GDP The value of the final goods and services produced in a given year expressed in terms of the prices of that same year. (p. 378)

Nominal interest rate The dollar amount of interest expressed as a percentage of the amount loaned. (p. 436)

Nominal wage rate The average hourly wage rate measured in *current* dollars. (p. 434)

Normal good A good for which demand increases when income increases and demand decreases when income decreases. (p. 89)

Normal profit The return to entrepreneurship. Normal profit is part of a firm's opportunity cost because it is the cost of not running another firm. (p. 251)

Oligopoly A market in which a small number of independent firms compete. (p. 278)

Open market operation The purchase or sale of government securities—U.S. Treasury bills and bonds—by the New York Fed in the open market. (p. 489)

Opportunity cost The opportunity cost of something is the best thing you *must* give up to get it. (p. 9)

Output gap Real GDP minus potential GDP expressed as a percentage of potential GDP. (p. 414)

Part time for economic reasons

People who work 1 to 34 hours per week but are looking for full-time work and cannot find it because of unfavorable business conditions. (p. 401)

Part-time workers People who usually work less than 35 hours a week. (p. 401)

Payoff matrix A table that shows the payoffs for each player for every possible combination of actions by the players. (p. 356)

PCE price index An average of the current price of the goods and services included in the consumption expenditure component of GDP expressed as a percentage of base-year prices. (p. 429)

Perfect competition A market in which there are many firms, each selling an identical product; many buyers; no barriers to the entry of new firms into the industry; no advantage to established firms; and buyers and sellers are well informed about prices. (p. 278)

Perfect price discrimination

Price discrimination that extracts the entire consumer surplus by charging the highest price that consumers are willing to pay for each unit. (p. 322)

Perfectly elastic demand When the quantity demanded changes by a very large percentage in response to an almost zero percentage change in price. (p. 114)

Perfectly elastic supply When the quantity supplied changes by a very large percentage in response to an almost zero percentage change in price. (p. 124)

Perfectly inelastic demand

When the percentage change in the quantity demanded is zero for any percentage change in the price. (p. 114)

Perfectly inelastic supply

When the percentage change in the quantity supplied is zero for any percentage change in the price. (p. 124)

Positive externality A production or consumption activity that provides an external benefit. (p. 224)

Positive relationship A relationship between two variables that move in the same direction. (p. 24)

Potential GDP The value of real GDP when all the economy's factors of production—labor, capital, land, and entrepreneurial ability—are fully employed. (pp. 381, 414, 447)

Price cap A government regulation that places an upper limit on the price at which a particular good, service, or factor of production may be traded. (p. 176)

Price cap regulation A rule that specifies the highest price that a firm is permitted to set—a price ceiling. (p. 330)

Price ceiling A government regulation that places an *upper* limit on the price at which a particular good, service, or factor of production may be traded. (p. 176)

Price-discriminating monopoly A monopoly that sells different units of a good or service for different prices not related to cost differences. (p. 308)

Price elasticity of demand A measure of the responsiveness of the quantity demanded of a good to a change in its price when all other influences on buyers' plans remain the same. (p. 112)

Price elasticity of supply A measure of the responsiveness of the quantity supplied of a good to a change in its price when all other influences on sellers' plans remain the same. (p. 124)

Price floor A government regulation that places a *lower* limit on the price at which a particular good, service, or factor of production may be traded. (p. 182)

Price support A price floor in an agricultural market maintained by a government guarantee to buy any surplus output at that price. (p. 189)

Price taker A firm that cannot influence the price of the good or service that it produces. (p. 279)

Prisoners' dilemma A game between two prisoners that shows why it is hard to cooperate, even when it would be beneficial to both players to do so. (p. 355)

Private sector balance Saving minus investment. (p. 854)

Producer surplus The price of a good in excess of the marginal cost of producing it, summed over the quantity produced. (p. 150)

Product differentiation Making a product that is slightly different from the products of competing firms. (p. 338)

Production efficiency A situation in which the economy is getting all that it can from its resources. (p. 62)

Production function A relationship that shows the maximum quantity of real GDP that can be produced as the quantity of labor employed changes and all other influences on production remain the same. (p. 448)

Production possibilities frontier The boundary between the combinations of goods and services that can be produced and the combinations that cannot be produced, given the available factors of production and the state of technology. (pp. 60, 141)

Profit Income earned by an entrepreneur for running a business. (p. 37)

Property rights Legally established titles to the ownership, use, and disposal of factors of production and goods and services that are enforceable in the courts. (pp. 229, 467)

Public provision The production of a good or service by a public authority that receives most of its revenue from the government. (p. 238)

Quantity demanded The amount of any good, service, or resource that people are willing and able to buy during a specified period at a specified price. (p. 85)

Quantity of labor demanded The total labor hours that all the firms in the economy plan to hire during a given time period at a given real wage rate. (p. 449)

Quantity of labor supplied The number of labor hours that all the households in the economy plan to work during a given time period at a given real wage rate. (p. 451)

Quantity supplied The amount of any good, service, or resource that people are willing and able to sell during a specified period at a specified price. (p. 92)

Rate of return regulation A regulation that sets the price at a level that enables a firm to earn a specified target rate of return on its capital. (p. 330)

Rational choice A choice that uses the available resources to best achieve the objective of the person making the choice. (p. 8)

Real GDP The value of the final goods and services produced in a

given year expressed in terms of the prices in a *base year*. (p. 378)

Real GDP per person Real GDP divided by the population. (pp. 381, 456)

Real interest rate The goods and services forgone in interest expressed as a percentage of the amount loaned and calculated as the nominal interest rate minus the inflation rate. (p. 436)

Real wage rate The average hourly wage rate measured in the dollars of a given reference base year. (p. 434)

Recession A period during which real GDP decreases for at least two successive quarters; or defined by the NBER as “a period of significant decline in total output, income, employment, and trade, usually lasting from six months to a year, and marked by contractions in many sectors of the economy.” (p. 382)

Recessionary gap A gap that exists when potential GDP exceeds real GDP and that brings a falling price level. (p. 520)

Reference base period A period for which the CPI is defined to equal 100. Currently, the reference base period is 1982–1984. (p. 420)

Regulation Rules administered by a government agency to influence prices, quantities, entry, and other aspects of economic activity in a firm or an industry. (p. 326)

Rent Income paid for the use of land (p. 37)

Rent ceiling A regulation that makes it illegal to charge more than a specified rent for housing. (p. 176)

Rent seeking Lobbying and other political activity that aims to capture the gains from trade. The act of obtaining special treatment by the government to create

economic profit or divert consumer surplus or producer surplus away from others. (pp. 217, 317)

Required reserve ratio The minimum percentage of deposits that banks and other financial institutions must hold in reserves. (p. 483)

Reserves The currency in the bank’s vaults plus the balance on its reserve account at a Federal Reserve Bank. (p. 483)

Rule of 70 The number of years it takes for the level of any variable to double is approximately 70 divided by the annual percentage growth rate of the variable. (p. 457)

Saving The amount of income that is not paid in net taxes or spent on consumption goods and services. (p. 370)

Scarcity The condition that arises because wants exceed the ability of resources to satisfy them. (p. 2)

Scatter diagram A graph of the value of one variable against the value of another variable. (p. 22)

Search activity The time spent looking for someone with whom to do business. (p. 178)

Self-interest The choices that are best for the individual who makes them. (p. 4)

Short run The time frame in which the quantities of some resources are fixed. In the short run, a firm can usually change the quantity of labor it uses but not its technology and quantity of capital. (p. 254)

Shutdown point The point at which price equals minimum average variable cost and the quantity produced is that at which average variable cost is at a minimum. (p. 283)

Single-price monopoly A monopoly that must sell each unit of its output for the same price to all its customers. (p. 308)

Slope The change in the value of the variable measured on the y -axis divided by the change in the value of the variable measured on the x -axis. (p. 27)

Social interest The choices that are best for society as a whole. (p. 4)

Social interest theory The theory that regulation achieves an efficient allocation of resources. (p. 326)

Stagflation A combination of recession (falling real GDP) and inflation (rising price level). (p. 522)

Standard of living The level of consumption of goods and services that people enjoy, *on average*; it is measured by average income per person. (p. 381)

Statistical discrepancy The discrepancy between the expenditure approach and the income approach estimates of GDP, calculated as the GDP expenditure total minus the GDP income total. (p. 376)

Store of value Any commodity or token that can be held and exchanged later for goods and services. (p. 477)

Strategies All the possible actions of each player in a game. (p. 356)

Structural surplus or deficit The budget balance that would arise if tax revenues and outlays were at their full-employment levels. (p. 540)

Structural unemployment The unemployment that arises when changes in technology or international competition change the skills needed to perform jobs or change the locations of jobs. (p. 411)

Subsidy A payment by the government to a producer to cover part of the cost of production. (pp. 189, 211, 239)

Substitute A good that can be consumed in place of another good. (p. 88)

Substitute in production A good that can be produced in place of another good. (p. 95)

Supply The relationship between the quantity supplied and the price of a good when all other influences on selling plans remain the same. (p. 92)

Supply curve A graph of the relationship between the quantity supplied of a good and its price when all the other influences on selling plans remain the same. (p. 93)

Supply of labor The relationship between the quantity of labor supplied and the real wage rate when all other influences on work plans remain the same. (p. 451)

Supply schedule A list of the quantities supplied at each different price when all the other influences on selling plans remain the same. (p. 93)

Tariff A tax imposed on a good when it is imported. (p. 205)

Tax incidence The division of the burden of a tax between the buyer and the seller. (p. 170)

Tax multiplier The effect of a change in taxes on aggregate demand. (p. 535)

Time-series graph A graph that measures time on the x -axis and the variable or variables in which we are interested on the y -axis. (p. 22)

Total cost The cost of all the factors of production used by a firm. (p. 261)

Total fixed cost The cost of the firm's fixed factors of production—the cost of land, capital, and entrepreneurship. (p. 261)

Total product The total quantity of a good produced in a given period. (p. 255)

Total revenue The amount spent on a good and received by the seller and equals the price of the good multiplied by the quantity of the good sold. (p. 120)

Total revenue test A method of estimating the price elasticity of demand by observing the change in total revenue that results from a price change (with all other influences on the quantity sold remaining unchanged). (p. 121)

Total surplus The sum of consumer surplus and producer surplus. (p. 153)

Total variable cost The cost of the firm's variable factor of production—the cost of labor. (p. 261)

Tradeoff An exchange—giving up one thing to get something else. (pp. 8, 63)

Transactions costs The opportunity costs of making trades in a market or conducting a transaction. (pp. 157, 230)

Transfer payments multiplier The effect of a change in transfer payments on aggregate demand. (p. 535)

Trend A general tendency for the value of a variable to rise or fall over time. (p. 22)

Underground production The production of goods and services hidden from the view of government. (p. 385)

Unemployment rate The percentage of the people in the labor force who are unemployed. (p. 399)

Unit elastic demand When the percentage change in the quantity demanded equals the percentage change in price. (p. 114)

Unit elastic supply When the percentage change in the quantity supplied equals the percentage change in price. (p. 124)

Unit of account An agreed-upon measure for stating the prices of goods and services. (p. 477)

Voucher A token that the government provides to households, which they can use to buy specified goods or services. (p. 240)

Wages Income paid for the services of labor. (p. 37)

Working-age population The total number of people aged 16 years and over who are not in jail, hospital, or some other form of institutional care or in the U.S. Armed Forces. (p. 398)

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Index

- Absolute advantage**, 73, 74–76
- Accounting, 250
- Addictive substances, 122
- Advanced economies, 39, 40, 41
- Advanced Micro Devices (AMD), 361
- Advertising
 - games, 359
 - in oligopoly, 358–359
 - selling costs of, 347
- Age distribution, 411
- Aggregate demand (AD)**, 512
 - AS-AD model and, 506, 524
 - changes in, 514–516, 546
 - cost-push inflation, 523
 - demand-pull inflation and, 522
 - fiscal/monetary policy
 - influencing, 515
 - foreign exchange rate influencing, 515–516
 - multiplier in, 516
 - price levels and real GDP in, 512
 - real business cycle and, 521
 - real interest rates and, 513–514
 - world economy influencing, 515–516
- Aggregate demand curve, 513
- Aggregate demand schedule, 513
- Aggregate supply (AS)**, 506–510
 - in AS-AD model, 506, 524
 - changes in, 509–510
 - cost-push inflation, 523
 - demand-pull inflation and, 522
 - fiscal policy and, 538
 - money wage rate in, 509–510, 519
 - real business cycle and, 521
 - real GDP and, 506–507, 518
 - recession from, 525
- Aggregate supply curve (AS curve), 507, 523
- Aggregate supply schedule, 507
- Agriculture
 - market, 187
 - price elasticity of demand
 - in, 122
- Airbus, 351–353, 357–358, 360
- Airline industry, 199, 321–324, 374
- Airplanes, 199, 351–353, 360
- Air pollution, 233
- Allocative efficiency**, 141
- AMD. *See* Advanced Micro Devices
- American Recovery and Reinvestment Act, 542
- Antitrust laws, 361
- AS-AD model, 524
 - aggregate supply and demand in, 506, 524
 - with goods and services, 506
 - monetary stabilization in, 548
- Automatic fiscal policy**, 533, 540, 542
- Automatic stabilizers**, 540
- Average cost, 263–264
- Average cost curve, 264
- Average cost pricing, 328
- Average cost pricing rule**, 328
- Average fixed cost**, 263
- Average fixed cost curve, 264
- Average income
 - in global economy, 44
 - United States and, 44
- Average product**, 258–259
- Average total cost**, 263, 271
- Average total cost curve, 264, 265, 288, 312
- Average variable cost**, 263
- Balanced budget**, 532
- Balanced budget multiplier**, 535
- Banking system**, 482–485
 - commercial banks in, 482–484
 - Europe’s creation of, 483
 - Federal Reserve System in, 482
 - monetary base and, 492
 - money market funds and, 485
 - thrift institutions in, 485
- Bank loans, 546
- Banks
 - deposits of, 482
 - excess reserves of, 492
 - liquid assets of, 484
 - loans by, 484
 - regional, 488
 - reserves of, 483
- Barriers to entry**, 306
 - legal, 307–308
 - monopolies caused by, 306–307
 - ownership and, 307
- Barro, Robert J., 541
- Barter**, 477
- Base-year prices, 393
- BEA. *See* Bureau of Economic Analysis
- Beige book**, 544
- Benefits**, 9
 - of education, 15
 - marginal external/private/social, 236
 - marginal private, 236
 - private, 236–237
 - social, 236–237
 - welfare, 48
- Bernanke, Ben, 487, 498, 550, 551
- Bias
 - commodity substitution, 427
 - in CPI, 426–427
 - CPI consequences of, 428
 - magnitude of, 427
 - of new goods, 426
 - outlet substitution, 427
 - quality change, 427
- Big tradeoff**, 159
- Black market**, 175–176
- Board of Governors, 488
- Boeing, 351–353, 357–358, 360
- Boskin, Michael, 427
- Break-even income, 281
- Budget deficit**, 6, 532
- Budget surplus**, 532
- Bureau of Economic Analysis (BEA), 374, 393
- Bush, George W., 187
- Business cycle**, 382, 521
 - phases of, 382–384
 - real, 521
 - in United States, 383
- Business cycle theory, 525
- Businesses
 - in circular flow, 46
 - cost/profit accounting of, 250, 252
 - economic loss and, 294–295

- Businesses (*continued*)
 economic policy of, 14
 economic profit incentive of, 294, 313
 economic profits goal of, 279
 failures of, 508
 market entry of, 293–294
 market exit of, 293–295
 in monopolistic competition, 338
 profit-maximizing decisions of, 250, 280–283, 450
 profits squeezed in, 508
 short-run supply curve of, 284–285
 shutdown decisions of, 283–284
- Buyers
 e-cash used by, 480
 markets for sellers and, 46, 84, 467–468
 number of, 89
 price discrimination among, 320–321
 price gouging and, 160
 self-interest of, 153
- Buying power, 512–513
- CAFTA. *See* Central American Free Trade Agreement
- Calvin Klein, 342
- Cap Executive Officer Pay Act, 185
- Capital, 35, 42**
 accumulation, 461–462
 in factors of production, 35
 financial, 35
 human, 35, 42
 increasing, 462
 interest cost of, 251
 specialization of, 269
- Capital goods, 32, 369**
- Capture theory, 326**
- Card, David, 183
- Career choices, 45
- Cartel, 350**
- CBO. *See* Congressional Budget Office
- Cell phones, 66, 71, 346
- Central American Free Trade Agreement (CAFTA), 205
- Central bank, 487**
- Ceteris paribus, 28
- Chained-dollar real GDP, 393, 395**
- Change in demand, 88–89, 295**
 income and, 89
 influence of, 88–89, 101, 104–105
 quantity demanded changes and, 90
- Change in quantity demanded, 90**
- Change in supply, 95–96**
 influence of, 95–96, 102, 104–105
 quantity supplied changes and, 97
- Change in the quantity supplied, 97**
- Charter schools, 239, 241
- Checks, 479
- Circular flows, 46**
 federal government and, 50
 with financial market, 371
 in global economy, 52–53
 government in, 48, 49
 households and businesses in, 46
 income and expenditure in, 371
 local/state governments and, 51
 markets with, 46
 model of, 46, 47
 money flows and, 46–47
 real flows and, 46–47
 in United States economy, 369–370
- Classical macroeconomics, 444–445**
- Clean Air Act, 231, 232
- Clean technologies, 233
- Climate change, 6
- Clinton, Bill, 52
- Close substitutes, 306
- Coase, Ronald, 230
- Coase theorem, 230**
- Collusion, 338, 350
- Command system, 139**
- Commercial banks, 482**
 in banking system, 482–484
 deposits of, 482
 financial crisis stressing, 485
 liquid assets of, 484
 loans by, 484
 net worth of, 484
 profit and risk of, 483
 reserves of, 483
 securities sold by, 494
- Commodity substitution bias, 427
- Common resources, 156**
- Comparative advantage, 74**
 absolute advantage compared to, 74–76
 in international trade, 196
- national, 196
 opportunity cost compared to, 74–76
- Competition, 315–318
- Competitive markets, 84, 153
- Complement, 88**
- Complement in production, 95–96**
- Compromise, 161
- Computer programs, 374
- Congress, 544
- Congressional Budget Office (CBO), 412, 541
- Constant returns to scale, 270**
- Consumer Price Index (CPI), 420**
 bias consequences in, 428
 bias sources in, 426–427
 calculating, 422–423
 goods and services and, 420–424
 inflation rate and, 424, 437
 market basket and, 420–421
 measure of, 430
 real GDP and, 433–434
 real value calculations of, 432
 student's, 437
- Consumers
 externalities and, 241
 facing monopolies, 331
 in globalization, 201
 in international trade, 197, 217
 perfect competition and, 299
 resource allocation and, 161
- Consumer surplus, 147, 177**
 decrease in, 208
 demand and, 147
 international trade with, 207–208
 price discrimination and, 320–321
- Consumption, 71, 225
- Consumption expenditures, 369, 546**
 aggregate demand multiplier and, 516
 disposable personal income influencing, 377
 expenditure approach and, 373–374
 income changes and, 525
 PCE price index and, 429
- Consumption goods and services, 32, 33, 369, 420, 429, 435**
- Contests, 139
- Copyright laws, 308
- Core inflation rate, 429**
- Correlation, 12**

- Cost curve, 266, 267
- Cost of living index, 426**
- Cost-push inflation, 523**
- Costs
- average fixed, 263
 - average total, 263, 271
 - of education, 15
 - explicit, 251
 - fixed, 329
 - glossary of, 265
 - implicit, 251
 - interest, 251
 - marginal external/private/
 - social, 226
 - private, 226
 - profits and, 250, 252
 - total fixed, 261
 - total variable, 261
 - transactions, 157, 230
 - zero marginal, 329
- CPI. *See* Consumer Price Index
- Credit cards, 479–480
- Credit easing, 489
- Credit Unions, 485
- Cross elasticity of demand, 129–130**
- Cross-section graphs, 22–23**
- Currency, 478**
- desired holding of, 492
 - drain, 492
 - drain ratio, 492
- Cyclical budget balances, 541
- Cyclical surplus or deficit, 540**
- Cyclical unemployment, 410**
- Dargay, Joyce, 121
- Deadweight loss, 155**
- average cost pricing
 - generating, 328
 - monopolies and, 316–317, 331
 - natural monopolies and, 326
 - overproduction and, 155
 - pollution causing, 228
 - price support creating, 189
 - regulations causing, 157
 - rent ceiling influencing, 177
 - rent seeking and, 318
 - subsidies and, 211
 - tariffs and, 208
 - taxes creating, 170
 - underproduction causing, 155
- DeBeers, 307
- Debit cards, 480
- Debts, 534
- Decreasing marginal returns, 256**
- Defense goods, 69
- Defense spending, 69
- Deflation, 423**
- Great Depression and, 524
 - historical, 424
 - inflation and, 424
 - nominal GDP and, 433
- Demand, 85**
- change in, 88–90, 101, 104–105, 295
 - consumer surplus and, 147
 - cross elasticity of, 129–130
 - elastic, 114
 - income elasticity of, 130–131
 - individual, 87
 - inelastic, 114
 - law of, 85, 86, 103
 - marginal revenue and, 310
 - market equilibrium and, 101–102
 - in perfect competition, 280
 - perfectly elastic, 114
 - perfectly inelastic, 114
 - regulations and, 185
 - selling costs and, 348
 - supply and, 102–103
 - unit elastic, 114
 - in your life, 103
- Demand curve, 86**
- aggregate, 513
 - elasticity and, 114, 117
 - marginal benefits and, 146
- Demand for labor, 449–450**
- Demand-pull inflation, 522**
- Demand schedule, 86**
- Demand-side effects, 535–536
- Deposits, 478
- of commercial banks, 482
 - loans and, 491–492
- Depreciation, 376**
- Deregulation, 326**
- Developing economies
- emerging markets and, 39
 - global economy with, 39, 42
 - human capital in, 42
 - physical capital in, 43
 - production in, 41
- Diminishing returns, 448**
- Discount rate, 489**
- Discouraged worker, 400**
- Discretionary fiscal policy, 533**
- demand-side effects of, 535–536
 - federal budget and, 539–540
 - fiscal stimulus and, 542
 - limitations of, 539
 - supply-side effects and, 537–538
- Diseconomies of scale, 271
- Diseconomies of scale, 270**
- Disposable personal income, 377**
- Diversity, 216
- Division of labor, 13, 73, 256–257
- Domestic market, 187–188
- Domestic production, 207
- Dumping, 214**
- Duopolists' Dilemma, 352, 357–358
- Duopoly, 350–351**
- Durable goods, 369
- Earnings sharing regulation, 331**
- East Asia, 468–469
- E-cash, 480
- E-checks, 480
- E-commerce, 154
- Economic(s), 2, 4**
- accounting, 252
 - beginning of, 13
 - business' loss in, 294–295
 - core ideas of, 8
 - forecasting, 540
 - Hong Kong's growth in, 72
 - loss, 294–295
 - models, 12, 24–26
 - personal policy of, 14
 - policies in, 14
 - production possibility expansion
 - in, 71
 - profit incentive, 294, 313
 - rational choices in, 8–9
 - real GDP and tracking of, 384
 - short run loss in, 290
 - Smith, Adam, in, 13
 - as social science, 13
 - unemployment benefits
 - investigations in, 12
 - zero profits in, 288, 342
- Economic depreciation, 251**
- Economic freedom, 467**
- Economic growth, 71, 456–457**
- conditions for, 467–468
 - consumption and, 71
 - formula calculating, 456
 - government policies achieving
 - faster, 468–469
 - Hong Kong's, 72

- Economic growth** (*continued*)
 - human capital and, 465
 - inflation trends and, 520–521
 - international trade stimulating, 469
 - PPF and, 71
 - sources of, 464
 - in U.S. economy, 520–521
- Economic growth rate, 456**
- Economic investigations, 12
- Economic profits, 251–252, 345**
 - business' goal of, 279
 - business incentive of, 294, 313
 - revenue concepts in, 279–280
 - in short run, 288–289
 - single-price monopoly and, 321
 - total revenue/total cost and, 281
 - zero, 288, 342
- Economies of scale, 269, 271**
- Economy
 - emerging market, 39
 - information age, 5–6, 36
 - monopolistic competition in, 340
 - post-industrial, 45
 - real GDP tracking of, 384
 - recession in, 525
 - specialization in United States, 73
 - of United States, 33, 45
 - United States circular flows in, 369–370
- Education
 - costs and benefits of, 15
 - external benefits of, 236–237
 - improving quality of, 469
 - quality of, 241
 - United States economy and, 241
 - vouchers used in, 241
- Efficiency
 - allocative, 141
 - market, 152–157
 - of minimum wage, 184–185
 - of monopolies, 316
 - of monopolistic competition, 348
 - of natural monopolies, 326–327
 - of oligopoly, 361
 - of perfect competition, 298–299
 - of price discrimination, 324
 - product innovation and, 345
 - production, 62–63, 74–76, 141
 - of public provision, 238
 - regulation, 326–327
 - of rent ceiling, 177–178
 - in resource allocation, 141–144
 - taxes and, 169–170
 - vouchers achieving, 240
 - zero marginal cost and, 329
- Efficient scale, 343**
- Elastic demand, 114**
- Elasticity, 170–171
 - addictive substances and, 122
 - cross, 129–130
 - demand curve and, 114, 117
 - marginal revenue and, 311–312
 - of supply, 124
- Elasticity of demand, 114, 171
 - cross, 129–130
 - income, 130–131
- Elastic supply, 124**
- Emerging market economy, 39
- Employment
 - equilibrium, 519
 - part-time, 407
 - production efficiency and, 62
 - in United States, 34
 - wage rate and, 183
- Energy, 42
- Entitlement programs, 539
- Entrepreneurship, 36**
- Entry, 339
 - barriers to, 306–308
 - of businesses, 293–294
 - legal barriers to, 307–308
 - monopolies causing barriers to, 306–307
 - in monopolistic competition, 339
 - ownership barriers to, 307
- Environmental Protection Agency (EPA), 231, 233
- Environmental Standards, 216
- EPA. *See* Environmental Protection Agency
- Equilibrium
 - forces creating, 100
 - full-employment, 519
 - of labor markets, 452–453, 506
 - long-run, 292
 - macroeconomic, 518, 519
 - rent seeking, 318
 - short run, 288, 289, 290
- Equilibrium price, 99**
- Equilibrium quantity, 99**
- Europe
 - banking system created in, 483
 - potential GDP in, 447
 - United States production compared to, 454
- Excess burden, 170**
- Excess capacity, 343**
- Excess reserves, 492**
- Exchange rates, 546
- Exit
 - of businesses, 293–295
 - in monopolistic competition, 339
- Expenditure approach, 373–374
- Expenditures
 - circular flows of income and, 371
 - of federal government, 50, 534
 - GDP measured using, 373–374
 - income equals, 370–371
 - of local/state governments, 51
 - in marketing, 346
- Explicit costs, 251**
- Export of goods and services, 32, 52, 370**
- Exports, 196**
 - airplane, 199
 - dumping of, 214
 - gains/losses from, 203
 - of goods and services, 32, 52, 370
 - in international finance, 52–53
 - in international trade, 52, 196–197
 - market with, 199
 - net, 370, 546
 - price levels influencing, 514
 - producer surplus influenced by, 202
 - subsidies, 211
 - United States, 33, 197, 198, 199
 - voluntary restraints on, 211
- External benefits
 - of college education, 236–237
 - government actions with, 238–240
 - marginal, 236
 - underproduction with, 237
- External costs
 - governments and, 231–232
 - inefficiency with, 228
 - marginal, 226
 - output and, 227
 - pollution as, 227–228
- Externalities, 156, 224**
 - consumers and, 241
 - positive, 224–225
 - positive consumption, 242
 - types of, 224

- Eye on the Global Economy
 - global standard of living in, 387
 - Hong Kong's economic growth and, 72
 - international trade and, 54
 - potential GDP in, 447
 - price elasticities of demand in, 119
 - real GDP per person in, 458
 - unemployment rate in, 404
 - women in, 405
- Eye on the Past
 - banking creation in, 483
 - economics born in, 13
 - federal government's revenues and debts in, 534
 - governments growth and, 52
 - inflation and deflation in, 424
 - production changes and, 34
 - United States tariffs in, 205
 - United States wage rates in, 435
- Eye on the U.S. Economy
 - airline price discrimination in, 324
 - air pollution trends in, 233
 - consumption goods and services in, 33
 - defense goods/services and, 69
 - e-commerce in, 154
 - economic growth in, 520–521
 - education in, 241
 - financial crisis in, 485
 - import/exports and, 197
 - information economy and, 36
 - invisible hand's influence in, 154
 - Lucas wedge in, 446
 - monopolistic competition in, 340
 - nominal GDP and, 433
 - Okun gap in, 446
 - population survey in, 401
 - production in, 33
 - social security and Medicare in, 539
 - software in, 374
 - specialization and trade in, 73
 - structural and cyclical budget balances in, 541
- Eye on Your Life
 - AS-AD model in, 524
 - comparative advantage and, 76
 - demand and supply in, 103
 - economic growth in, 465
 - externalities in, 241
 - fiscal and monetary policy in, 551
 - GDP contributions in, 386
 - global economy and, 45
 - grade point averages in, 259
 - international trade and, 217
 - labor market activity in, 412
 - money created in, 491
 - monopolies in, 331
 - payoff matrix in, 360
 - perfect competition and, 299
 - PPF and, 64
 - price ceilings/price floors and, 64, 189
 - price elasticities of demand and, 131
 - resource allocation in, 161
 - selling costs in, 348
 - student's CPI in, 437
 - United States economy and, 45
- Facebook, 36
- Factor markets, 46**
- Factor prices, 266–267**
- Factors of production, 34**
 - capital in, 35
 - entrepreneurship in, 36
 - labor in, 35
 - land in, 34
- Fair Labor Standards Act*, 183
- Fairness
 - big tradeoff and, 159
 - of markets, 159
 - of minimum wage, 185
 - of monopolies, 317
 - of perfect competition, 299
 - of price gouging, 160
 - of rent ceilings, 178
 - of resource allocation, 161
 - rules of, 159
- Farm product markets, 187
- Fast-food servers, 180
- Federal budget, 532–533**
 - discretionary fiscal policy and, 539–540
 - time line of, 533
 - 2012, 532
- Federal funds rate, 484, 545**
- Federal government, 48
 - circular flows and, 50
 - expenditures/revenues of, 50, 534
 - Social Security provided by, 48, 50
 - taxes received by, 50
- Federal Open Market Committee (FOMC), 488, 544**
- Federal Reserve System (the Fed), 487**
 - actions and influence of, 546–547
 - banking system and, 482
 - Board of Governors of, 488
 - crisis measures of, 489
 - discount rate used by, 489
 - districts of, 487
 - FOMC of, 488
 - Great Depression averted by, 550
 - inflation fought by, 549
 - money creation by, 498–499
 - open market operation used by, 489
 - policy tools of, 488–489
 - recession fought by, 548–549
 - regional banks of, 488
 - required reserve ratio used by, 488
 - securities bought by, 493–495
 - securities sold by, 496
 - structure of, 487–488
- Feige, Edgar L., 385
- Fiat money, 478**
- Final good or service, 368**
- Financial capital, 35
- Financial crisis
 - commercial banks under stress from, 485
 - in United States, 485, 525
- Financial markets, 371
- Firms, 46**
- Fiscal policy, 515, 532, 551**
 - aggregate supply and, 538
 - automatic, 533, 540, 542
 - types of, 533
- Fiscal stimulus, 536, 542**
- Fixed costs, 329
- Fixed plant, 254
- FOMC. *See* Federal Open Market Committee
- Food Stamp program, 240
- Force, 140–141
- Foreign exchange rate, 515–516
- Foreign labor, 215
- Four-firm concentration ratio, 340**
- Free lunch, 63–64
- Frictional unemployment, 409, 411**
- Friedman, Milton, 445, 550
- Full employment, 410**
 - above or below, 519
 - government intervention for, 444–445

Full employment (*continued*)

- Keynesian macroeconomics and, 444–445
 - potential GDP and, 412, 447, 453
 - price levels and, 523
 - restoring, 523
- Full-employment equilibrium, 519**
- Full-time workers, 401**
- Functional distribution of income, 37
- Future prices, 96

Game theory, 355–361

- Gasoline prices, 121
- Gates, Bill, 6, 36, 331
- GATT. *See* General Agreement on Tariffs and Trade
- GDP. *See* Gross domestic product
- GDP price index, 429**
- General Agreement on Tariffs and Trade (GATT), 205
- General Motors, 296–297
- The General Theory of Employment, Interest, and Money* (Keynes), 444

GHG. See Greenhouse gases

Gifts of nature, 34

Global economy

- advanced economies in, 39, 40
- average incomes in, 44
- career choices in, 45
- circular flows in, 52–53
- developing economies in, 39, 42
- energy in, 42
- goods and services in, 39, 42
- Hong Kong's economic growth and, 72
- income distribution in, 43–44
- inequalities in, 43–44
- international trade in, 54
- potential GDP in, 447
- poverty in, 43–44
- price elasticity of demand in, 119
- production in, 40
- real GDP per person in, 458
- standard of living in, 384, 387
- unemployment rate in, 404
- women in, 405

Globalization

- consumers in, 201
 - international outsourcing and, 5
- GNP. *See* Gross national product
- Gokhale, Jagadeesh, 539
- Goldsmith, Samuel, 483

Gone with the Wind, 436

Goods

- bias of new, 426
- capital, 32, 369
- defense, 69
- durable, 369
- GDP and import of, 386
- inferior, 89
- nondurable, 369
- normal, 89
- price elasticity of demand and, 112–113, 131
- price level measures of, 426–430
- service, 69
- used, 374

Goods and services, 3

- AS-AD model with, 506
- consumption of, 32, 33, 369, 420, 429, 435
- CPI measure of, 420–424
- expenditure approach on, 373–374
- explanation of, 3–4
- exports of, 32, 52, 370
- fiscal and monetary policies and, 515
- GDP and omitted, 385
- GDP measurement of, 368–369
- GDP price index and, 429
- in global economy, 39, 42
- GNP and, 377
- governments purchasing, 32
- imports of, 370
- Keynesian macroeconomics and, 444–445
- money used for, 476–480
- net exports of, 370
- nominal GDP value of, 378
- production of, 385–386
- real GDP value of, 378, 447
- real interest rates and, 436
- standard of living value of, 381, 384, 386
- United States deficits from, 6
- United States producing, 33

Goods markets, 46

Goodwin, Phil, 121

Google, 329

Government

- budget balances of, 540
- in circular flow, 48, 49
- economic growth achieved by, 468–469

external benefits and, 238–240

- external costs and, 231–232
- farm product markets
 - intervention of, 187
- federal, 48
- full employment intervention by, 444–445
- goods and services purchased by, 32
- growth of, 52
- import quotas imposed by, 210–211
- license, 308
- minimum wage set by, 181–182
- outlay increases of, 428
- securities issued by, 484
- state/local, 48, 51
- subsidy from, 328
- supply-side effects of, 537–538
- tariff revenue of, 207

Government expenditure**multiplier, 535****Government expenditure on goods and services, 370****Government goods and services, 32**

Grade point average (GPA), 64, 259

Graphs

- axes of, 21
- ceteris paribus used in, 28
- cross-section of, 22–23
- economic models using, 24–26
- making, 21
- origin of, 21
- relationships/variables in, 21, 28, 29
- time-series, 22–23

Great Depression, 403

- classical macroeconomics during, 444–445
- deflation and, 524
- Federal Reserve averting, 550
- money creation and, 498–499

Great Moderation, 383

Greenhouse gases (GHG), 234

Gross domestic product (GDP), 368

- expenditures measuring, 373–374
- goods and services in, 368–369
- goods and services omitted from, 385
- import of goods and, 386
- income measuring, 375–376
- measuring, 373–379

- personal contributions in, 386
- production and income measures in, 377
- Gross national product (GNP), 377**
- Hamermesh, Daniel, 183
- Hanly, Mark, 121
- Health, 386
- Health-care markets, 242–243
- Henderson, Fritz, 296
- Herfindahl-Hirschman index, 340**
- Hiring, illegal, 182
- Hong Kong, 72
- Household production, 385**
- Households, 46**
- House market, 174
- Human capital, 35**
 - in developing economies, 42
 - economic growth and, 465
 - expansion of, 462–463
 - technologies and, 463
- Implicit costs, 251**
- Import quotas, 209**
 - government imposing, 210–211
 - influence of, 209–211
 - international trade and, 209–211
 - producer surplus and, 209–211
 - profits from, 211
- Imports, 196**
 - gains/losses from, 202
 - of goods, 386
 - of goods and services, 370
 - government imposing quotas on, 210–211
 - policy barriers of, 211
 - price levels influencing, 514
 - producer surplus influenced by, 202
 - United States, 33, 197, 198, 199
- Imports of goods and services, 370**
- Incentive mechanisms, 468
- Incentives, 11**
- Incidence, 170–172
- Income
 - break-even, 281
 - change in demand and, 89
 - circular flows of expenditure and, 371
 - consumption expenditure and changes in, 525
 - disposable personal, 377
 - expected future, 89
 - expenditure equals, 370–371
 - functional distribution of, 37
 - GDP measured using, 375–376
 - GDP measures of production and, 377
 - global economy distribution of, 43–44
 - personal distribution of, 37, 43
 - price elasticity of demand and, 119
 - profit, 375
 - rent, 37
 - from wages, 37, 375
- Income elasticity of demand, 130–131**
- Increasing marginal returns, 256**
- Individual demand, 87
- Individual supply, 94
- Induced taxes, 540**
- Industrial Revolution, 460, 463
- Inefficiency, 170–172
 - deadweight loss and, 155
 - with external costs, 228
 - of minimum wage, 184–185
 - of monopolies, 316
 - production, 62–63, 74–76, 141
 - of rent ceiling, 177–178
- Inelastic demand, 114**
- Inelastic supply, 124**
- Inequalities, 43–44
- Infant-industry argument, 213**
- Inferior goods, 89**
- Inflation**
 - cost-push, 523
 - cycles of, 522–523
 - deflation and, 424
 - demand-pull, 522
 - economic growth trends of, 520–521
 - Federal Reserve fighting, 549
 - historical, 424
- Inflationary gap, 519, 522**
- Inflation rate, 423**
 - core, 429
 - CPI and, 424, 437
 - measures of, 429–430
 - in United States, 423–424
- Information age economy, 5–6, 36
- Information revolution, 5
- Intel Corporation, 361
- Interest, 37, 251, 375**
- Interest payments, 50
- Interest rates, 546
- Intermediate good, 374
- Intermediate good or service, 368**
- International finance, 52–53
- International Monetary Fund, 384
- International outsourcing, 5
- International trade
 - comparative advantage in, 196
 - consumer/producers in, 197, 217
 - with consumer/producer surplus, 207–208
 - economic growth stimulated through, 469
 - exports in, 52, 196–197
 - in global economy, 54
 - import quotas and, 209–211
 - protection/restriction arguments of, 213–217
 - regulations in, 211
 - restrictions to, 205–211, 216–217
 - slump in, 54
 - of United States, 52–53, 196
- Inverse relationships, 25**
- Investments, 369**
 - changes in, 546
 - in physical capital, 460–462
- Invisible hand, 153, 154
- iPhone, 41, 346
- Job-search activity, 182
- Keynes, John Maynard, 444
- Keynesian macroeconomics, 444**
 - full employment and, 444–445
 - goods and services in, 444–445
- Kimberly-Clark, 359
- Kotlikoff, Laurence, 242–243
- Krueger, Alan, 183
- Krugman, Paul, 445, 541
- Kydland, Finn E., 444
- Labor, 35**
 - demand for, 449–450
 - division of, 13, 73, 256–257
 - in factors of production, 35
 - foreign, 215
 - productivity, 460
 - specialization of, 73
 - supply of, 451
 - technology influencing, 463–464
 - in United States, 35, 60

- Labor force, 398**
 categories of, 399
 participation of, 452
 unemployment rate in, 399
- Labor force participation rate, 400**
- Labor markets
 activity and status in, 412
 demand for labor in, 449–450
 equilibrium of, 452–453, 506
 indicators in, 398–401
 participation rate in, 405
 supply of labor in, 451
 unemployment rate in, 403–404
- Labor productivity, 460–465**
 growth of, 464
 real GDP and, 460
 technologies influence on, 463–464
- Land, 34**
 in factors of production, 34
 as natural resources, 34
- Law-making time lag, 539
- Law of decreasing returns, 258**
- Law of demand, 85, 86, 103**
- Law of diminishing marginal returns, 461–462**
- Law of market forces, 99–100**
- Law of supply, 92, 103, 283**
- Legal barriers to entry, 307–308
- Legal monopolies, 307**
- Leisure time, 385, 452
- Life expectancy, 386
- Linear relationships, 24**
- Liquid assets, 484
- Loans
 bank, 484, 546
 deposits by making, 491–492
- Local governments, 48, 51
- Long run, 254, 269–372**
 costs, 269
 equilibrium, 292
 output and price in, 342
 plant size and cost in, 269–271
 variable plant and, 254
 zero economic profit in, 288, 342
- Long-run average cost curve, 270–271**
- Lottery, 140
- Lucas, Robert E., Jr., 446, 541
- Lucas wedge, 446
- M1, 478–479**
- M2, 478–479**
- Macroeconomic equilibrium, 518, 519**
- Macroeconomics, 3**
 classical, 444–445
 Keynesian, 444–445
 monetarist, 445
 nominal and real values in, 433
- Majority rule, 139
- Margin, 10**
- Marginal analysis, 282–283
- Marginal benefits, 10–11, 142**
 demand curve and, 146
 marginal costs equal to, 142–143, 152–153
 rational choices and, 11
- Marginal cost curve, 264, 312
- Marginal cost pricing rule, 326–327**
- Marginal costs, 10, 262**
 average cost and, 263
 marginal benefits equal to, 142–143, 152–153
 natural monopolies pricing and, 326–327
 short-run cost and, 262
 supply and, 149
 zero, 329
- Marginal external benefits, 236**
- Marginal external costs, 226**
- Marginally attached worker, 400**
- Marginal private benefits, 236**
- Marginal private costs, 226**
- Marginal product, 256**
 average product and, 258–259
 total product and, 256, 257
- Marginal returns, 256–258, 461–462
- Marginal revenue, 279**
 curve, 310
 demand and, 310
 elasticity and, 311–312
 in perfect competition, 279–280
 price and, 310–311
 total revenue and, 310–311
- Marginal social benefits, 236**
- Marginal social costs, 226**
- Market(s), 46**
 agriculture, 187
 for airplanes, 199, 351–353
 alternatives to, 157
 black, 175–176
 businesses entering, 293–294
 businesses exiting, 294–295
 buyers and sellers in, 46, 84, 467–468
 with circular flow, 46
 competitive, 84, 153
 developing economies and emerging, 39
 domestic, 187–188
 efficiency, 152–157
 emerging, 39
 with exports, 199
 factor, 46
 failure, 156–157
 fairness of, 159
 farm product, 187
 financial, 371
 goods, 46
 health-care, 242–243
 house, 174
 monopolies, 278
 scarce resources and prices in, 138
 types of, 278
 value, 368
- Marketable pollution permits, 232, 234
- Market demand, 87**
- Market equilibrium, 99**
 demand/supply changes influencing, 101–102
 law of market forces and, 99–100
 price influencing, 99–100
- Market failure, 155**
- Market forces, law of, 99–100
- Marketing
 expenditures in, 346
 in monopolistic competition, 338–339
 product development and, 345–348
- Market price, 375
- Market share, 338
- Market supply, 94**
 curve, 287
 in short run, 287
- Maximum/minimum points, 26
- Means of payment, 476**
- Medicaid, 242–243
- Medicare, 242–243, 539
- Medium of exchange, 477**
- MFA. *See* Multifiber Arrangement
- Microeconomics, 2**
- Microsoft, 36, 329, 331
- Midpoint method, 112–113

- Mill, John Stuart, 444
- Minimum wage**
 efficiency and inefficiency of, 184–185
 fairness of, 185
 government setting, 181–182
 job search created by, 182
 unemployment created by, 181, 183
- Minimum wage law, 181–182**
- Monetarist macroeconomics, 445**
- Monetary base, 489**
 banking system and, 492
 money multiplier and, 497–499
 open market operations changing, 493–494, 496–497
- Monetary policy, 515, 544**
 aggregate demand influenced by, 515
 federal funds rate in, 545
 goods and services and, 515
 process of, 544
 report to congress of, 544
 in United States, 551
- Monetary stabilization, 548–549, 551
- Money, 476**
 buying power of, 512–513
 e-cash as, 480
 Federal Reserve's creation of, 498–499
 fiat, 478
 flows, 46–47
 functions of, 476–477
 for goods and services, 476–480
 Great Depression and creation of, 498–499
 individuals role in creating, 491
 measures of, 478–479
 prices, 510
 quantity of, 546
 regulating quantity of, 491–499
- Money market funds, 485
- Money multiplier, 497–499**
- Money wage rate, 509–510, 519
- Monopolies, 156, 278, 306**
 barriers to entry causing, 306–307
 buying/creating, 317
 causes of, 306
 close substitutes and, 306
 competition and, 315–318
 consumers facing, 331
 deadweight loss and, 316–317, 331
 efficiency/inefficiency of, 316
 fairness of, 317
 Gates and, 331
 legal, 307
 market, 278
 natural resources and, 307
 oligopoly and, 278
 output/price decisions of, 312, 315
 price-discriminating, 308
 price-setting strategies of, 308
 profit-maximizing output/price of, 313
 profits maximized by, 156, 313
 regulation of, 326–331
 rent seeking creating, 317–318
 single-price, 308, 310–313, 315, 321
- Monopolistic competition, 278, 338–343**
 business involved in, 338
 efficiency of, 348
 entry/exit in, 339
 four-firm concentration ratio and, 340
 Herfindahl-Hirschman index and, 340
 identifying, 339–340
 perfect competition and, 343
 product differentiation in, 338
 profit-maximizing decisions in, 341–342
 quality price and marketing in, 338–339, 341
 in U.S. economy, 340
- Moore, Gordon, 6
- Moulton, Brent, 374
- MP3 players, 169
- Multifiber Arrangement (MFA), 215
- Multiplier effect, 496–497, 549
- Multipliers**
 in aggregate demand, 516
 government expenditure, 535
 money, 497–499
 open market operations and effect of, 496–497
 tax, 535
 transfer payments, 535
- Murphy, Kevin, 183
- NAFTA. *See* North American Free Trade Agreement
- Nash, John, 356
- Nash equilibrium, 356, 358**
- National Bureau of Economic Research (NBER), 382, 384
- National comparative advantage, 196
- National debt, 50, 533**
- National security, 213
- Natural monopolies, 306**
 average cost pricing of, 328
 deadweight loss and, 326
 efficient regulation of, 326–327
 marginal cost pricing in, 326–327
 price cap regulations and, 330–331
 second-best regulation of, 327–331
- Natural resources
 land as, 34
 monopolies and, 307
 renewable, 284–285
- Natural unemployment, 410–411**
- NBER. *See* National Bureau of Economic Research
- Needs-tested spending, 540**
- Negative externalities, 224**
 Coase theorem and, 230
 consumption as, 225
 pollution as, 226–234
- Negative relationships, 25**
- Net domestic product at factor cost, 375**
- Net exports, 546
- Net exports of goods and services, 370**
- Net operating surplus, 375
- Net taxes, 370**
- Net worth, 484**
- Nintendo, 126
- Nominal GDP, 378, 433–434**
 calculating, 379
 deflation and, 433
 goods and services value expressed by, 378
 real GDP and, 378
 in United States, 433
- Nominal interest rates, 436–437**
- Nominal values, 433
- Nominal wage rate, 434–435**
- Nondurable goods, 369
- Normal goods, 89**
- Normal profits, 251–252**
- Normative statements, 13
- North American Free Trade Agreement (NAFTA), 205, 469
- Nozick, Robert, 159

- Obama, Barack, 541
 Obama Affordable Care Act, 243
 Okun, Arthur B., 446
 Okun gap, 446
Oligopoly, 278, 350–353
 advertising in, 358–359
 collusion in, 350
 efficiency of, 361
 monopolies outcome in, 278
 research games in, 358–359
 OPEC. *See* Organization of the Petroleum Exporting Countries
Open market operations, 489
 Federal Reserve using, 489
 monetary base changed by, 493–494, 496–497
 money multiplier process with, 497–499
 multiplier effect of, 496–497
 Operation twist, 489
Opportunity cost, 9–10
 of cell phones, 66
 comparative advantage compared to, 74–76
 PPF slope and, 67
 ratios in, 67
 search activity influencing, 176
 Orange prices, 122
 Organization of the Petroleum Exporting Countries (OPEC), 358
 Origin (of graphs), 21
 Outlet substitution bias, 427
 Output
 changing rate of, 508
 external costs and, 227
 gaps in, 519
 in long run, 342
 monopolies/price decisions of, 312–313, 315
 prices and, 312–313, 315
 profit-maximizing, 280–281, 313
Output gap, 412, 413
 Overproduction, 155
 Ownership barriers to entry, 307
 Part-time employment, 407
Part time for economic reasons, 401
Part-time workers, 401
 Patent, 308
Payoff matrix, 356–357, 360
PCE price index, 429
Perfect competition, 278
 consumers and, 299
 demand/price/revenue in, 280
 efficiency of, 298–299
 fairness of, 299
 marginal revenue and, 279–280
 monopolistic competition and, 343
 price taker in, 279
 supply decisions in, 282–283
 technological change in, 266
Perfectly elastic demand, 114, 171–172
Perfectly elastic supply, 124, 172
Perfectly inelastic demand, 114
Perfectly inelastic supply, 124, 172
Perfect price discrimination, 322–323
 Perpetual motion machine, 465
 Personal characteristics, 140
 Personal contributions, 386
 Personal distribution of income, 37, 43
 Personal economic policy, 14
Physical capital
 in developing economies, 43
 investments/savings in, 460–462
 Pizza, 143–150
 Plant size, 269–271
 Policy tools, 488–489
 Political freedom, 386
 Pollution
 air, 233
 clean technologies and, 233
 Coase theorem and, 230
 deadweight loss caused by, 228
 external costs of, 227–228
 limits, 231
 marketable permits for, 232, 234
 as negative externalities, 226–234
 production causing, 228
 standard of living and, 385
 tax on, 231–232
 in United States, 233
 Population growth, 411
 Population survey, 398, 401
 Positive consumption externalities, 242
Positive externalities, 224–225
Positive relationships, 24
 Positive statements, 13
 Post-industrial economy, 45
Potential GDP, 381, 412, 447
 changes in, 509
 estimating, 540
 in European Union and United States, 447
 full employment and, 412, 447, 453
 in global economy, 447
 per person, 382
 real GDP and, 524, 536
 supply-side effects on, 538
 of United States, 382, 447
 Poverty, 44, 386
 PPF. *See* Production possibilities frontier
 PPP. *See* Purchasing power parity
Predatory pricing, 214
 Preferences, 89
 Prescott, Edward C., 444
 Price(s)
 base-year, 393
 equilibrium, 99
 factor, 266–267
 future, 96
 gasoline, 121
 gouging, 160
 index measures of, 429–430
 in long run, 342
 marginal revenue and, 310–311
 market, 375
 market equilibrium influenced by, 99–100
 Microsoft, 329
 money, 510
 monopolies decisions on, 312
 monopolies discriminating on, 308
 monopolies profit-maximizing, 313
 in monopolistic competition, 338–339, 341
 orange, 122
 output and, 312–313, 315
 percent change in, 112
 in perfect competition, 280
 predatory, 214
 predicting changes in, 100
 regulations, 156
 relative, 394
 of resources, 96
 scarce resources and, 138
Price cap regulation, 330–331
Price ceiling, 64, 174, 189
Price-discriminating monopoly, 308
 Price discrimination
 in airline industry, 321–324

- among buyers, 320–321
- consumer surplus and, 320–321
- efficiency and, 324
- profiting by, 321–322
- Price elasticity of demand, 112**
 - in agriculture, 122
 - applying, 122
 - calculating, 116–118
 - food spending and, 119
 - gasoline prices and, 121
 - in global economy, 119
 - goods and, 112–113, 131
 - income and, 119
 - influences on, 114–116
 - interpreting, 117
 - midpoint method in, 112–113
 - price change in, 112, 116
 - quantity demanded changes and, 113–114
 - ranges of, 115
 - total revenue and, 120–121
- Price elasticity of supply, 124**
 - calculating, 126–127
 - influences on, 124–126
 - range of, 125
- Price floor, 180**
 - in agriculture market, 187
 - price ceilings and, 64, 189
 - regulations, 180
- Price levels, 508
 - aggregate demand and, 512
 - exports and imports influenced by, 514
 - full employment and, 523
 - goods and measures of, 426–430
- Price-setting strategies, 308
- Price support, 187–189**
- Price survey, 421
- Price taker, 279**
- Prisoners' dilemma, 355–357**
- Private benefits, 236–237
- Private contracts, 428
- Private costs, 226**
- Procter & Gamble, 359
- Producer surplus, 150, 177**
 - import quotas influencing, 209–211
 - imports/exports influencing, 202
 - international trade and, 207–208
 - supply and, 150
 - tariffs influencing, 206–208
 - total surplus and, 153
- Product curve, 266, 267
- Product development, 345–348
- Product differentiation, 338, 346**
- Product innovation, 345
- Production
 - in advanced economies, 41
 - changes in, 34
 - complement in, 95–96
 - in developing economies, 41
 - domestic, 207
 - efficient/inefficient, 62–63, 74–76, 141
 - factor prices of, 266–267
 - GDP measures of income and, 377
 - in global economy, 40
 - of goods and services, 385–386
 - household, 385
 - pollution caused by, 228
 - short-run, 255–259
 - substitute in, 95–96
 - technological change in, 295–298
 - underground, 384
 - United States compared to
 - European, 454
 - in United States economy, 33
 - value, 394
- Production efficiency, 62–63, 74–76, 141**
- Production function, 448–449**
- Production possibilities frontier (PPF), 60–61, 141**
 - attainable/unattainable combinations in, 62
 - economic growth and, 71
 - efficient/inefficient production in, 62–63, 74–76, 141
 - opportunity costs and slope of, 67
 - tradeoffs/free lunches in, 63–64
- Productivity, 73, 96
- Productivity curve, 462
- Profit-maximizing decisions, 250, 280–283, 341–342, 450
- Profits, 37**
 - businesses and, 508
 - businesses maximizing, 250, 280–283, 450
 - of commercial banks, 483
 - cost and, 250, 252
 - economic incentive for, 294, 313
 - entrepreneurship seeking, 36
 - import quota bringing, 211
 - income, 375
 - maximizing, 329, 341–342
 - monopolies maximizing, 156, 313
 - normal, 251–252
 - output maximizing, 280–281, 313
 - price discrimination for, 321–322
 - quantity of labor maximizing, 450
 - shutdown decisions and, 283–284
 - zero economic, 288, 342
- Property rights, 229, 467–468**
- Protection, arguments for, 213–217
- Public franchise, 307–308
- Public provisions, 238**
 - with efficient outcome, 238
 - private subsidy compared to, 239
- Purchasing power parity (PPP), 384**
- Quality
 - change bias, 427
 - of education, 241
- Quantitative Easing (QE), 489
- Quantity demanded, 85, 90, 113–114**
- Quantity of labor
 - labor market equilibrium and, 452–453, 506
 - labor productivity and, 464
 - production function in, 448–449
 - profit-maximizing, 450
 - real wage rate and, 507–508
- Quantity of labor demanded, 449**
- Quantity of labor supplied, 451**
- Quantity supplied, 92, 97**
- Rate of return regulation, 330**
- Rational choices, 8–9, 11**
- Reagan, Ronald, 52, 69
- Real business cycle, 521**
- Real flows, 46–47
- Real GDP, 378**
 - aggregate demand and, 512
 - aggregate supply and, 506–507, 518
 - calculating, 378–379, 394–395
 - chained-dollar, 393, 395
 - CPI and, 433–434
 - economic tracking of, 384
 - goods and services value of, 378, 447
 - labor productivity and, 460
 - measuring, 393–395
 - nominal GDP and, 378
 - potential GDP and, 524, 536
 - production function and, 448–449
 - unemployment and, 411–412

- Real GDP per person, 381, 456**
 in global economy, 458
 sustained growth of, 457
 in United States, 382, 387, 458
- Real interest rates, 436–437**
 aggregate demand and, 513–514
 goods and services and, 436
- Real values
 CPI calculations of, 432
 nominal values and, 433
- Real wage rate, 411, 434–435,**
 507–508
- Recession, 382, 404**
 from aggregate supply, 525
 in economy, 525
 Federal Reserve fighting, 548–549
 of United States, 525
- Recessionary gap, 519, 536**
- Reference base period, 420**
- Regulations, 326**
 deadweight loss caused by, 157
 earnings sharing, 331
 efficient, 326–327
 in international trade, 211
 law of supply and demand
 and, 185
 of monopolies, 326–331
 of natural monopolies, 327–331
 price, 156
 price cap, 330–331
 price floor as, 180
 rate of return, 330
 second-best, 327–331
- Relationships
 inverse/negative, 25
 linear, 24
 maximum/minimum points in, 26
 output gap's, 413
 positive, 24
 slope of, 27
 variables in, 21, 28, 29
- Relative price, 394**
- Renewable resources, 284–285
- Rent, 37, 375**
- Rent ceiling, 174–176**
 black market from, 176–177
 deadweight loss influenced
 by, 177
 efficiency and inefficiency of,
 177–178
 fairness of, 178
 shortages created by, 175
- Rent income, 37
- Rent seeking, 217, 317**
 deadweight loss and, 318
 equilibrium, 318
 monopolies created by, 317–318
- Required reserve ratio, 483, 488**
- Research and development, 358–359,
 469
- Research games, 358–359
- Reserves, 483**
- Resource allocation
 command system and, 139
 consumers and, 161
 contests and, 139
 efficiency in, 141–144
 fairness of, 161
 first-come first-served and,
 139–140
 force used in, 140–141
 lotteries in, 140
 majority rule and, 139
 methods of, 138–141
 personal characteristics in, 140
- Resources, 96
- Restarts, 508
- Revenue
 economic profits and concepts
 of, 279–280
 federal government's debts and,
 50, 534
 of local/state governments, 48, 51
 in perfect competition, 280
 from tariffs, 207
- Ricardo, David, 444
- Risk, 483
- Rodriguez, Alex, 15
- Romer, Christina, 541
- Rule of 70, 457**
- Running shoes, 348
- Sala-i-Martin, Xavier, 44
- Saving, 370, 460–462, 468–469**
- Savings and loan association, 485
- Savings bank, 485
- Scarce resources, 138
- Scarcity, 2**
- Scatter diagrams, 22–23**
- Schwartz, Anna J., 550
- Scientific method, 12
- Search activity, 176**
- Securities
 commercial banks selling, 494
- Federal Reserve System
 buying, 493–495
 Federal Reserve System
 selling, 496
 government issuing, 484
- Self-interest, 4–5, 153**
- Sellers
 markets for buyers and, 46, 84,
 467–468
 price gouging and, 160
 self-interest of, 153
- Selling costs
 of advertising, 347
 demand and, 348
 of running shoes, 348
 total costs and, 347
- Service goods, 69
- 7-Eleven, 271
- Shepperson, John, 160
- Short run, 254**
 economic loss in, 290
 economic profit in, 288–289
 equilibrium/bad times, 290
 equilibrium/good times, 289
 equilibrium/normal times, 288
 market supply in, 287
- Short-run costs
 average cost and, 263–264
 curve, 266
 marginal cost and, 262
 in total costs, 261–262
- Short-run production, 255–259
- Short-run supply curve, 284–285
- Shutdown decisions, of businesses,
 283–284
- Shutdown point, 283**
- Single-price monopoly, 308,**
 310–313, 315, 321
- Slope, 27**
 calculating, 27
 PPF, 67
 of relationships, 27
- Smetters, Kent, 539
- Smith, Adam, 13, 73, 153, 444
- Smoot-Hawley Act, 205
- Smoothie bars, 74–76, 261–264
- Social benefits, 236–237
- Social interest, 4–5**
- Social interest theory, 326**
- Social justice, 386
- Social science, 12, 13
- Social Security, 539

- budget deficits and, 6
- federal government providing, 48, 50
- programs, 6, 48
- Software, 374
- Specialization
 - of capital, 269
 - of labor, 73
 - productivity gains from, 73
 - trade gains from, 76–77
 - in United States economy, 73
- Stability, 216
- Stagflation**, 523
- Standard of living**, 381
 - in global economy, 384, 387
 - goods and services value in, 381, 384, 386
 - influences on, 386
 - pollution and, 385
- Startups, 508
- State governments, 48, 51
- Statistical discrepancy**, 376
- Store of value**, 477
- Strategies**, 356
- Structural budget balances, 541
- Structural change, 411
- Structural surplus or deficit**, 540
- Structural unemployment**, 409, 411
- Subsidies**, 156, 187, 211, 214, 239
 - deadweight loss and, 211
 - export, 211
 - from governments, 328
 - price support and, 188
 - private, 239
- Substitute in production**, 95–96
- Substitutes**, 88, 114
- Sugar beets, 188
- Supply**, 92
 - change in, 95–97, 102, 104–105
 - demand and, 102–103
 - elastic/inelastic, 124
 - elasticity of, 172
 - individual, 94
 - of labor, 451
 - law of, 92, 103, 283
 - marginal analysis and decisions of, 282–283
 - marginal costs and, 149
 - market, 94, 287
 - market equilibrium and, 101–102
 - perfect competition decisions on, 282–283
 - perfectly elastic, 124, 172
 - perfectly inelastic, 124, 172
 - price elasticity of, 124–127
 - producer surplus and, 150
 - regulations and, 185
 - unit elastic, 124
 - in your life, 103
- Supply curve**, 93, 103
- Supply of labor**, 451
- Supply schedule**, 93
- Supply-side effects, 537–538
- Surplus
 - budget, 532
 - consumer, 147, 177, 207–208, 320–321
 - net operating, 375
 - producer, 150, 153, 177, 202, 206–211
 - total, 153
- Tariffs**, 205
 - deadweight loss and, 208
 - governmental revenue from, 207
 - producer surplus influenced by, 206–208
 - in United States, 205
- Taxes, 156
 - deadweight loss created by, 170
 - decreases in, 428
 - efficiency and, 169–170
 - federal government receiving, 50
 - induced, 540
 - local/state governments
 - receiving, 48, 51
 - on MP3 players, 169
 - net, 370
 - on pollution, 231–232
 - supply-side influence of, 537
- Tax incidence**, 168–169
- Tax multiplier**, 535
- Taylor, John B., 541
- Technology
 - clean, 233
 - human capital and, 463
 - labor productivity influenced by, 463–464
 - perfect competition and, 266
 - production changes of, 295–298
 - short-run cost curve and, 266
- Temporary shutdowns, 508
- Thrift institutions, 485
- Time-series graphs**, 22–23
- Token, 476
- Tommy Hilfiger, 341–343
- Total costs**, 261
 - average, 263, 271
 - average curve of, 264, 265, 288, 312
 - curve, 262
 - selling costs and, 347
 - short-run costs in, 261–262
 - total revenue/economic profit and, 281
- Total fixed costs**, 261
- Total product**, 255–257
- Total revenue**, 120
 - marginal revenue and, 310–311
 - orange prices and, 122
 - price elasticity of demand and, 120–121
 - total cost/economic profit and, 281
- Total revenue test**, 121
- Total surplus**, 153
- Total variable costs**, 261
- Trade gains, 76–77
- Tradeoffs**, 8, 63–64, 69
- Transactions costs**, 157, 230
- Transfer payments multiplier**, 535
- Trends**, 22
- T-shirts, 198, 206–208
- Underground production**, 385
- Underproduction, 155, 237
- Unemployment, 12
 - alternative measures of, 406–407
 - cyclical, 410
 - duration of, 410
 - economic benefits investigations and, 12
 - frictional, 409, 411
 - global, 404
 - marginally attached workers in, 400
 - measures of, 406–407
 - minimum wage creating, 181, 183
 - natural, 410–411
 - natural rates of, 411
 - output gap's relationship with, 413
 - part-time workers in, 401
 - real GDP and, 411–412
 - structural, 409, 411
 - types of, 409–410

- Unemployment benefits
 - economic investigations of, 12
 - natural unemployment rates and, 411
 - state government providing, 48
- Unemployment rate, 399–400**
 - in global economy, 404
 - in labor force, 399
 - in labor markets, 403–404
 - measures of, 407
 - in United States, 403
- United States
 - air pollution in, 233
 - antitrust laws in, 361
 - average incomes and, 44
 - business cycle in, 383
 - circular flows in economy of, 369–370
 - economic growth in, 520–521
 - economy of, 33, 45
 - education in, 241
 - employment in, 34
 - European production compared to, 454
 - financial crisis in, 485, 525
 - fiscal and monetary policy in, 551
 - goods and services deficits of, 6
 - goods and services produced in, 33
 - health care in, 242–243
 - imports/exports of, 33, 197, 198, 199
 - inflation rate in, 423–424
 - international trade of, 52–53, 196
 - labor in, 35, 60
 - monopolistic competition in, 340
 - nominal GDP in, 433
 - pollution in, 233
 - post-industrial economy of, 45
 - potential GDP of, 382, 447
 - presidential wage rates in, 435
 - production in, 33
 - real GDP per person in, 382, 387, 458
 - recession of, 525
 - social security and Medicare in, 539
 - specialization in, 73
 - structural and cyclical budget balances of, 541
 - tariffs in, 205
 - unemployment rates in, 403
- Unit elastic demand, 114**
- Unit elastic supply, 124**
- Unit of account, 477**
- Unrelated variables, 26
- Used goods, 374
- Value
 - goods and services, 378, 447
 - market, 368
 - nominal, 433
 - nominal GDP, 378
 - production, 394
 - real, 432, 433
 - real GDP, 378, 447
 - standard of living, 381, 384, 386
 - store of, 477
- Variable plant, 254
- Variables, 21, 26, 28, 29
- Voluntary export restraints, 211
- Vouchers, 240, 241**
- Wage rate
 - employment and, 183
 - money, 509–510, 519
 - nominal and real, 434–435
 - United States presidents, 435
- Wages, 37**
 - career choices and, 45
 - explicit cost of, 251
 - income from, 37, 375
- Wal-Mart, 36, 271
- Walton, Sam, 36
- Waxman, Henry, 234
- Wealth of Nations* (Smith), 13, 153
- Welch, Finis, 183
- Welfare benefits, 48
- Wind power, 68
- Women, 405
- Working-age population, 398**
- World economy, 515–516
- World Trade Organization (WTO), 205
- Zero economic profit, 288, 342
- Zero marginal costs, 329
- Zuckerberg, Mark, 36

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- Sherman**
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- Silberberg**
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- Stock/Watson**
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- Studenmund**
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- Weil**
Economic Growth
- Williamson**
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Macroeconomic Data

These macroeconomic data series show some of the trends in GDP and its components, the price level, and other variables that provide information about changes in the standard of living and the cost of living—the central questions of macroeconomics. You will find these data in a spreadsheet that you can download from your MyEconLab Web site.

| NATIONAL INCOME AND PRODUCT ACCOUNTS | | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 |
|--------------------------------------|---|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| EXPENDITURE APPROACH | | | | | | | | | | | |
| the sum of | 1 Personal consumption expenditures | 3,350 | 3,595 | 3,836 | 3,980 | 4,237 | 4,484 | 4,751 | 4,987 | 5,274 | 5,571 |
| | 2 Gross private domestic investment | 822 | 875 | 861 | 803 | 865 | 953 | 1,097 | 1,144 | 1,240 | 1,389 |
| | 3 Government expenditure | 1,039 | 1,101 | 1,182 | 1,236 | 1,274 | 1,295 | 1,330 | 1,374 | 1,421 | 1,474 |
| | 4 Exports | 444 | 503 | 552 | 597 | 635 | 656 | 721 | 812 | 868 | 954 |
| | 5 Imports | 554 | 591 | 630 | 624 | 668 | 720 | 813 | 903 | 964 | 1,056 |
| equals | 6 Gross domestic product | 5,100 | 5,482 | 5,801 | 5,992 | 6,342 | 6,667 | 7,085 | 7,415 | 7,839 | 8,332 |
| INCOME APPROACH | | | | | | | | | | | |
| | 7 Compensation of employees | 2,955 | 3,133 | 3,329 | 3,441 | 3,634 | 3,800 | 4,003 | 4,199 | 4,396 | 4,670 |
| plus | 8 Net operating surplus | 1,199 | 1,271 | 1,299 | 1,317 | 1,400 | 1,487 | 1,642 | 1,770 | 1,959 | 2,135 |
| equals | 9 Net domestic product at factor cost | 4,154 | 4,403 | 4,627 | 4,758 | 5,035 | 5,287 | 5,644 | 5,970 | 6,355 | 6,805 |
| plus | 10 Indirect taxes less subsidies | 345 | 372 | 398 | 430 | 453 | 466 | 513 | 523 | 546 | 578 |
| | 11 Depreciation (capital consumption) | 611 | 652 | 691 | 724 | 744 | 778 | 819 | 870 | 913 | 964 |
| equals | 12 GDP (income approach) | 5,110 | 5,426 | 5,716 | 5,912 | 6,232 | 6,532 | 6,976 | 7,362 | 7,813 | 8,346 |
| plus | 13 Statistical discrepancy | -10 | 56 | 84 | 80 | 110 | 136 | 109 | 53 | 26 | -14 |
| equals | 14 GDP (expenditure approach) | 5,101 | 5,482 | 5,801 | 5,992 | 6,342 | 6,667 | 7,085 | 7,415 | 7,839 | 8,332 |
| | 15 Real GDP (billions of 2005 dollars) | 7,607 | 7,879 | 8,027 | 8,008 | 8,280 | 8,516 | 8,863 | 9,086 | 9,426 | 9,846 |
| | 16 Real GDP growth rate (percent per year) | 4.1 | 3.6 | 1.9 | -0.2 | 3.4 | 2.9 | 4.1 | 2.5 | 3.7 | 4.5 |
| OTHER DATA | | | | | | | | | | | |
| | 17 Population (millions) | 245 | 247 | 250 | 254 | 257 | 260 | 263 | 267 | 270 | 273 |
| | 18 Labor force (millions) | 122 | 124 | 126 | 126 | 128 | 129 | 131 | 132 | 134 | 136 |
| | 19 Employment (millions) | 115 | 117 | 119 | 118 | 118 | 120 | 123 | 125 | 127 | 130 |
| | 20 Unemployment (millions) | 7 | 7 | 7 | 9 | 10 | 9 | 8 | 7 | 7 | 7 |
| | 21 Labor force participation rate (percent of working-age population) | 65.9 | 66.4 | 66.5 | 66.2 | 66.5 | 66.3 | 66.6 | 66.6 | 66.8 | 67.1 |
| | 22 Unemployment rate (percent of labor force) | 5.5 | 5.3 | 5.6 | 6.9 | 7.5 | 6.9 | 6.1 | 5.6 | 5.4 | 5.0 |
| | 23 Real GDP per person (2005 dollars per year) | 31,043 | 31,850 | 32,085 | 31,587 | 32,228 | 32,719 | 33,642 | 34,083 | 34,947 | 36,071 |
| | 24 Growth rate of real GDP per person (percent per year) | 3.2 | 2.6 | 0.7 | -1.6 | 2.0 | 1.5 | 2.8 | 1.3 | 2.5 | 3.2 |
| | 25 Quantity of money (M2, billions of dollars) | 2,936 | 3,058 | 3,226 | 3,345 | 3,407 | 3,442 | 3,488 | 3,560 | 3,732 | 3,920 |
| | 26 GDP price index (2005 = 100) | 67.0 | 69.6 | 72.3 | 74.8 | 76.6 | 78.3 | 79.9 | 81.6 | 83.2 | 84.6 |
| | 27 GDP price index inflation rate (percent per year) | 3.4 | 3.8 | 3.9 | 3.5 | 2.4 | 2.2 | 2.1 | 2.1 | 1.9 | 1.8 |
| | 28 Consumer price index (1982-1984 = 100) | 118.3 | 123.9 | 130.7 | 136.2 | 140.3 | 144.5 | 148.2 | 152.4 | 156.9 | 160.5 |
| | 29 CPI inflation rate (percent per year) | 4.1 | 4.8 | 5.4 | 4.2 | 3.0 | 3.0 | 2.6 | 2.8 | 2.9 | 2.3 |
| | 30 Current account balance (billions of dollars) | -121.2 | -99.5 | -79.0 | 2.9 | -51.6 | -84.8 | -121.6 | -113.6 | -124.8 | -140.7 |

| 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| 5,919 | 6,343 | 6,830 | 7,149 | 7,439 | 7,804 | 8,271 | 8,804 | 9,301 | 9,772 | 10,036 | 9,866 | 10,246 |
| 1,511 | 1,642 | 1,772 | 1,662 | 1,647 | 1,730 | 1,969 | 2,172 | 2,327 | 2,295 | 2,088 | 1,547 | 1,795 |
| 1,526 | 1,631 | 1,731 | 1,846 | 1,983 | 2,113 | 2,233 | 2,370 | 2,518 | 2,674 | 2,878 | 2,918 | 3,003 |
| 954 | 989 | 1,093 | 1,028 | 1,003 | 1,041 | 1,180 | 1,305 | 1,471 | 1,662 | 1,847 | 1,583 | 1,840 |
| 1,116 | 1,251 | 1,475 | 1,399 | 1,430 | 1,545 | 1,799 | 2,028 | 2,240 | 2,375 | 2,557 | 1,975 | 2,357 |
| 8,794 | 9,354 | 9,952 | 10,286 | 10,642 | 11,142 | 11,853 | 12,623 | 13,377 | 14,029 | 14,292 | 13,939 | 14,527 |
| 5,028 | 5,359 | 5,794 | 5,985 | 6,116 | 6,388 | 6,700 | 7,072 | 7,484 | 7,863 | 8,079 | 7,815 | 7,981 |
| 2,227 | 2,343 | 2,445 | 2,480 | 2,522 | 2,625 | 2,926 | 3,236 | 3,540 | 3,438 | 3,375 | 3,222 | 3,674 |
| 7,255 | 7,702 | 8,238 | 8,464 | 8,638 | 9,014 | 9,626 | 10,308 | 11,023 | 11,301 | 11,454 | 11,037 | 11,654 |
| 603 | 628 | 663 | 669 | 721 | 758 | 817 | 869 | 935 | 973 | 986 | 958 | 997 |
| 1,021 | 1,094 | 1,184 | 1,256 | 1,305 | 1,354 | 1,433 | 1,541 | 1,661 | 1,768 | 1,854 | 1,866 | 1,875 |
| 8,879 | 9,425 | 10,086 | 10,390 | 10,664 | 11,126 | 11,876 | 12,718 | 13,619 | 14,041 | 14,294 | 13,862 | 14,526 |
| -85 | -71 | -134 | -103 | -22 | 17 | -22 | -95 | -242 | -12 | -2 | 77 | 1 |
| 8,794 | 9,354 | 9,952 | 10,286 | 10,642 | 11,142 | 11,853 | 12,623 | 13,377 | 14,029 | 14,292 | 13,939 | 14,527 |
| 10,275 | 10,771 | 11,216 | 11,338 | 11,543 | 11,836 | 12,247 | 12,623 | 12,959 | 13,206 | 13,162 | 12,703 | 13,088 |
| 4.4 | 4.8 | 4.1 | 1.1 | 1.8 | 2.5 | 3.5 | 3.1 | 2.7 | 1.9 | -0.3 | -3.5 | 3.0 |
| 276 | 279 | 282 | 285 | 288 | 291 | 294 | 296 | 299 | 302 | 305 | 307 | 310 |
| 138 | 139 | 143 | 144 | 145 | 146 | 147 | 149 | 151 | 153 | 154 | 154 | 154 |
| 131 | 134 | 137 | 137 | 136 | 138 | 139 | 142 | 144 | 146 | 145 | 140 | 139 |
| 6 | 6 | 6 | 7 | 8 | 9 | 8 | 8 | 7 | 7 | 9 | 14 | 15 |
| 67.1 | 67.1 | 67.1 | 66.9 | 66.6 | 66.2 | 66.0 | 66.0 | 66.2 | 66.1 | 66.0 | 65.4 | 64.7 |
| 4.5 | 4.2 | 4.0 | 4.7 | 5.8 | 6.0 | 5.5 | 5.1 | 4.6 | 4.6 | 5.8 | 9.3 | 9.6 |
| 37,206 | 38,559 | 39,716 | 39,734 | 40,062 | 40,697 | 41,727 | 42,612 | 43,332 | 43,726 | 43,178 | 41,313 | 42,205 |
| 3.1 | 3.6 | 3.0 | 0.0 | 0.8 | 1.6 | 2.5 | 2.1 | 1.7 | 0.9 | -1.3 | -4.3 | 2.2 |
| 4,199 | 4,509 | 4,779 | 5,195 | 5,587 | 5,972 | 6,255 | 6,522 | 6,865 | 7,298 | 7,816 | 8,432 | 8,623 |
| 85.6 | 86.8 | 88.7 | 90.7 | 92.2 | 94.1 | 96.8 | 100.0 | 103.2 | 106.2 | 108.6 | 109.7 | 111.0 |
| 1.1 | 1.5 | 2.2 | 2.3 | 1.6 | 2.1 | 2.8 | 3.3 | 3.2 | 2.9 | 2.2 | 1.1 | 1.2 |
| 163.0 | 166.6 | 172.2 | 177.0 | 179.9 | 184.0 | 188.9 | 195.3 | 201.6 | 207.3 | 215.3 | 214.5 | 218.1 |
| 1.5 | 2.2 | 3.4 | 2.8 | 1.6 | 2.3 | 2.7 | 3.4 | 3.2 | 2.9 | 3.8 | -0.3 | 1.6 |
| -215.1 | -301.7 | -416.3 | -396.6 | -457.2 | -519.1 | -628.5 | -745.8 | -800.6 | -710.3 | -677.1 | -376.6 | -470.9 |

~StormRG~