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CONTEMPORARY STUDIES IN ECONOMIC AND
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CONTEMPORARY ISSUES IN BANK FINANCIAL MANAGEMENT

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CONTEMPORARY STUDIES IN ECONOMIC AND FINANCIAL ANALYSIS SPECIAL EDITION - VOLUME 97 CONTEMPORARY ISSUES IN BANK FINANCIAL MANAGEMENT

The Emerald book series *Contemporary Studies in Economic and Financial Analysis* special edition include studies by the University of Malta, MSc Banking and Finance graduates, MBA graduates, MA Financial Services and MA Accountancy graduates and the respective lecturers, on financial services within particular countries or regions and studies of particular themes such as Equity Mutual Funds, Active and Passive Investing, Forex Hedging using Derivatives and Sovereign Fixed-Income Portfolios, Returns on Director trading, Retail Payment Markets, and Annual Report Weaknesses by a Supreme Audit Institution.

The chapter 'Active and Passive Investing: A Focus on US and European Equity Funds' by Pace, Hili and Grima looks at the confrontation between active and passive equity funds in terms of risk-adjusted performance and the bone of contention of alpha generation. The 'mutual fund puzzle' (Gruber, 1996) jointly with the recent explosive growth of ETFs has again rejuvenated the active versus passive debate, making it worth a comprehensive analysis predominantly for the benefit of uninformed investors who are in a quandary when choosing between the two management styles. This chapter examines the risk-adjusted performance of active and passive investment vehicles by analysing American and European domiciled actively managed mutual funds, index mutual funds and passive exchange traded funds (ETFs), which are geographically exposed to the United States and Europe. This is performed by constructing 12 equally weighted equity fund portfolios covering the period January 2004 to December 2014. Application of mainstream single-factor and multi-factor asset pricing models namely Fama (1968), Fama and Macbeth (1973), Lintner (1965), Mossin (1966), Sharpe (1964), Treynor

(1961), Fama and French (1993) and Carhart (1997) models plus an enhanced variant of the standard market model developed by the researcher encompassing gold, oil and United States dollar index risk factors are employed. As a side analysis, a dummy variable to identify seasonality patterns is included in the regression equations for the diverse actively and passively managed equity fund portfolios. When considering solely net asset value (NAV) thereby overlooking supplementary costs, such as initial fees, findings suggest that active management is equivalent to index replication in terms of generated alphas and risk-adjusted returns. This triggers investors to be neutral gross of fees, yet when considering all expenses it is a distinct story, as actively managed funds are typically less cost efficient. Without any prejudice towards active management, the relatively heftier overheads appear to revoke any outperformance in excess of the market portfolio thereby ensuing in the Fool's Errand Hypothesis, albeit anomalies do exist. Nonetheless, active management is acknowledged for keeping high levels of market efficiency, which paradoxically is not a main priority for the individual investor, especially for passive investors who act as free riders. The researcher urges investors to progressively concentrate on equity funds' expense ratios and other transaction costs rather than solely past returns, by accessing the cheapest available vehicle for each investment objective, regardless of being an active mutual fund, passive mutual fund or index replication ETF.

The chapter 'FX Hedging using Forwards and 'Premium-Free' Options' by Caruana studies an optimal way to hedge foreign exchange exposures on three main currency pairs being the EURUSD, EURGBP and EURJPY. This chapter bases the paper on a back-testing analysis over a period of seven years starting in January 2007 and ending in December 2014. Two main Foreign Exchange Premium-Free strategies were structured using the Bloomberg Terminal. These were the 'At-Expiry Forward Extra' and the 'Window Forward Extra'. Such strategies may be considered as 'low risk hedging strategies' and are well known within the FX hedging industry. An explanation of how the 'zero premium' is achieved is explained throughout this text. Portfolios were created using FX options strategies, FX spot and FX forwards. After analysing such portfolios it was found that the optimal strategies in all cases were the FX option strategies. The portfolios' risk analysed indicated that optimal portfolios do not necessarily derive the lowest risk. The EURUSD portfolios were also analysed and compared with the VIX level in order to see whether volatility has a direct effect on the outcome of the strategies. It was found that with a high VIX level, the forward contract

was the most beneficial whilst the option strategy benefited from a low VIX level. Nevertheless, the option strategy was the most beneficial when taking into consideration the whole period under analysis. The statistical significance of the difference between returns of portfolios was analysed using a paired sample t-test. Since portfolios are derived from the same asset, that is, the spot foreign exchange market, in most cases, the difference in returns between portfolios resulted to be statistically insignificant. The histogram and distribution curve of each portfolio were created and plotted in order to provide a more visual analysis of returns. Although some similarities were noticed, distribution curves differed from the normal distribution. Kurtosis analysis was also performed on the portfolios. Most kurtosis levels differed from that of a normal distribution which has a kurtosis level of 3.

The chapter 'Director Trading in Malta: An Analysis of Returns' by Caruana determines whether director trades provide information to investors about the future prospects of the company they form part of and thus reduce the information asymmetry beyond what is already conveyed in the financial statements. The author treated director dealings as an investment strategy. She looked at past transactions of directors executed between January 2005 and December 2014 on the Malta Stock Exchange (MSE) and evaluated whether investors who followed director trades had an increase in their returns. The study focused on short-term returns for up to 12 months after the transaction date. The findings show that Maltese directors do transmit information to the market both when they purchase shares in their own companies and also when they sell shares. Moreover, some companies which are listed on the Malta Stock Exchange are more indicative as to their future performance than others. It was ultimately concluded that even though there are informational asymmetries between directors in a company and outsiders, an outsider cannot trade solely by following director trades.

The chapter 'EQUITY MUTUAL FUND PERFORMANCE EVALUATION: An Emerging Market Perspective' by Hili, Pace and Grima examines the remarkable growth in mutual funds worldwide and the dynamics of their returns in an attempt to identify skilful managers who can actually create added value for their investors. The majority of the research papers on this area have focused on mutual funds in developed markets, and thereby leaves the emerging market (EM) fund industry relatively underfollowed in this respect. Today, more than ever, this is of potential concern knowing that fund managers are frequently including into their portfolios securities from the less developed economies, whilst a large number of investors believe that EMs are a good entry point for

long-term investment due to their growth potential. The uncertainty as to whether investments in riskier and less efficient markets allow managers to '*beat the market*' remains a question to which answers are required. This empirical work seeks to offer new insights on portfolios of the United States, European and EM domiciled equity mutual funds whose objectives are the investment in emerging economies, and specifically analyses two main issues: alpha generation and the influence of the funds' characteristics on their risk-adjusted performance. The study uses regression analysis and employs the Jensen's (1968) Single-Factor model along with the Fama and French's (1993) and Carhart's (1997) multifactor models to authenticate results and answer both questions. Findings reveal that EM exposed fund managers fail to collectively outperform the market. It thereby offers ground to believe that the emerging world is very close to being efficient, proving that the Efficient Market Hypothesis (EMH) ideal exists in this scenario where market inefficiency might only be a perception of market participants as any apparent opportunity to achieve above-average returns is speedily snapped up by very active managers. Overall, these managers take a conservative approach to portfolio construction, whereby they are more unperturbed investing in large cap equity funds so as to lessen somewhat the exposure towards risks associated with liquidity, stability and volatility. In addition, the findings show that large-sized equity portfolios have the lead over the medium- and small-sized competitors, whilst the high cost and mature collective investment vehicles enjoy an alpha which although is negative is superior to their peers. The riskiest funds generated the lowest alpha, and thereby produced doubts as to whether investors should accept a higher risk for the hope of earning higher returns, at least when aiming to gain an exposure into the emerging world. Unquestionably, diversification effects remain the basis for investing in collective investment vehicles, and thereby the researcher encourages market participants to incorporate EM exposed securities into their portfolios. EMs can offer new investment opportunities to prospective investors, especially if careful consideration is given to the mutual funds' characteristics analysed through the current research. Outstandingly, this work has shown that investors should not allow cost to be the deciding factor in selecting equity mutual funds, but rather to rationally elect the cheapest fund from a list of funds with an identical objective.

The chapter 'Recent Annual Report Weaknesses by a Supreme Audit Institution: An Analysis' by Baldacchino, Pule, Tabone and Aguis examines the Annual Report on Public Accounts prepared by the Maltese National Audit Office (NAO), Malta's Supreme Audit Institution. Its

objectives are to analyse and classify the reported issues, evaluate their significance and how the findings are reflected in the Public Sector, and assess the adequacy of the communication of these findings through the Annual Report. The research consisted of a qualitative analysis of the Annual Reports for the three years 2007, 2009 and 2011. This analysis was supplemented by unstructured interviews conducted with both NAO and Government officials. Findings report a significant number of issues emerging from different factors. The highest incidence of weaknesses was related to record-keeping and compliance with policies and procedures. Moreover, the interviews with NAO officials showed that the departments were not always taking on board the recommendations made through the Annual Reports, thus indicating a passive attitude towards the reported findings. The results also show that while the Government has its own structures of checks-and-balances to prevent and detect errors, and no internal control system is completely effective, there is still much room for improvement within the Public Sector to ensure that public funds are appropriately utilised. The detection of various issues by the NAO is therefore inevitable, particularly given the complexity and size of the Public Sector. In conclusion, the NAO findings should be more thoroughly examined to reduce the incidence of issues. Furthermore, the way forward should be directed at enhancing the current systems and promoting a more positive relationship between the NAO and auditees.

The chapter 'Analysis of Risk Parity Approach for Sovereign Fixed-Income Portfolios in Eurozone countries' by Cassar and Grima examined the recent development of the European debt sovereign crisis, which led to the reconsideration of sovereign credit risk – citing that sovereign debt is not 'risk free'. The traditional index bond management used during the last two decades such as the market-capitalization weighting scheme has been severely called into question. In order to overcome these drawbacks, alternative weighting schemes have recently prompted great attention, both from academic researchers and market practitioners. One of the key developments was the introduction of passive funds using economic fundamental indicators. Through this chapter, the author has moved a step further by introducing models with economic drivers. The aim of this study was to investigate whether the fundamental approaches outperformed the other models on risk-adjusted returns and on other terms. Here the author constructed five portfolios composed of the Eurozone sovereigns bonds. The models are the Market Capitalization RP, GDP model RP, Ratings RP model, Fundamental-Ranking RP and Fundamental-Weighted RP models.

These models are created exclusively for this chapter. Both Fundamental models are using a range of 10 country fundamentals. A variation from other studies is that this dissertation applied the Risk-Parity concept which is an allocation technique that aims at equalizes risk across different assets. This concept has been applied by assuming the Credit Default Swap as proxy for sovereign credit risk. The models were run using the Generalized Reduced Gradient Method (GRG) as the optimization model, together with the Lagrange Multipliers as techniques and the Karush-Kuhn-Tucker conditions. This led to the comparison of all the models mentioned earlier in terms of performance, risk-adjusted returns, concentration and weighted average ratings. By analysing the whole period between 2006 and 2014, it was found that both the fundamental models gave very appealing results in terms of risk-adjusted returns. The best model was resulted to be the Fundamental-Ranking RP model followed by the Fundamental-Weighting RP model. However, on a yearly basis and sub-dividing the whole period in three equal periods, the results show mixed performance and risk-adjusted returns. From this study, the author concluded that over the long term, the fundamental bond indexing triumphed over the other approaches by offering superior return and risk characteristics. Thus, one can use the fundamental indexation as an alternative to other traditional models.

The chapter 'The Evolution of the Retail Payment Market – A Focus on Malta' by Cilia Tortell looks at the future trends in the retail payment market in Malta, and the manner in which the major stakeholders are set to respond to the potential that innovative technology within this area is unlocking. Stakeholders strive to keep abreast with developments within this ambit, in pursuit of implementing a proactive approach within their respective roles. This is achieved through a series of semi-structured interviews with the major stakeholders in the local retail payment market, mainly Financial Services Regulators, Supervisors and Overseers as well as the Maltese Financial Services licence holders. The evolution in the retail payment landscape witnessed in recent years exposes immeasurable challenges to Malta's financial services sector and the economy at large. The conclusions derived from this research dovetail with the thorough literature review conducted, in exploring the manner in which such trends are envisaged to unfold within this sector. This study explores the legislative framework and regulatory regime, both current and proposed, which lay the foundations for the interplay between the respective stakeholders. It reveals the approach taken by the various stakeholders, as they each respond to

such developments in the retail payment sphere. These are predominately driven by market forces endowed with a mix of opportunities, as each stakeholder strives to remain resilient towards future industry challenges. This research is conducive towards enhancing the much needed clarity and awareness in the local retail payment market, and promotes the use of innovative, secure and cost-efficient retail payment methods.

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ACTIVE VERSUS PASSIVE INVESTING: AN EMPIRICAL STUDY ON THE US AND EUROPEAN MUTUAL FUNDS AND ETFS

Desmond Pace, Jana Hili and Simon Grima

ABSTRACT

Purpose – *In the build-up of an investment decision, the existence of both active and passive investment vehicles triggers a puzzle for investors. Indeed the confrontation between active and index replication equity funds in terms of risk-adjusted performance and alpha generation has been a bone of contention since the inception of these investment structures. Accordingly, the objective of this chapter is to distinctly underscore whether an investor should be concerned in choosing between active and diverse passive investment structures.*

Methodology/approach – *The survivorship bias-free dataset consists of 776 equity funds which are domiciled either in America or Europe, and are likewise exposed to the equity markets of the same regions. In addition to geographical segmentation, equity funds are also categorised by*

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structure and management type, specifically actively managed mutual funds, index mutual funds and passive exchange traded funds ('ETFs'). This classification leads to the analysis of monthly net asset values ('NAV') of 12 distinct equally weighted portfolios, with a time horizon ranging from January 2004 to December 2014. Accordingly, the risk-adjusted performance of the equally weighted equity funds' portfolios is examined by the application of mainstream single-factor and multi-factor asset pricing models namely Capital Asset Pricing Model (Fama, 1968; Fama & Macbeth, 1973; Lintner, 1965; Mossin, 1966; Sharpe, 1964; Treynor, 1961), Fama French Three-Factor (1993) and Carhart Four-Factor (1997).

Findings – *Solely examination of monthly NAVs for a 10-year horizon suggests that active management is equivalent to index replication in terms of risk-adjusted returns. This prompts investors to be neutral gross of fees, yet when considering all transaction costs it is a distinct story. The relatively heftier fees charged by active management, predominantly initial fees, appear to revoke any outperformance in excess of the market portfolio, ensuing in a* Fool's Errand Hypothesis. *Moreover, both active and index mutual funds' performance may indeed be lower if financial advisors or distributors of equity funds charge additional fees over and above the fund houses' expense ratios, putting the latter investment vehicles at a significant handicap vis-à-vis passive low-cost ETFs. This chapter urges investors to concentrate on expense ratios and other transaction costs rather than solely past returns, by accessing the cheapest available vehicle for each investment objective. Put simply, the general investor should retreat from portfolio management and instead access the market portfolio using low-cost index replication structures via an execution-only approach.*

Originality/value – *The battle among actively managed and index replication equity funds in terms of risk-adjusted performance and alpha generation has been a grey area since the inception of mutual funds. The interest in the subject constantly lightens up as fresh instruments infiltrate financial markets. Indeed the mutual fund puzzle (Gruber, 1996) together with the enhanced growth of ETFs has again rejuvenated the active versus passive debate, making it worth a detailed analysis especially for the benefit of investors who confront a dilemma in choosing between the two management styles.*

Keywords: Active management; passive management; mutual funds; exchange traded funds; asset pricing models; modern portfolio theory

INTRODUCTION

The funds' industry role has evolved to a central channel where both retail and professional investors can access a wide spectrum of markets, without retaining a directional exposure to a single instrument. Perceptibly, this allows for diversification effects to be augmented through the reduction of the specific risk associated with individual securities. Initially the main purpose for the formation of funds was to facilitate the pooling of investors' capital into a single structure, thereby exploiting economies of scale and scope by employing a professional portfolio manager and relevant expertise, reducing transaction costs *vis-à-vis* a do-it-yourself portfolio, whilst also permitting retail investors to access securities with elevated minimum investment thresholds which would be otherwise remote and not doable to invest in.

With regard to indexing prior to the existence of passive funds, it was practically unviable for investors to replicate effectively the returns of an underlying index or basket of instruments due to significant transaction costs and time constraints, owing to ongoing portfolio rebalancing. Moreover, if any physical replication was done by individual investors, the question would be that of whether the tracking quality was an adequate one. Subsequently admission to a broad range of securities is nowadays more feasible without encountering the aforementioned setbacks, leading to superior market efficiency, enhanced liquidity and induced financial markets' growth including market completion.

The establishment of different fund categories with distinct investment objectives has pioneered the confrontation involving active and passive investment structures, with the diversity between both ends emanating from the investment management style. More specifically, actively managed mutual funds aim to outperform the market portfolio proxied by major stock indices, whereas passive funds merely endeavour to replicate an underlying index, whilst preserving tracking error to a minimum. Undoubtedly, due to various factors including research costs and maintenance of the fund's objective, actively managed mutual funds charge higher fees vis-à-vis index funds, as the latter's solely concern is tracking the benchmark index as close as possible, with no effort exhausted on searching for undervalued and/or overvalued securities.

It is of common knowledge that albeit a percentage of actively managed mutual funds may indeed outperform the market and hence outshine passive funds, the net returns for active investors may be equivalent to or less than index funds' net returns, owing to higher management fees

and transaction costs. Indeed, it is worth researching whether the expenses incurred in attempting to outperform the market do actually cancel the efforts of the outperformance component over and above the market portfolio whilst also considering risk into the equation, thereby resulting in the *Fool's Errand Hypothesis*. In such case if risk-adjusted returns, net of fees, transpire to be equivalent, active and passive investors will be indifferent which way to elect. The issue is that with passive funds the market portfolio is 'guaranteed' as long as the tracking error isn't abnormal, whereas with actively managed mutual funds performance may either be better or even worse than the market index gross of fees, let alone after costs. This portrays a dilemma as to whether investors should opt for passive or active investment funds. Another concern is that apart from the conventional index funds, investors can nowadays access index replication investments via passive ETFs, therefore the uncertainty of choosing the optimal structure is further amplified.

Passive ETFs are akin to index funds, being a basket of instruments pooled together to replicate the returns of a specific benchmark. Alike to other passive investment vehicles, ETFs also provide a relatively cost-effective exposure to a wide spectrum of securities including equities, fixed income, commodities, currencies, real estate and major indexes. Apart from the initial passive types, active ETFs were gradually introduced in the market and this trend is expected to augment further. The latter instruments are a priori deemed as perfect or close substitutes for actively managed mutual funds.

Succinctly, ETFs are more liquid as they trade intraday on a stock exchange like any publicly listed security, whereas index and actively managed mutual funds are only priced at end of day via the NAV calculation. Being exchange tradable, less liquid ETFs may be inefficiently priced, at least intraday, and thereby enabling investors to long-sell under-priced and short-sell over-priced ETFs relative to their intraday indicative values. The characteristic of being exchange tradable makes ETFs a crossbreed between a mutual fund and a stock, essentially a product of financial innovation.

Ultimately the construction of these innovative instruments has provided new horizons for both retail and institutional investors, including exposure to a diversified index or portfolio through leverage and possibly arbitrage opportunities, due to the eventuality of ETFs' intraday prices deviating from their underlying portfolio values. Yet such arbitrage may be short-lived especially during wide mispricings, since ETF structures

enable approved parties to create and redeem ETFs at the respective NAV at end of trading, hence reducing price inefficiencies by enhancing market efficiency.

For the benefit of investors, this chapter aims to provide robust conclusions on distinct equity fund structures by tackling the successive research questions and hypothesis.

Existing literature suggests that the majority of actively managed mutual funds tend to underperform their underlying benchmarks, gross and net of fees (Blake, Elton, & Gruber, 1993; Gruber, 1996; Harper, Madura, & Schnusenberg, 2006; Malkiel, 1995; Rompotis, 2009; SPIVA, 2013, 2014), and hence passive structures including ETFs tend to be the wiser choice for investors. Therefore, is it rational to consider that passive management actually outperforms active? If this is the case, what explains the existence of the mutual fund puzzle (Gruber, 1996) along the past two decades?

Secondly, being close substitutes and index replication structures, ETFs and index funds are expected to mimic their underlying benchmarks, and thus calculated alphas are expected to be inexistent. In particular, existence of high alphas should be solely capturing a high tracking error. Consequently, given that passive ETFs and index funds do not seek to outperform a relative benchmark but rather track, calculated alphas will be negligible in case both structures have equivalent expense ratios. Hence, is it practical to solely consider passive management structures which actually charge the lowest expense ratios vis-à-vis their peers?

AIM OF THE STUDY

The aim of this chapter is to distinctly underscore whether an investor should be concerned in choosing between active and diverse passive investment structures. It will focus on measuring the generated alphas of actively managed mutual funds, index funds and passive ETFs, hence undertaking a risk-adjusted return approach. The researchers aim to grant a recommendation to the general investor to successively distribute investment capital effectively by procuring the highest alphas and risk-adjusted returns. Ultimately the study pursues to shed light on whether an investor benefits from selecting among active and passive investment funds, amid fierce competition between such collective investment structures and the recent explosive growth of exchange tradable funds.

LITERATURE REVIEW

Fundamental theories, asset pricing models and evidence on diverse fund structures are central to this research, all of which are reviewed in this section. Indeed the foremost reliable literature including research papers feature in this partition.

Theoretical Background

Markovitz' portfolio theory (1952a, 1952b) and the CAPM (Fama, 1968; Fama & Macbeth, 1973; Lintner, 1965; Mossin, 1966; Sharpe, 1964; Treynor, 1961) are the cornerstones which pioneered the birth and growth of asset pricing models. Indeed the anomalies' literature and CAPM's sceptics notably Roll (1977) indirectly encouraged the development of the basic model to extend its structure further. CAPM's enhancements predominantly ensued into Jensen's Alpha, the Three-Factor and Four-Factor Models as proposed by Fama and French (1993) and Carhart (1997), respectively. Complimenting these asset pricing models are a number of risk-adjusted performance measures primarily the Treynor ratio (1965), Sharpe ratio (1966) and Jensen's alpha (1968).

CAPM and Risk-Adjusted Models

Performance evaluation chiefly evolved from the establishment of CAPM, which was introduced as an asset pricing model. The CAPM as a theoretical model follows the mean-variance efficient concept initiated by Markowitz (1952a, 1952b). Put simply this theory entails that an investor will request the highest return for a given level of risk or the lowest risk for a given level of return, leading to the formation of portfolios on the efficient frontier. Specifically, investors can design the efficient frontier by employing the CAPM formula (Eq. (1)), which exhibits the relationship between risk and return via the market or beta risk, hence termed single-factor model.

$$E(R_p) = R_f + \beta\left[E(R_m) - R_f\right] \tag{1}$$

CAPM (*Source*: Sharpe, 1964)

where $E(R_p)$ refers to the individual's portfolio expected return, R_f incorporates the return on risk-free securities, $\left[E(R_m) - R_f\right]$ illustrates the excess

return of the market portfolio over and above the risk-free rate and the β coefficient represents the strength of the relationship between the investor's portfolio and the market portfolio.

An important concept of CAPM is that an investor is only compensated for systematic or market risk, as it cannot be diversified away. Put differently, no compensation is supplied for firm-specific risk since it can be reduced by diversification by incorporating more securities in a portfolio. The direction and extent of co-movement with market risk is computed by beta (Eq. (2)).

$$\beta_P = \frac{\operatorname{cov}(R_P, R_m)}{\sigma_m^2} \tag{2}$$

Beta (*Source*: Sharpe, 1964)

A beta of 1 connotes a perfectly positively correlation between an investor's portfolio and market portfolio. Therefore, a specific return generated by the market should be identically replicated by the investor's portfolio. Portfolios with a beta of 0 provide return equivalent to the risk-free rate, and hence are uncorrelated with the market returns. Portfolios with a beta of −1 inversely replicate the market, thus distribute perfectly opposite returns to those of the market. As a side note, investors typically expand portfolio betas throughout economic growth but contract such betas during turbulent times.

The formation of CAPM has long substantiated that computing return on its own simply supplies a trivial outcome. This signifies that portfolio return has to be assessed in tandem with its underlying risk to undertake a correct investment decision. This has led to the creation of two distinguished risk-adjusted ratio proposed by Sharpe (1966) (Eq. (3)) and Treynor (1965) (Eq. (4)), which concisely underscore the amount of return per each unit of risk.

$$S_P = \frac{E(R_P) - R_f}{\sigma_P} \tag{3}$$

Sharpe Ratio (*Source*: Sharpe, 1966)

$$T_P = \frac{E(R_P) - R_f}{\beta_P} \tag{4}$$

Treynor Ratio (*Source*: Treynor, 1965)

Though a priori both ratios may appear analogous, this is not the case as in the denominator a diverse path is employed. The Sharpe ratio is concerned with the portfolio's standard deviation by utilising the capital market line methodology, whereas the Treynor ratio adopts the portfolio beta via the security market line approach. Pro Roll's critique will noticeably favour the Sharpe ratio, as the latter does not make reference to a specific benchmark, which is unobservable and inexistent (Roll, 1977).

Single-Factor Regression Model

The single-factor model as proposed by Jensen (1968) remains to date a prevalent methodology for quantifying managers' skill and fund performance via alpha estimation (Eq. (5)). Jensen's alpha builds on the standard CAPM and hence assumes its empirical validity and robustness, predominantly that portfolio returns are explained by a linear relationship with beta plus the risk-free rate.

$$E\left(R_p\right) - R_f = \propto_P + \beta_P \left[E\left(R_M\right) - R_f\right] + \varepsilon_P \tag{5}$$

Jensen's Alpha (*Source*: Jensen, 1968)

where $E\left(R_p\right) - R_f$ represent the excess return on portfolio p, as a result of the exposure to the market risk premium $\left\{\beta_P[E(R_m) - R_m]\right\}$, plus ε_P being the error term and the notorious Jensen's alpha (α_p). Put simply a positive α_p implies that a portfolio manager has yielded higher risk-adjusted return than the underlying index or benchmark signifying skill and/or good luck. Conversely a negative alpha denotes a manager inability to generate the minimum expected return vis-à-vis the market portfolio, hence displaying lack of skill and/or bad luck.

Nevertheless supplementary research depicts that CAPM including Jensen's alpha is not able to explain returns entirely. Indeed stocks with certain characteristics tend to generate higher returns than that predicted by CAPM, leading to the introduction of multi-factor regression models.

Multi-Factor Regression Models

The first empirical evidence for testing the CAPM for equity portfolios via the SML demonstrated a robust positive relationship between mean returns and beta (Black, Jensen, & Scholes, 1972; Fama & Macbeth, 1973). Yet as further empirical studies were undertaken, less encouraging support for CAPM was shaping, ensuing in the anomalies' literature and declaring that beta is dead.

Basu (1977), Banz (1981), Fama and French (1993) authenticated that CAPM is mis-specified, since equity portfolios exhibiting large exposures to the size and/or value effect on average generate higher returns than that predicted by the single-factor model. Basu (1977) observed that portfolios encompassing value stocks outperformed growth stocks. Banz (1981) consecutively identified the small size effect, where small cap portfolios outshined larger caps. This evidence has led to consider the rejection of the Efficient Market Hypothesis ('EMH') and that securities' prices could possibly be biased, as an investor could obtain abnormal returns by going long value stocks signalled by a low price to earnings ratio, and small caps denoted by market capitalisation size. Nevertheless a general explanation for higher returns is that value stocks have a higher exposure to bankruptcy risk, whereas small caps have a larger exposure to liquidity risk. This means that higher returns are merely a compensation for undertaking a higher risk and hence this does not lead to a breakdown in the EMH. Although Basu (1977) and Banz (1981) evidence may have put some uncertainties on the EMH, it had geared up the trail for the construction of multi-factor models and/or improvement of existing ones. Indeed the shortcomings and naive approach of CAPM has led to notable theoretical and empirical research confirming that expected returns can be described by a number of variables via a multi-factor model leading to CAPM enhancement or even the creation of other asset pricing models (Carhart, 1997; Fama & French, 1993; Jagannathan & Wang, 1996; Ross, 1976).

A case in point was the development of the Arbitrage Pricing Theory by Ross (1976), which is established on the law of one price implying no arbitrage opportunities. Similarly to CAPM for fully diversified portfolios, the model assumes that idiosyncratic risk becomes inexistent, and hence expected returns are only explained by the exposure to risk factors. In Arbitrage Pricing Theory ('APT'), the model is constructed either as a single-factor or a multi-factor. For this reason, as an asset pricing model the APT is more flexible than CAPM, since it can absorb a variety of risk factors even in the absence of theoretical background. More specifically the APT assumes that expected returns can be explained by a single or a number of risk factors, yet it does not visibly sketch out which risk factors to employ. For instance the utilised risk factors can be stock indexes, fundamental variables, firm characteristics (Fama & French, 1992), macroeconomic factors (Chen, Roll, & Ross, 1986) and other generic factors.

Fama and French (1993) utilised previous empirical work predominantly from Basu (1977) and Banz (1981) to develop a Three-Factor model (Eq. (6)) for the purpose of explaining asset returns. Fama and French (1993) used firm

characteristics, namely size proxied by market capitalisation (SMB) and book to market ratio (HML) to gauge systematic risk exposure.

$$R_P - R_f = \propto_p + \beta_{0P}\left(R_M - R_f\right) + \beta_{1P}SMB + \beta_{2P}HML + \varepsilon_P \tag{6}$$

Fama French Three-Factor Model (*Source*: Fama & French, 1993)

The SMB (small minus big) risk factor adjusts for the exposure of the general outperformance of small cap portfolios over large ones. The HML (high minus low) variable corrects for the exposure of value stock portfolios, measured by a high book to market ratio, which typically outperform growth equity portfolios exhibiting low book to market ratios. The SMB is constructed by grouping small caps (S), being those equities with market cap below the median, and grouping large caps (B), that is, those firms with above the median market cap. Once both groups are finalised, then a risk premium is formulated by subtracting (M) the two and obtain an excess return. For HML a similar procedure is performed as stocks are sorted depending on book to market ratio into three distinct classes. The top 33% of stocks with the highest book to market ratio are categorised as H, whilst the bottom 33% of equities with the lowest book to market ratio are grouped as L. Then the risk premium or excess return between the two is calculated by subtracting (M). A high beta for the SMB risk factor would illustrate that a portfolio has a large exposure to small caps. Similarly a high beta for HML would signify that a fund has a greater exposure to value stocks rather than growth equities. In practice the Fama French Three-Factor model aids to illustrate whether a fund manager is generating returns given skill, or simply due to a greater risk exposure for small caps and value stocks, therefore reducing noise from alpha.

As an effort for cleaning alpha further, Carhart (1997) added another risk factor capturing momentum effects (Eq. (7)), which theoretically was introduced by Jegadeesh and Titman (1993). The momentum anomaly demonstrates that buying past winners and short selling past losers generates abnormal returns. Put simply, top performing equities are expected to continue performing well in the future and vice versa. Therefore, the momentum risk factor corrects for the overexposure to past winning stocks which generally outperform past losing stocks. The MOM risk factor is the risk premium or excess return of a past winner portfolio over the loser portfolio. It is composed by grouping an equally weighted average of last year's top 30% high performing equities versus an equally weighted average of last year's bottom 30% lowest performing ones, then taking the difference between the two.

$$R_P - R_f = \propto_P + \beta_{0p}\left(R_M - R_f\right) + \beta_{1P}\text{SMB} + \beta_{2P}\text{HML} + \beta_{3p}\text{MOM} + \varepsilon_P \quad (7)$$

Carhart Four-Facctor Model (*Source*: Carhart, 1997)

To recapitulate, Carhart's (1997) Four-Factor model evolved from the Fama and French (1993) Three-Factor model, where the latter model was derived by employing earlier empirical work from Basu (1977), Banz (1981) and Jegadeesh and Titman (1993). Even though such multi-factor models may be criticised for lacking theoretical foundation, numerous empirical studies employed these models to assess portfolio performance. Indeed the widespread usage of these factor models confirms that several researchers endorse their validity.

Evidence on Active and Passive Management

Fund managers' ability, predominantly securities' selectivity skills, has had a fundamental role in the financial literature. The majority of researchers clinch that active investment strategies tend to underperform passive ones, prior and post expenses (Blake et al., 1993; Bogle, 1998; Gruber, 1996; Harper et al., 2006; Malkiel, 1995; Rompotis, 2009; SPIVA, 2013, 2014). Furthermore, distinguished researchers namely Treynor (1965), Sharpe (1966) and Jensen (1968) all confirm that risk-adjusted performance of actively managed mutual funds underperforms a passive strategy after adjusting for expenses, at least for the period studied.

Malkiel (1995) investigated the performance and survivorship bias for equity mutual funds, authenticating that the latter typically underperform their underlying index, even gross of fees. Frino and Gallagher (2001) equivalently demonstrated that throughout their period of study, the Standard & Poor's 500 index fund boasted superior risk-adjusted return net of fees. Moreover Bogle (1998) presents a trade-off between fund selection and low expense funds, outlining that it would be prudent to select low expense funds at the expense of limiting fund selection.

Malkiel (1995) also suggests that performance persistence was present in the past and thus an investor could generate excess returns using historical data at least for a decade in the 1970s. As markets became efficient and investors more informed, such information was gradually reflected in instruments' prices, and as a result excess returns along with arbitrage opportunities disappeared. Yet Kuo and Mateus (2006), Rompotis (2007) together with Andreu, Swinkels, and Tjong-A-Tjoe (2012) disagree and

exhibit evidence of performance persistence. More specifically Andreu et al. (2012) highlight country and industry momentum using ETFs and conclude that investors are able to yield an excess return of 5% per annum by buying previous winners and shorting previous losers. Rompotis (2007) emphasises the existence of a November effect for ETFs, whilst also outlining November as the best month for index replicating ETFs in terms of tracking ability. Indeed Rompotis (2007) states that given the blend of high positive performance, low risk and minimum tracking error in such month, it signifies an opportunity for investors to obtain excess returns, which on average can beat the buy and hold strategies on a five-year horizon.

Harper et al. (2006) contrasted the performance of actively managed closed ended funds with passive ETFs. Analogous to the mainstream literature, findings depict that passive instruments reveal higher alphas and superior Sharpe ratios. More distinctively, on average closed ended funds exhibited negative alphas. One motivation was that ETFs' higher alphas and risk-adjusted returns may be driven by diversification effects when holding positions in globally diversified portfolios.

Rompotis (2009) applied the active versus passive argument to ETFs, by examining the performance of actively and passively managed ETFs. As a continuation to the existing literature, Rompotis (2009) authenticated previous research by demonstrating that actively managed ETFs underperform their counterparts plus market indexes. Furthermore it was observed that market timing and selection skills of active ETFs are poor. The same results in terms of manager skills emerged for passive ETFs, yet since the latter do not try to beat the market but only replicate a benchmark, it is trivial to analyse or search for such skills.

In addition to the available literature, Standard & Poor's Dow Jones Indices Versus Active (SPIVA) suggest that a large percentage of US actively managed equity mutual funds underperform their benchmarks including passive funds. From 2008 to 2013, more than 70% of large-cap funds holding the Standard & Poor's 500 as their benchmark underperformed. During 2013 and 2014, above 60% of large cap and around 70% of small cap underperformed their relative benchmarks net of fees (SPIVA, 2013, 2014). The phenomenon that passive funds may indeed outperform actively managed mutual funds is not solely present for equity mutual funds. Blake et al. (1993) employed models for US bond mutual fund samples to determine performance vis-à-vis their benchmarks. Aggregately it was established that for diverse bond categories, fixed income funds underperform their related benchmarks net of fees. Moreover a robust regression equation illustrated that a percentage unit increase in management fees yields a percentage unit

decrease in bond fund return. Ultimately the core source for bond fund underperformance are the higher costs incurred by investors, generating inefficiency compared to the underlying index. Also historical performance adjusted for survivorship bias was found to have no explanatory power for future return predictability, and this was also confirmed by Malkiel (1995).

It is evident that existing literature suggests that investors will fare better by employing a buy and hold approach. Nevertheless even though actively managed funds underperform and charge higher fees on average, their explosive growth during the last two decades has been remarkable. Gruber (1996) refers to this setting as the actively managed mutual fund puzzle. Still Minor (2001) states that there is potential for actively managed mutual funds to outperform their peers during certain periods, and hence time horizon is a major factor when analysing data. Yet Sharpe (1991) endorsed that prior transaction costs, the aggregate return of all actively managed portfolios will be equivalent to the market portfolio, and hence equal to passively managed portfolios. But post fees, the aggregate return of all actively managed portfolios will be less than the passive portfolios, given higher friction costs.

Since the majority of the literature reckons that passive outperforms active, this should result in the Grossman–Stiglitz paradox (Grossman & Stiglitz, 1980). If this holds in practice, actively managed mutual funds will cease to exist given their underperformance, ensuing in an increased demand for replication structures. This will consecutively trigger markets to become less efficient as fewer investors and portfolio managers will endeavour to beat the market. Such scenario will eventually lead to inferior market efficiency, and hence would be the optimal moment to attempt in outperforming the market. Consequently a priori, although it may be better to elect index funds in efficient markets, this may not be the case in less efficient markets given the existence of arbitrage opportunities.

Evidence on Index Mutual Funds and Passive ETFs

Dellva (2001) states that small investors may find ETFs less attractive than index funds due to higher initial entry costs, even though management fees are relatively cheaper for ETFs. Simultaneously due to the in-kind creation and redemption procedure, ETFs provide considerable tax advantages (Bernstein, 2002; Dellva, 2001; Kostovetsky, 2003; Poterba & Shoven, 2002). This is since current ETF investors are only liable for paying capital gains tax once their position is closed and not at the end of each financial

year. Yet Bernstein (2002) states that regular trading will extinguish ETFs' advantages including taxation benefits, and for this reason recommends them for long-term horizons. Indeed Bernstein outlines that in 2001, whilst a mutual fund was being held for three years, SPDR's ETFs were only being kept for 19 days on average. Such statistic is outdated and hence the scenario may possibly have changed. Also Elton, Gruber, Comer, and Li (2002) argue that a drawback of some ETFs is that investors cannot receive interest on their dividends. However this disadvantage can be circumvented, as ETFs can be structured as open ended investment company or Unit Investment Trusts (Elton et al., 2002).

Kostovetsky (2003) summarised the significant disparities between passive mutual funds and ETFs. The two structures vary in terms of management fees, shareholder transaction costs, taxation settlement and other qualitative factors such as the convenience and ease to buy or sell an ETF intraday at a transparent market price as opposed to the end of day NAV of an index mutual fund. As a concept the bid-offer spreads paid on passive mutual funds correspond to the bid-ask spread and brokerage fees on ETFs, indicating that both structures charge entry and exit fees apart from management ones. Gastineau (2004) tackled the operating efficiency issue, instead of addressing the lower expense ratios and tax efficiency of ETFs. Gastineau (2004) concluded that index mutual funds possess greater flexibility and superior operating efficiency, as these can outperform their underlying index and relative ETFs, however at the expense of augmenting tracking error by not undertaking a complete replication.

Engle and Sarkar (2006), Rompotis (2006) and Aber, Li, and Can (2009) closely examined trading patterns for ETFs. Aber et al. (2009) together with Rompotis (2006) observed that ETFs are more likely to be priced at a premium vis-à-vis their actual NAV or intraday indicative value, implying a higher price to earnings ratio. Engle and Sarkar (2006) further demonstrated that international ETFs have a tendency to significantly deviate from the actual NAV, more than local ETFs. Aber et al. (2009) also established that index mutual funds exhibit lower tracking error than their relative ETFs during their period of study. This is denied by Rompotis (2008), stating that index funds and ETFs exhibit analogous tracking ability on average. One motive for such divergence may possibly be the different data employed. Interestingly, Johnson (2009) found that a core factor for explaining tracking error was the difference in trading hours between non-US-domiciled ETFs which mimicked US benchmarks.

Guedj and Huang (2008), Rompotis (2008) and Agapova (2009) focused on the coexistence and substitutability of index mutual funds and ETFs,

highlighting market segmentation. Guedj and Huang (2008) observed that the mutual fund structure supplies liquidity shocks' insurance for investors, and therefore it is preferred by risk-averse and short-term horizon investors. Rompotis (2008) states that although both structures deliver similar solutions, conservative equity and low risk-averse mutual funds investors together with professional investors who cannot use derivatives have a preference for ETFs, whilst conventional retail investors usually avoid ETFs. Likewise Agapova (2009) explained that even though ETFs and index mutual funds are seen as perfect substitutes, they cannot be categorised as such, owing to structural variations leading to the so-called '*clientele effect*'. Guedj and Huang (2008), Svetina and Wahal (2008) and Agapova (2009) concur that the existence of both vehicles resulted into enhanced market completion. Specifically Svetina and Wahal (2008) remark that approximately only 17% of the ETF universe compete directly with index mutual funds. With regard to the remaining 83%, they are relatively specific niche areas where passively managed mutual funds are not usually present, and this is also evidenced by Guedj and Huang (2008).

METHODOLOGY AND DATA

The applied research and data methodology have been extensively utilised in research papers as it consents huge volume of data to be examined, providing wider analysis and more robust conclusions (Banz, 1981; Basu, 1977; Carhart, 1997; Fama & French, 1993; Jegadeesh & Titman, 1993).

Sample Description

NAV data for all American and European-domiciled actively managed equity mutual funds, index equity mutual funds and equity ETFs, was gathered from the Thomson Reuters Eikon Fund Screener. The monthly NAVs cover the period from December 2003 to December 2014 for each individual investment vehicle, yielding 133 observations for funds surviving the whole period of investigation. Those funds which did not endure the entire period of study are also included in the dataset to eliminate survivorship bias.

Survivorship bias is a shortcoming that samples are prone to if liquidated, merged or dead funds are entirely ignored from a dataset. The repercussions will be a bias towards funds which are still alive overstating

the returns of a sample, as on average dead funds typically underperform. The Thomson Reuters Eikon Fund Screener enables data samples to be free of survivorship bias by including *Liquidated* and *Merged funds* with *Active* and *Primary Funds* in the *Funds Status* criteria.

An array of criteria was established in the Thomson Reuters Eikon Funds Screener to acquire the desired mutual funds and ETFs based on a list of variables. The criteria include *Fund Status* (Active, Liquidated, Merged, Primary fund), *Asset Universe* (Mutual Funds or ETFs), *Asset Type* (Equity), *Domicile* (US or European), *Geographical Focus* (US or European) and *Strategy* (Index Replication or otherwise). With regard to the *Strategy* variable, any funds which are not passive in nature and do not perform index replication methods are considered to be actively managed.

The selection criteria yielded the NAVs for US- and European-domiciled Active and Passive Equity Mutual Funds and Passive Equity ETFs, with a geographical focus to the United States and Europe (Table 1). The fund dataset provided by Thomson Reuters Eikon Funds Screener accumulated to 776 investment vehicles, representing the research fund universe. NAV data for all individual funds was subsequently grouped into distinct categories, forming 12 equally weighted portfolios to gauge aggregated results for each subsample (Table 2).

Performance examination of the equally weighted portfolios' for 10 financial years is deemed satisfactory especially given the diverse economic cycles encountered, notably the turmoil of the 2007−2008 global financial crisis, the subsequent European Sovereign Debt crisis and the 2014 Oil crisis inter alia. Such time horizon could not be exceeded given that certain passively managed funds, specifically ETFs are a 'recent' innovation and hence lack historical data. Moreover below a 10-year sample data might encompass plenty of noise rather than 'normal' patterns. Therefore a decade of financial data is seen as the optimal period for the research.

Fund portfolios' performance are analysed via three major asset pricing namely the Capital Asset Pricing Model (Fama, 1968; Fama & Macbeth, 1973; Lintner, 1965; Mossin, 1966; Sharpe, 1964; Treynor, 1961), Fama French Three-Factor Model (1993) and Carhart Four-Factor Model (1997), outlined earlier. A crucial aspect for forming portfolios was the extensive presence of heteroscedasticity and serial correlation in residuals, when analysing individual funds' residual diagnostics. This violated CLRM assumptions, hence a modification in the methodology to construct equally weighted portfolios was requisite. Indeed undertaking regression analysis for individual securities and/or funds is susceptible to huge noise generated by idiosyncratic risk, whilst when merging into portfolios 'normal conditions' are reinstated.

Table 1. Funds' Sample Data and Portfolio.

Origin	Style	Geographical Focus	
		USA	Europe
US mutual funds	Index replication	152	5
	Active	184	4
EU mutual funds	Index replication	20	88
	Active	34	188
US ETFs	Index replication	53	3
EU ETFs	Index replication	3	42

Table 2. Equally Weighted Portfolios Representation.

Portfolio Code	Representation
EU_ETF_GF_EU_IR_PORTFOLIO	European passive ETF with European geographical focus
EU_ETF_GF_US_IR_PORTFOLIO	European passive ETF with US geographical focus
EU_MF_GF_EU_ACT_PORTFOLIO	European active mutual fund with European geographical focus
EU_MF_GF_EU_IR_PORTFOLIO	European passive mutual fund with European geographical focus
EU_MF_GF_US_ACT_PORTFOLIO	European active mutual fund with US geographical focus
EU_MF_GF_US_IR_PORTFOLIO	European passive mutual fund with US geographical focus
US_ETF_GF_EU_IR_PORTFOLIO	US passive ETF with European geographical focus
US_ETF_GF_US_IR_PORTFOLIO	US passive ETF with US geographical focus
US_MF_GF_EU_ACT_PORTFOLIO	US active mutual fund with European geographical focus
US_MF_GF_EU_IR_PORTFOLIO	US passive mutual fund with European geographical focus
US_MF_GF_US_ACT_PORTFOLIO	US active mutual fund with US geographical focus
US_MF_GF_US_IR_PORTFOLIO	US passive mutual fund with US geographical focus

Asset Pricing Models, Benchmarks and Proxies

Prior to employing asset pricing models, it is crucial underlining the applied equity benchmarks and risk-free rate proxies. The Standard & Poor's 500 and the EUROSTOXX are used as equity market portfolios proxies, given widespread recognition as mainstream equity benchmarks for their relevant region. The end-of-month trading price of both benchmarks is acquired from Thomson Reuters Eikon.

As for the risk-free rate, the *3-Month US Treasury Bill* is generally utilised, and likewise is chosen as a proxy. More specifically the *3-Month US Treasury Bill* monthly ask yield is selected, as it reflects the actual return for retail and institutional investors. The risk-free rate plays an important role in asset pricing models, since investors are merely concerned with excess returns, that is the return over and above the risk-free rate. Nevertheless given late and existing global economic conditions, the risk-free rate has immensely declined across the years to near zero levels.

With regard to Fama French Three-Factor model and Carhart Four-Factor model, the data for the relevant risk factors is accessed from Kenneth French online library. Data for HML being the return-on-value stocks portfolios less growth stocks portfolios' return; SMB that is, small cap portfolios minus large cap stocks portfolios' return; and MOM representing the momentum factor, put simply going long-sell winners' equity portfolios and short-sell losers' equity portfolios. These risk factors are necessary to perform regression analysis and statistical inferences for capturing alpha if present, for the equally weighted portfolios. Specifically the SMB, HML and MOM European risk factors are employed for the European exposed equity fund portfolios. Similarly the SMB, HML and MOM US risk factors are applied for the US-exposed stock fund portfolios. This procedure is necessary as application of US research factors for European focused equity portfolio funds and vice versa delivers feeble explanatory power.

Regression Models

The standard CAPM together with the Three and Four-Factor models are implemented to exhibit any alpha presence for the distinct equally weighted equity fund portfolios, ensuing into 36 regressions.[1] The three models can be represented as follows:

$$\ln \Delta R_{pi,t} - \ln \Delta R_{f,t} = \propto_i + \beta_{i1} \left\{ \ln \Delta R_{mi,t} - \ln \Delta R_{f,t} \right\} + \varepsilon_{i,t} \tag{8}$$

The Market Model

where

$\ln \Delta R_{pi,t}$ is the natural logarithm change on the return of portfolio i at time t

$\ln \Delta R_{f,t}$ denotes the natural logarithm change on the risk-free rate at time t

$\ln \Delta R_{pi,t} - \ln \Delta R_{f,t}$ implying fund excess returns for portfolio i at time t

$\propto_i$ is the alpha for portfolio i

β_k (for $k=1$) stands for the sensitivity of fund portfolios' excess returns to the exogenous variable

$\ln \Delta R_{mi,t}$ is the natural logarithm change on the market portfolio proxy at time t

$\ln \Delta R_{mi,t} - \ln \Delta R_{f,t}$ signifies market excess returns at time t

$\varepsilon_{i,t}$ embodies the residual for portfolio i assumed to be homoscedastic, normally distributed and with zero mean.

$$\ln \Delta R_{pi,t} - \ln \Delta R_{f,t} = \propto_i + \beta_{i1} \left\{ \ln \Delta R_{mi,t} - \ln \Delta R_{f,t} \right\} + \beta_{i2} \left\{ \mathrm{SMB}_t \right\} + \beta_{i3} \left\{ \mathrm{HML}_t \right\} + \varepsilon_{i,t} \quad (9)$$

The Three-Factor Model

where

β_ks (for $k=1-3$) stand for the sensitivity of portfolios' excess returns to the explanatory variables

$\{\mathrm{SMB}_t\}$ indicates the Small Minus Big risk factor for small cap exposure at time t

$\{\mathrm{HML}_t\}$ represents the High Minus Low risk factor for value stock exposure at time t.

$$\ln \Delta R_{pi,t} - \ln \Delta R_{f,t} = \propto_i + \beta_{i1} \left\{ \ln \Delta R_{mi,t} - \ln \Delta R_{f,t} \right\} + \beta_{i2} \left\{ \mathrm{SMB}_t \right\} + \beta_{i3} \left\{ \mathrm{HML}_t \right\} + \beta_{i4} \left\{ \mathrm{MOM}_t \right\} + \varepsilon_{i,t} \quad (10)$$

The Four-Factor Model

where

β_ks (for $k=1-4$) stand for the sensitivity of portfolios' excess returns to the explanatory variables

$\{\mathrm{MOM}_t\}$ is the Momentum risk factor for momentum exposure at time t.

OLS and CLRM Assumptions

Application of regression analysis entails routine diagnostic checks to avoid violation of assumptions under the CLRM (Classical Linear Regression Model). Such breach will affect the desirable properties of estimators under OLS which will no longer remain BLUE (Best, Linear, Unbiased, Estimator), predominantly influencing hypothesis testing ensuing into type 1 and type 2 errors.

There are five CLRM assumptions which need not be violated for OLS to well function (Brooks, 2008). The first assumption is $E(u_t) = 0$, implying that the average value of residual terms is zero. This assumption is circumvented and never violated by including a constant term in the regression. Secondly var $(u_t) = \sigma^2 < \infty$ signifying that the variance of the residuals is constant hence homoscedastic. The White Heteroscedasticity test will verify such data property. Thirdly $\text{cov}(u_i,u_j) = 0$ outlining that the covariance of the error term overtime equals zero and hence there is no serial correlation. The Breush Godfrey and Durbin Watson tests will authenticate whether residuals are autocorrelated or otherwise. Fourthly $\text{cov}(u_t,x_t) = 0$ illustrating that the residuals are not correlated with risk factors, that is the independent variables and hence absence of multicollinearity. Lastly the normality assumption $u_t \sim N(0, \sigma^2)$ requires data to have the characteristics of a normal distribution, thus skewness and excess kurtosis will equal zero. In reality this may not be the case for asset returns, however the Jarque–Bera test will substantiate the matter.

If the first four assumptions are not violated, then the constant coefficient represented by α and the beta coefficient/s will be BLUE. B (Best) implies that the OLS beta coefficient will have the minimum variance among all linear unbiased estimators. L (Linear) signifies that the constant and beta coefficient are a linear combination for the dependent variable y. U (Unbiased) means that on average the constant and beta coefficient will be equivalent to their true values. E (Estimator) insinuates that the estimated regressors for α and β represent the true values of alpha and beta (Brooks, 2008).

Dataset and Residual Diagnostics Results

This section illustrates the results emanating from the pre- and post-regression tests namely the ADF unit root test, the KPSS stationarity test, the Jarque–Bera normality test, the Durbin Watson serial correlation test, the Breusch–Godfrey autocorrelation test, the White heteroscedasticity test and the ARCH test.

The ADF and KPSS tests are performed for all the equally weighted portfolios, market proxies, risk-free rate and all the exogenous variables to assess whether they exhibit stationary or unit root trends. A priori, raw data for all variables was expected to display random walk characteristics, and this was unsurprisingly confirmed, supported by large *P-values* in the ADF test and likewise by sizeable LM stats in the KPSS. As mentioned earlier, this data characteristic is not desirable and requires alteration to stationarity, thus becoming fit for regression analysis via OLS. For illustration purposes

the endogenous variable US_MF_GF_US_IR_PORTFOLIO (Fig. 1) required data transformation from raw unit root data till LN(x/x_{-1}) modification to stationarity. The LN(NAV/NAV$_{-1}$) is subsequently employed as LN(NAV) was not sufficient to induce stationarity.

When applying LN(x/x_{-1}) on the monthly NAVs, the change on previous month is calculated hence losing a single observation from the dataset. After the LN(NAV/NAV$_{-1}$) modification, the data sample now ranges from January 2004 to December 2014, implying 10 financial years. This adjustment is crucial as all data was transformed into a stationary time series.

Equally important, due to the non-normality nature of the dataset as confirmed by the Jarque–Bera, the LN(x/x_{-1}) is employed to approximate normality. Nevertheless when dealing with asset returns, it is a regular procedure to allow for non-normality by assuming normality (Black & Scholes, 1973; Falzon & Castillo, 2013). The Jarque–Bera normality test jointly with the distribution graphs confirm that on average all data is non-normal distributed except for SMB_EU, SMB, HML_EU, whilst also demonstrate negatively skewed data except for the HML_EU and HML independent variables. Furthermore the data is leptokurtic rather than mesokurtic, given that excess kurtosis is repeatedly exhibiting a positive integer. Summing

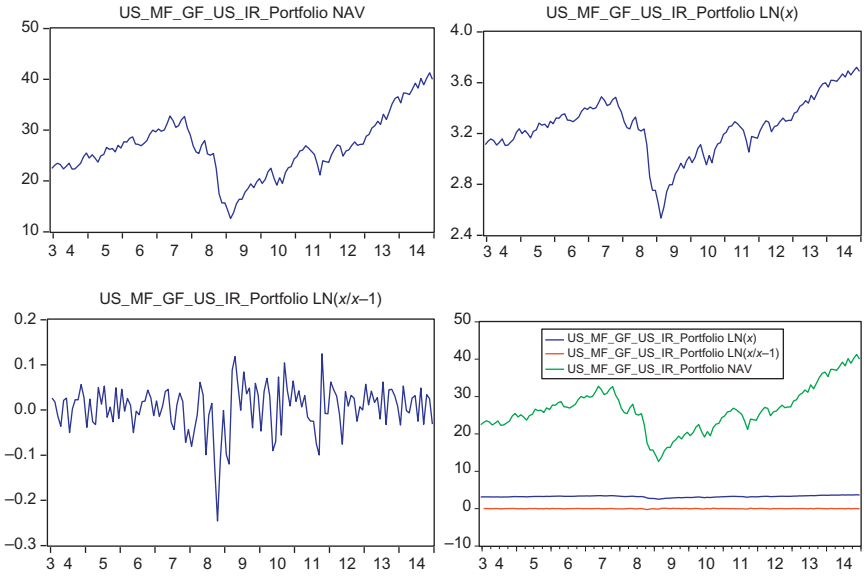

Fig. 1. US_MF_GF_US_IR_PORTFOLIO.

up, this overall negative skewness implies frequent small gains and few but large extreme losses, where such downside is further amplified by a positive and large kurtosis, given that extreme observations are more likely vis-à-vis a mesokurtic. Given these results EU_MF_GF_EU_ACT_PORTFOLIO is the most risky portfolio indicating the largest negative skewness and the highest positive kurtosis, signifying a left skewed leptokurtic distribution.

Moving on to residual diagnostics, auto correlation for the three asset pricing models is practically inexistent, with only minor occurrence. The residuals' auto correlation is examined via the Durbin Watson for lag 1 and Breush Godfrey for lag(s) 1, 2, 6 and 12. This was done to investigate any presence of monthly, two months, semi-annually and annual auto correlation. The null hypothesis of no serial correlation in residuals for the three asset pricing models was virtually never rejected and hence no assumption of CLRM was violated. At the 95% confidence interval, autocorrelation was only accepted in 11 instances from 144 cases, mainly for index replication portfolios at lag 12. This may indicate the existence of a specific pattern at lag 12 and indeed a seasonality dummy variable may be employed to capture the presence of such effects.

The White test, another residual diagnostic, confirms that error terms are predominantly homoscedastic for all employed asset pricing models including their extensions, signifying no or slight violation of CLRM. Indeed for the three standard asset pricing models, at the 95% confidence level the null hypothesis of homoscedasticity is accepted for 30 instances from 36 cases. Furthermore given the nature of financial markets, the frail presence of non-constant variances is accepted by notable papers (Falzon & Castillo, 2013). This result is further confirmed by the ARCH test, indicating trivial ARCH effects among the dataset. The fact that residuals are overall homoscedastic and no significant ARCH effects are present, GARCH type model and its variants are not appropriate and hence are overlooked. This ensued as the error terms exhibited characteristics which are desirable by OLS, and hence orthodox regression analysis methods are exploited.

RESULTS AND ANALYSIS

Recall that central to this chapter is the question of whether investors should be inclined towards any particular investment style between active and passive management, given the examined risk-adjusted performance and alphas. Such examinations are considered robust given that no or trivial violations of CLRM are encountered as by the pre- and post-regression tests.

Orthodox Asset Pricing Models Results

As a starting point the asset pricing models outcomes are based on the assumption that a positive linear relationship subsists between risk and return. This is crucial to highlight as specific research negates that such assumption holds in theory, thereby underlining no relationship or even the existence of a trade-off between risk and return (Campbell, 1987; Merton, 1973; Whitelaw, 1994; Zhang & Jacobsen, 2014). Nonetheless the hypothesis that return can be explained by various forms of risk, a case in point is via multi-factor models, has been widely analysed and applied in numerous distinguished research papers (Black et al., 1972; Carhart, 1997; Chen et al., 1986; Fama, 1968; Fama & French, 1993; Fama & Macbeth, 1973; Jensen, 1968; Lintner, 1965; Mossin, 1966; Sharpe, 1964; Treynor, 1961). Accordingly this research together with the ensuing regression analysis and results examination is deemed authentic and valid.

For the upcoming regression models (Tables 3–5), the alpha, α, coefficient measures the extent to which portfolio managers given the underlying risk are either creating exceptional gains over and above the market portfolio or otherwise. Evidently this coefficient is desired to be positive as negative results signify deterioration of value. The market's β_1 measures the concurrent impact of the changes in the market benchmark on the funds' portfolio returns, where predictably results are found to be highly statistically significant and positively related. The risk factor loadings' betas, β_2 (SMB), β_3 (HML) and β_4 (MOM) evaluate the concurrent exposure to the small size effect, value risk factor and momentum variable, respectively. Put simply the higher the beta coefficient, the larger the exposure to the prior mentioned risk factors, which are solely authentic in case of statistical significance.

Moving to the actual research findings, on average it is prevalent that fund managers' skill or luck is inexistent, as denoted by the constant coefficient in the regression equations symbolised by alpha (Tables 3–5). Indeed the solitary presence of positive alpha is exhibited by a class of ETFs specifically EU_ETF_GF_EU_IR_PORTFOLIO. This may seem peculiar since index replication structures simply aim to track an underlying benchmark rather than outperform the market. However an essential reminder is that EU_ETF_GF_EU_IR_PORTFOLIO's constituents have dissimilar benchmarks, and hence not necessarily track the EUROSTOXX equity index. The presence of alpha for passively managed funds is therefore not an anomaly but simply a justification that on average the constituents are tracking a superior benchmark in terms of risk-adjusted returns.

Table 3. Capital Asset Pricing Model Regression Results.

Capital Asset Pricing Model			
Model Results			
Series	α	Market	Adjusted R^2
EU_ETF_GF_EU_IR_PORTFOLIO	−0.0029**	0.9996***	0.9996
EU_ETF_GF_US_IR_PORTFOLIO	−0.0005	1.0038***	0.9987
EU_MF_GF_EU_ACT_PORTFOLIO	−0.0037	0.9963***	0.9959
EU_MF_GF_EU_IR_PORTFOLIO	−0.0007	1.0006***	0.9992
EU_MF_GF_US_ACT_PORTFOLIO	−0.0001	0.9984***	0.9988
EU_MF_GF_US_IR_PORTFOLIO	−0.0012	1.0005***	0.9979
US_ETF_GF_EU_IR_PORTFOLIO	−0.0011	0.9981***	0.9984
US_ETF_GF_US_IR_PORTFOLIO	−0.0005	0.9985***	0.9998
US_MF_GF_EU_ACT_PORTFOLIO	−0.0009	0.9959***	0.9973
US_MF_GF_EU_IR_PORTFOLIO	−0.0003	0.9982***	0.9977
US_MF_GF_US_ACT_PORTFOLIO	−0.0011	0.9978***	0.9991
US_MF_GF_US_IR_PORTFOLIO	−0.0003	0.9988***	0.9996

Notes: *, ** and *** signify rejection of the null hypothesis that α or $\beta = 0$ at 10%, 5% and 1% significant level, respectively.
Model: $\ln \Delta R_{pi,t} - \ln \Delta R_{f,t} = \alpha_i + \beta_{i1}\{\ln \Delta R_{mi,t} - \ln \Delta R_{f,t}\} + \varepsilon_{i,t}$.
Market portfolio is either S&P500 or EUROSTOXX depending on geographical focus. As a side analysis, DAX & MSCI EU and MSCI US are employed as market portfolios for their respective regions. N.B. No significant differences from the above are obtained.
Exogenous variables are given lagged and lead values for further empirical tests, however residual terms are found to be heteroscedastic, without finding ARCH effects.

For the remaining portfolios, results demonstrate that calculated alphas are not statistically different from zero. This entails that considering the employed market portfolios for the relevant region, 11 equally weighted portfolios irrespective of whether they are actively or passively managed are not adding value over and above their market benchmarks. For index tracking funds this upshot was anticipated, as their purpose is merely to replicate market return rather than to outperform. Yet, the outcome was fairly unexpected and disappointing that none of the four active equity fund portfolios produced any positive alphas. Evidently this doesn't signify that none of the actively managed mutual funds constituents in the equally weighted portfolios were able to outperform the market. Indeed specific active funds might have indeed outperformed the market.

The reality is that the top active funds are concealed by the underperformance of their peers forming part of the portfolio. Nonetheless identifying the best actively managed funds prior exhibiting superior performance is a huge task. Selecting active funds simply on historical performance may be

Table 4. Fama French Three-Factor Model Regression Results.

Three-Factor Model					
Model Results					
Series	α	Market	SMB	HML	Adjusted R^2
EU_ETF_GF_EU_IR_PORTFOLIO	−0.0030***	0.9994***	−0.0007	−0.0004	0.9996
EU_ETF_GF_US_IR_PORTFOLIO	−0.0003	1.0030***	−0.0008	−0.0017	0.9987
EU_MF_GF_EU_ACT_PORTFOLIO	−0.0035	0.9957***	−0.0010	−0.001	0.9959
EU_MF_GF_EU_IR_PORTFOLIO	−0.0007	1.0005***	−0.0004	−0.0001	0.9991
EU_MF_GF_US_ACT_PORTFOLIO	−0.0002	0.9981***	−0.0003	−0.0007	0.9988
EU_MF_GF_US_IR_PORTFOLIO	−0.0009	0.9998***	−0.0020	−0.0020	0.9979
US_ETF_GF_EU_IR_PORTFOLIO	−0.0008	0.9988***	−0.0027**	−0.0007	0.9985
US_ETF_GF_US_IR_PORTFOLIO	−0.0001	0.9986***	−0.0027***	−0.0008	0.9998
US_MF_GF_EU_ACT_PORTFOLIO	−0.0004	0.9971***	−0.0041***	−0.0012	0.9974
US_MF_GF_EU_IR_PORTFOLIO	−0.0001	0.9993***	−0.0039***	−0.0013	0.9978
US_MF_GF_US_ACT_PORTFOLIO	−0.0018	0.9985***	−0.0044***	−0.0024*	0.9992
US_MF_GF_US_IR_PORTFOLIO	−0.0009	0.9989***	−0.0038***	−0.0011	0.9996

Notes: *, ** and *** signify rejection of the null hypothesis that α or $\beta = 0$ at 10%, 5% and 1% significant level, respectively.

Model: $\ln \Delta R_{pi,t} - \ln \Delta R_{f,t} = \alpha_i + \beta_{i1}\{\ln \Delta R_{mi,t} - \ln \Delta R_{f,t}\} + \beta_{i2}\{\mathrm{SMB}_t\} + \beta_{i3}\{\mathrm{HML}_t\} + \varepsilon_{i,t}$.

Market portfolio is either S&P500 or EUROSTOXX depending on geographical focus. As a side analysis, DAX & MSCI EU and MSCI US are employed as market portfolios for their respective regions. N.B. No significant differences from the above are obtained.

Exogenous variables are given lagged and lead values for further empirical tests, however residual terms are found to be heteroscedastic, without finding ARCH effects.

Fama French US research factors are employed for US equity portfolios and European research factors are applied for European stock portfolios. When applying US research factors for European exposed equity portfolio funds and vice versa, weaker explanatory power is found.

an expensive option and undeniably, mutual funds displaying an excellent past performance don't guarantee outperformance in the future. Indeed literature suggests that the top performing funds in any one decade tend to be completely different from the preceding and subsequent period (Greenblatt, 2011), indicating imprudence in choosing mutual funds based on their past performance. This has a twofold effect, primarily in terms of underperformance but may also apparently ensue into higher fees reflecting higher demand given the mutual fund popularity.

From a risk-adjusted return perspective in view of the 12 equally weighted portfolios, there is practically no diversity between active and passive management style for the studied decade. Put simply with the exception of a class of European ETFs tracking European indices, an investor will be indifferent when choosing between the two structures in the absence of transaction costs. Nevertheless in reality friction costs play a crucial role

Table 5. Carhart Four-Factor Model Regression Results.

Four-Factor Model						
Model Results						
Series	α	Market	SMB	HML	MOM	Adjusted R^2
EU_ETF_GF_EU_IR_PORTFOLIO	−0.0029**	0.9994***	−0.0007	−0.0003	−0.0002	0.9996
EU_ETF_GF_US_IR_PORTFOLIO	−0.0006	1.0041***	−0.0010	−0.0016	−0.0013	0.9987
EU_MF_GF_EU_ACT_PORTFOLIO	−0.0041	0.9958***	−0.0010	−0.0004	−0.0007	0.9959
EU_MF_GF_EU_IR_PORTFOLIO	−0.0007	1.0006***	−0.0004	−0.0002	−0.0001	0.9991
EU_MF_GF_US_ACT_PORTFOLIO	−0.0000	0.9992***	−0.0007	−0.0009	−0.0050**	0.9988
EU_MF_GF_US_IR_PORTFOLIO	−0.0011	1.0009***	−0.0022	−0.0018	−0.0006	0.9978
US_ETF_GF_EU_IR_PORTFOLIO	−0.0014	0.9987***	−0.0026**	−0.0000	−0.0008	0.9985
US_ETF_GF_US_IR_PORTFOLIO	−0.0001	0.9986***	−0.0027***	−0.0007	−0.0013	0.9998
US_MF_GF_EU_ACT_PORTFOLIO	−0.0016	0.9969***	−0.0040***	−0.0001	−0.0013*	0.9974
US_MF_GF_EU_IR_PORTFOLIO	−0.0009	0.9992***	−0.0039***	−0.0002	−0.0013*	0.9979
US_MF_GF_US_ACT_PORTFOLIO	−0.0012	0.9962***	−0.0044***	−0.0015	−0.0041**	0.9992
US_MF_GF_US_IR_PORTFOLIO	−0.0007	0.9980***	−0.0037***	−0.0008	−0.0019	0.9996

Notes: *, ** and *** signify rejection of the null hypothesis that α or $\beta=0$ at 10%, 5% and 1% significant level, respectively.

Model: $\ln \Delta R_{pi,t} - \ln \Delta R_{f,t} = \alpha_i + \beta_{i1}\{\ln \Delta R_{mi,t} - \ln \Delta R_{f,t}\} + \beta_{i2}\{\mathrm{SMB}_t\} + \beta_{i3}\{\mathrm{HML}_t\} + \beta_{i4}\{\mathrm{MOM}_t\} + \varepsilon_{i,t}$.

Market portfolio is either S&P500 or EUROSTOXX depending on geographical focus. As a side analysis, DAX & MSCI EU and MSCI US are employed as equity market portfolios for their respective regions. N.B. No significant differences from the above are obtained.

Exogenous variables are given lagged and lead values for further empirical tests, however residual terms are found to be heteroscedastic, without finding ARCH effects.

Fama French US research factors are employed for US equity portfolios and European research factors are applied for European stock portfolios. When applying US research factors for European exposed equity portfolio funds and vice versa, weaker explanatory power is found.

when selecting an investment structure particularly in instances where the financial instruments yield a similar cash flow or more importantly identical risk-adjusted returns. Another consideration which plays an essential role and is understood to be higher for actively managed funds are agency costs. This indicates that in discretionary management active fund managers may not always perform their duties in the best interests of investors. A classic scenario is where portfolio managers have incentives to take on more risks which may not be desirable from the investors' point of view. Conversely for passively managed structures, the actual management is usually much more clearly defined and the only hazard is the tracking error.

The revealed alphas emphasise a pivotal role for the cost factor and hence decisive in an investment decision. It is of general knowledge that the cost structure of passively managed funds is more favourable, since the sole objective of the latter is to track an underlying index. Conversely active funds engage their efforts in searching for mispriced securities, undertaking a more complex process and eventually more costly.

Given the exposed results, for the typical investor who doesn't seek regular monitoring, but is more concerned about a longer term horizon and hence growth, it is advisable to opt for a low-cost passive equity fund or ETF. However this is easier said than done, as there is a wide spectrum of index replication structures for investors to choose from namely ranging from cap size, style that is value, growth or blend, sector category, region, etc., and consequently a financial advisor is required for novice investors. For such investors who may also lack financial literacy, it is prudent to elect passive funds which track the general market such as the Standard & Poor's 500 and the EUROSTOXX, or may diversify further by creating a portfolio of passive funds. Passive structures can be chosen depending on the desired regional exposure, sector and exposure to foreign exchange. Nonetheless investors can still be exposed to overseas markets without having a foreign exchange exposure, by choosing funds with the same currency denomination which are daily hedged, and hence not capturing currency risk.

Portfolios' Characteristics Analysis

Examination of the equity fund portfolios' degree of fluctuation as measured by market risk depicts an ETF portfolio EU_ETF_GF_US_IR_PORTFOLIO, exhibiting the highest volatility in all three asset pricing models. Hence an index replication structure does not necessarily provide a lower standard deviation or inferior beta risk as this is dictated by the behaviour of the underlying benchmark. Conversely US_MF_GF_EU_ACT_PORTFOLIO, an actively managed mutual fund portfolio displayed the weakest shocks in both CAPM and Three-Factor Model, whilst another actively managed mutual fund portfolio, EU_MF_GF_EU_ACT_PORTFOLIO revealed the lowest market risk in the Four-Factor Model. In fact market betas for active fund portfolios, on average are lower than their peers. Given regression results, active fund portfolios are less volatile than the employed market benchmarks which could imply that whilst active investors are charged higher fees due to identification of undervalued and overvalued securities, fund managers may be conservative in the process of stock picking. Conversely it can be viewed that on average active mutual funds provide more stability given smaller betas, and hence enhanced peace of mind especially for active risk averse investors, even though this might mean higher costs. The absence of statistically significant positive alphas could ensue from the lack of appetite revealed by active fund managers to detect bargains. The solitary fund portfolio exhibiting a statistically significant positive alpha, EU_ETF_GF_EU_IR_PORTFOLIO, is a relatively cautious index replication

portfolio as illustrated by a beta below one. Another reason could be that fund managers try to spot opportunities, yet the identified undervalued or overvalued equities could endure the mispricing in the long run and hence not returning to their intrinsic value, due to model risk.

Investigation of portfolios' investment styles proves that US equity fund portfolios have a positive exposure to small caps, and the effect is even stronger for actively managed mutual funds. Put simply, active portfolio managers may search for such exposure, since research authenticates the general outperformance of small caps over large ones (Banz, 1981; Fama & French, 1993), however this effect was not statistically significant and thus not present in the case of European equity fund portfolios. Also for the HML risk factor, no particular preference or exposure among value or growth stocks was revealed, except for a single portfolio US_MF_GF_US_ACT_PORTFOLIO, which showed a statistically significant negative beta in the Three-Factor Model implying an overexposure to growth equities. As for the momentum risk factor, three out of four active fund portfolios have a statistically significant exposure. More specifically two active fund portfolios, EU_MF_GF_US_ACT_PORTFOLIO and US_MF_GF_US_ACT_PORTFOLIO pursue a momentum strategy, whilst another actively managed fund portfolio, US_MF_GF_EU_ACT_PORTFOLIO employs contrarian and reversal strategies. Lastly the adjusted R^2 in all regressions for all the three asset pricing models is found to be relatively high, signifying that on average the models are describing an adequate proportion of the variation in the equally weighted equity fund portfolios' returns implying adequately explained results.

Hybrid Equity Mutual Funds

The absence of positive alphas indicates that the nightmare for portfolio managers continues, as they consistently fail to beat market benchmarks. This downside can be straightforwardly resolved by switching to passive styles by tracking market benchmarks, also benefiting investors owing to the lower charges. Nonetheless if the majority of fund managers turn passive, competition for information declines and fewer participants will try to outperform the market, leading to market inefficiency. At this point, given the assumed existence of a trade-off between market efficiency and abnormal returns, arbitrage opportunities will become prevalent magnetising the attention of market participants. This will again attract fund managers to perform active management to benefit from such existing and potential

opportunities. Theoretically it may be one explanation to Gruber (1996) mutual funds puzzle, apart from the mutual funds' hard selling and investors' lack of financial literacy. However as portfolio managers switch back to active management, market efficiency increases again, thereby reducing the likelihood of abnormal returns and presence of arbitrage.

Understandably investment managers and their fund structures may not be flexible due to a variety of friction costs and barriers halting them from a rapid switch. Barriers for altering from passive to active and vice versa may include regulatory constraints, legal costs, non-compliance of prospectus among other changing costs that arise in the process. Also funds may not wholly employ a discretionary investment management policy and thus any transfer of clients' assets may require prior approval, leading to time lag hence defeating the scope of flexibility. Yet an equity fund can avoid these costs by straightaway stressing its intentions in the prospectus to operate as a hybrid, that is, altering from passive to active style depending on changes in market efficiency. Such a fund structure may not yield any benefits in consistently highly efficient markets. Yet this fund structure may be valuable for less constantly efficient markets such as emerging markets, where the flow of information may not be uniformly reflected in asset prices. Such vehicle should also promote a cost-effective fee structure including a cheaper expense ratio, given that it does not undertake active management on an ongoing basis.

Active Management Costs as a Subsidy for Market Efficiency

The dilemma remains whether active management provides any benefits at all. From a market structure point of view, active mutual funds are crucial for keeping high levels of market efficiency. However from the investors' perspective given these results, the benefits sought are questionable especially in the light of higher fees. In general, high levels of market efficiency are positive for investors as financial instruments' prices reflect all the available information. But maintaining market efficiency doesn't come automatic but rather the system creates incentives in inefficient markets for participants to exploit. Yet when markets are already highly efficient, it is not clear as to why mutual funds persist in charging high fees when opportunities are practically 'inexistent'. One possible explanation could be due to menu costs. Certainly the high fees paid by active investors help in preserving market efficiency and indirectly subsidise passive investors' costs. Put simply passive investors are the free riders of the fund industry profiting from enhanced market efficiency at lower costs due to an intrinsic cost

charged by the 'market system' to active investors. Hence part of the fees paid by active investors rather for alpha creation may be deemed as a natural cost imposed by the 'market structure' to maintain market efficiency by supporting and encouraging fund managers to retain market efficiency.

This natural cost for keeping market efficiency is vital from the system's perspective, yet still a cost for active investors as calculated alphas for active fund portfolios do not appear to compensate for this drawback. Nonetheless the results confirm that although on average no positive alphas have been generated in the last decade, no statistically significant negative alphas were produced neither. This finding is important since it clearly indicates the huge influence of the market benchmarks on the distinct equity fund portfolios, as exhibited by the highly statistically significant market beta coefficients proxying market risk in the three asset pricing models. Put simply in booming markets, funds generally enjoy good returns and vice-versa, except in cases where an inverse strategy is employed. Hence active management for the typical investor is deemed as a caveat emptor, as a passive instrument or index replication structure will perform very well especially given its low cost composition, also considering that the tracking error is well managed.

CONCLUSION

The study provides evidence that neither active nor passive management style is superior in terms of risk-adjusted performance when analysing solely NAVs for a 10-year timeframe. Nevertheless investors are instinctively informed of the higher expenses associated with actively managed mutual funds, such as initial fees which can range from 2% and over including higher annual expense ratios, amongst other possible costs. Investors shouldn't overlook the heftier fees charged by mutual funds, as these have a massive bearing on portfolio returns. Indeed an investor with a 100,000 worth of investment capital and a 20-year horizon seeking a US-Large Cap Growth equity fund is expected to lose 170,644 due to higher costs, if an actively managed mutual fund such as Morgan Stanley's with an expense ratio of 1.69% is elected over a Charles Schwab ETF, which has a matching objective but is accessible at a hugely cheaper expense ratio of 0.07%. The assumptions for this calculation are a market expected annual rate of return of 10%, ensuing into a cost-adjusted return rate of 8.31% and 9.93% leading to a final balance of 493,595 and 664,239 for the active and passive structures, respectively. Certainly this calculation is

overlooking the initial fees for both cases, where for the actively managed mutual fund it is in the region of 5.75%, whereas for the ETF transaction costs are equivalent to when purchasing a stock. Again the discrepancy is substantial, yet this illustration shouldn't be taken as a blue print as other active equity funds might be more cost efficient than demonstrated in this specimen and indeed anomalies do exist. For instance if an investor desires exposure to the US Healthcare sector, iShares US Healthcare ETF is available at an expense ratio of 0.45%, whereas Vanguard's actively managed Healthcare mutual fund supplies an expense ratio of 0.34%. Using the aforementioned calculation, at a market expected annual rate of return of 10%, cost-adjusted return rates are of 9.55% and 9.66% leading to a final balance of 619,794 and 632,361 for the ETF and active structure, respectively. This demonstrates that the active fund is cheaper than the corresponding ETF, and will indeed deliver an added value of 12,567 over its competitor. Yet if tax advantages of ETFs are considered in the equation, the balance will easily favour the ETF over the active mutual fund, especially in the case of long horizon and high net worth investors.

This leads to resolve that it is prudent not to generalise about whether active or passive management is unquestionably superior to its peer and to analyse on a case-by-case basis. Simultaneously investors are subliminally informed that on average passive vehicles are more cost-effective, whereas ETFs provide higher tax advantages. Categorically decisive for investors is the access to the cheapest available investment structure for their investment objective, regardless of being an active mutual fund, passive mutual fund or index replication ETF.

LIMITATIONS AND RECOMMENDATIONS FOR FUTURE RESEARCH

The primary shortcoming of this research is the employment of an equity benchmark as opposed to a well-diversified market portfolio, which in theory (Roll, 1977) would have to encompass the entire asset universe including commodities, currencies, real estate, precious metals inter alia. This signifies that alpha generation and risk-adjusted returns are not computed on all available investments opportunities and that the true and actual returns are unobservable.

Secondly, the application of an equity benchmark implies that both active and passive equity funds are disadvantaged when evaluated with

the former, as it is a purely theoretical concept. Put simply this comparison does not have a bearing on investors in practice, as it does not actually show investors' opportunity set and investment choices. The closest real life structures to equity indices and thus more realistic benchmarks are index replication structures such as index mutual funds and ETFs. This is since as opposed to an index mutual fund, pure theoretical equity benchmarks like the Standard & Poor's 500 do not illustrate the expenses undertaken in replicating an underlying benchmark. The bottom line of this limitation is that risk-adjusted returns and generated alphas for both active and passive equity funds will be lower than they actually are. Nonetheless utilising the aforesaid equity benchmarks for both active and passive equity funds result in the identical yardstick without favouring a management style or investment vehicle over another.

Thirdly, the recently enhanced popularity and growth of ETFs signifies lack of historical data for these investment structures. Indeed adequate data availability for ETFs can be traced back for a period of 10 years, with data accessibility reducing exponentially when exceeding such timeframe.

Fourthly, the assessment of active and index replication vehicles via a portfolio approach ensues in findings for fund categories, but conceals outcomes for top performing and worst performing equity funds. Nevertheless as a side analysis, assessment of individual equity funds demonstrated undesirable OLS characteristics and therefore non robust results.

After analysing the empirical work of this study jointly with the present literature review relating to active and passive management, a list of new research ideas emerge. Principally, the majority of the research is only concerned with developed equity mutual funds and equity ETFs, with no reference to any other asset classes and/or emerging/frontier markets. This presents a literature gap to analyse active and index replication equity funds, predominantly ETFs, in emerging and frontier markets, primarily given the relative diverse levels of market efficiency. Additionally it presents an opportunity to undertake a comparison between active and passive management for other asset classes including bonds, commodities, mixed assets and real estate primarily REITs (Real Estate Investment Trusts).

NOTE

1. Twelve equally weighted portfolios require 12 CAPM regressions, 12 Three-Factor model regressions and 12 Four-Factor model regressions.

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FX HEDGING USING FORWARDS AND 'PREMIUM-FREE' OPTIONS

John Mark Caruana

ABSTRACT

Purpose – *This chapter aims to find an optimal way to hedge foreign exchange exposures on three main currency pairs being the EURUSD, EURGBP and EURJPY. Furthermore, it analyses the risk level of each portfolio together with its kurtosis level. This chapter also looks into the relationship between the EURUSD portfolios and the VIX level.*

Methodology/approach – *This study is based on a back-testing analysis over a period of seven years starting in January 2007 and ending in December 2014. Two main Foreign Exchange Premium-Free strategies were structured using the Bloomberg Terminal. These were the 'At-Expiry Forward Extra' and the 'Window Forward Extra'. Portfolios were created using FX options strategies, FX spot and FX forwards. The EURUSD portfolios were also analysed and compared with the VIX level in order to see whether volatility has a direct effect on the outcome of the strategies. The statistical significance of the difference between returns of portfolios was analysed using a paired sample* t*-test. Finally, the histogram and distribution curve of each portfolio were created and plotted in order to provide a more visual analysis of returns.*

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Findings – *It was found that the optimal strategies in all cases were the FX option strategies. The portfolios' risk was analysed and indicated that optimal portfolios do not necessarily derive the lowest risk. It was also found that with a high VIX level, the forward contract was the most beneficial whilst the option strategy benefited from a low VIX level. When testing for statistical significance between returns of different portfolios, in most cases, the difference in returns between portfolios resulted to be statistically insignificant. Although some similarities were noticed in distribution curves, these differed from the normal distribution. When analysing the kurtosis levels, it is found that such levels differed from that of a normal distribution which has a kurtosis level of 3. Interpretation of such histograms, distribution curves and the kurtosis analysis was explained.*

Keywords: Foreign exchange; derivatives; exotic options; premium-free options

INTRODUCTION

This chapter tackles the issue of foreign exchange risk management by looking into two main methods of hedging. These are through forward contracts and premium-free option strategies. Two main FX premium-free strategies were constructed; being the At-Expiry Forward Extra and the Window Forward Extra. Both strategies are considered as low risk within the FX hedging industry. This chapter looks into how such strategies are available without upfront premium by analysing the dynamics of FX options and compare them to those of a forward contract. Portfolios made up of FX premium-free options, forward contracts and spot have been created in order to analyse the optimal way to hedge foreign exchange risk. Different exposure to each financial instrument was created in different portfolios. This chapter is ideal for industry professionals, financial institutions, FX brokers and also for corporations having an exposure to foreign exchange. Unfortunately, not much analysis was conducted on the best way to hedge foreign currency due to its complexity and several factors all affecting the outcome of a hedge.

Thus, this chapter aims to provide insight into the optimal way to hedge foreign currency and the underlying risks involved. The author analysed data throughout a seven-year period from 2007 to 2014. This captured

the financial crisis and a recovery period which would also provide information on how hedging is effected in volatile times. The strategies have a tenor of one year each and are rolled over every month. Therefore, after the first 12 months, the analysis had a forward contract or FX option strategy expiry on a monthly basis.

Three main currency pairs were used: the EURUSD, Euro against the US Dollar; EURGBP, Euro against the British Pound; and the EURJPY, Euro against the Japanese Yen. The author selected these three main strategies as they are found to be the most used ones within the international trade industry. Furthermore, such currency pairs represent different levels of volatility, with the EURJPY being the most volatile followed by the EURUSD and EURGBP.

Therefore, this chapter has the ultimate aim to provide readers with an overview of the FX industry and to provide information about the pricing of exotic options and the importance of FX hedging using alternative methods such as premium-free FX option strategies.

LITERATURE REVIEW

Charvin, Fullwood, and James (2013) quoted the BIS (2010) report which states that the average daily turnover in the FX options market was 207 Billion US Dollars in 2010. However, this is still smaller than the daily Spot turnover which reached 1.5 Trillion USD in 2010. Charvin et al. (2013) also quoted James, Marsh, and Sarno (2012): 'one should note that a substantial part of the spot turnover is actually due to option activity. This is estimated to be 30% of the total spot flow due to delta and gamma hedging'.

The author focused on the area of exotic options through this chapter with special attention to the FX market. These options are also called 'Barrier Options' and are given importance in this research as they are the most important tool used to obtain results and analysis. In fact, through this chapter, the author refers to one main type of barrier option which is the 'Forward Extra'. Two versions of this structured product are used, one using a 'European barrier' and another using an 'American barrier'.

Blumke (2009) argued that 'FX is the only asset class where basic options are priced on two assets: the reference currency and the alternative currency. As a result, a call on the reference currency is equal to a put on the alternative currency'. This may prove to be challenging for non-FX specialists to understand and get familiar with these conventions.

As time goes on, options are becoming more complex and research in this area has been somewhat vast and relatively little could be found specifically on FX options. As noted by Charvin et al. (2013), 'most option studies focus on equity data and there is no guarantee that results can be extrapolated to FX'. As shown in this chapter, the use of FX derivatives is actually the highest percentage when compared to other asset classes. As described by Bossens, Rayee, Skantzos, and Deelstra (2010), 'the Foreign Exchange (FX) option's market is the largest and most liquid market of options in the world', thus, the author believes that such an area is gaining importance in today's market and researching it would be beneficial for both academics and professionals alike.

Exotic (Barrier) Options

Bossens et al. (2010) listed three generations of exotic options. The first generation consists of 'touch-like options and vanillas with barriers'. Second generation exotic options are 'options with a fixing-date structure or options with no available closed form value'. Third generation exotic options are 'hybrid products between different classes'. This chapter focuses on the first generation exotic options. First generation exotic options, also known as 'Barrier Options', are considered to be a more innovative version of general options. They are mostly used in equities and foreign exchange and are important in the underlying structure of some structured products. Through these financial instruments, traders achieved additional flexibility in their portfolios.

These options may also offer additional benefits since they are (depending on their direction) usually cheaper than the vanilla call or put options, due to additional risk built into them. However, innovation might also lead to additional risks as some traders fail to fully understand the dynamics of these instruments which may lead to unexpected losses.

Knock-Ins and Knock-Outs

As defined by Hull (2006), 'barrier options are options where the pay-off depends on whether the underlying asset's price reaches a certain level during a certain period of time. A number of different types of barrier options regularly trade over-the-counter (OTC). These barrier options can be classified as either *knock-out options* or *knock-in options*'. Briys, Bellalah,

Minh Mai, and De Varenne (1998) states that 'Barrier options allow the option holder to go "out" or "in" some specified levels of the underlying asset only on specified days during the option's life'.

DeRosa (2011) identified a knock-in barrier option as 'an option that does not come into existence unless the spot exchange rate breaches a specified in-strike level. The in-strike of the knock-in is located out-of-the-money. If the in-strike level (barrier level) trades, the knock-in permanently becomes a vanilla put or call. If the in-strike never trades, the knock-in will expire worthless at expiration, even if it is in-the-money'.

Bouzoubaa and Osseiran (2010) describe Knock-Out options as '"extinguishable" options which are path-dependent options that are terminated if a specified spot's price reaches a specified trigger level at any time between inception and expiry'. Furthermore, they noted that the closer the barrier level is to the initial spot, the cheaper the knock-out option would be. Moreover, a knock-out option is less sensitive to volatility than a vanilla option carrying the same features. DeRosa (2011) identified that 'the combination of an *in-option* and an *out-option* with the same strike, barrier and expiration is equivalent to a vanilla option; if the barrier is triggered, the out-option extinguishes but the in-option springs into life'. Hence,

$$C_{\text{out}} + C_{\text{in}} = C$$

$$P_{\text{out}} + P_{\text{in}} = P$$

There are four types of directions for these barrier options. These are '*up-and-out*', '*up-and-in*', '*down-and-out*' and '*down-and-in*'. DeRosa (2011) explains further that 'Knock-Out options are popular since their value is lower than that for a vanilla in the proximity of the barrier. When the spot is far away from the barrier, the probability that the barrier is breached would diminish, making the value of the barrier option in line with that of a vanilla. When the barrier of a knock-out is hit, the delta of the barrier option instantly becomes zero. Otherwise, the knock-out delta will always be considerably higher than the vanilla delta'.

Structured Barrier Options – The Forward Extra

A structured barrier option is a combination of various instruments in order to form a single product. Hull (2006) describes a structured barrier

option as a package which is 'structured by traders so that it has zero cost initially'. Various products exist in the market which allows their holders' various pay-offs. In this chapter, the author used one of these structured barrier options called the '*Forward Extra*'.

Briys et al. (1998) describes the *Forward Extra* as a type of protection 'from a long option position with a predetermined strike price for zero cost unless a specified level is hit. If this specified level is traded, then the right to exercise the option becomes an obligation through a synthetic forward contract'.

Constructing a Forward Extra

A Forward Extra is constructed by combining two options: buying a plain vanilla option and selling a knock-in option. The structure is considered as a 'zero-premium' or 'zero cost' product within the OTC market. The reason behind this is that the holder of the product does not pay a premium upfront. This is possible since the product provider makes money by buying a cheaper vanilla and selling a more expensive knock-in option having the same strike and maturity but being a different option, that is, a call or a put. As noted by Krapels and Pratt (1998), 'the sale of an option, of course, entails an obligation to deliver the underlying contract if the option is exercised. This obligation is what gives option selling its special spice: options that move into the money expose the option seller to significant losses. As a result, the sale of options can be evaluated as a distinct risk management program'.

For example, let us say that the client has a requirement to buy USD and sell EUR once again. The client can get a Forward Extra contract through the OTC market with a strike rate of 1.3000 and a barrier level of 1.3500 having an expiry of one year. The customer will not pay a premium for the product.

Such a product can be constructed with the following underlying instruments:

- Buying a Vanilla USD Call Option with strike of 1.3000 and an expiry of one year and having a notional of 1 million USD.
- Selling a Knock-in USD Put Option with a strike of 1.3000, an up-and-in barrier level (knock-in level) at 1.3500 and an expiry of one year and having a notional of 1 million USD.

Understanding How the 'Zero-Premium' Is Achieved

It is expected that the market maker would pay a premium for buying the vanilla call option, and receive a premium for selling the knock-in put option. In other words, the holder of the product will *sell* the *right* to sell the underlying if the knock-in level (barrier level) is breached, meaning the holder of the product will have an obligation to buy the underlying at the strike rate. This is how this product is offered at no premium, as the premium paid for the call option is lower than the premium received for selling a put with a knock-in due to the risk involved.

For the benefit of readers, a numeric example is provided to enhance the understanding of how the zero-premium works. Assume that the long USD call for 1 million USD notional at the strike of 1.3000 and the expiry being one year from now costs a premium of USD 10,000. On the other hand, selling a knock-in USD put option with a strike of 1.3000 and a knock-in level of 1.3500 having the same expiry and notional pays a premium of USD 15,000. Although for the client the product is offered at 'zero-premium', the broker or market maker made a profit of USD 5,000, being the 'excess premium' received over and above the cost of the long vanilla call option.

The price sensitivity of the knock-in depends heavily on the implied volatility used in the pricing model of the market maker. It is ideal that one understands the dynamic of the knock-in instrument. The premium paid, or received, for, or from, a knock-in option would depend mostly on the barrier level and the type of barrier. As one expects, the standard option pricing factors, being the strike, spot level, time to maturity and implied volatility also play a crucial part on the premium received or paid for such a knock-in option.

WINDOW FORWARD EXTRA AND AT-EXPIRY FORWARD EXTRA

The author used two sub-versions of the forward extra in this chapter; these being the Window Forward Extra and the At-Expiry Forward Extra. The main difference between the two lies in the types of barriers used. The at-expiry forward extra is constructed using a 'European' barrier. That is, such a barrier will be monitored only at the expiry date and expiry time. Hence, if the barrier level is breached before expiry, such a breach would not affect the option as the knock-in level will only be activated at expiry,

and so such a breach will be ignored. If, on expiry date and time, the spot market is still at or above the barrier level, then the knock-in will be triggered and the instrument becomes 'alive'.

The *window forward extra* is constructed using an 'American' barrier. Such a barrier would be monitored during a specified term between the start and expiry of the option. The term could be the lifetime of the option or less and is known as the '*barrier level period*'. Hence, if the barrier level is breached during the 'barrier level period' of the knock-in, the barrier is activated and the instrument becomes 'alive'. Wystup (2006) describes *window barriers* as 'barriers being active during a period of time which is shorter than the whole lifetime of the option'. In this chapter, the author utilised the whole life of the option when using these types of barriers for comparison purposes.

It is important to note that in such products, even if the barrier is breached, the holder of the product may have an obligation only at expiry; this would also apply for the 'American' barrier. One should also note that for the 'American' barrier, if the barrier is breached during the 'barrier level period', this does not necessarily mean that the customer will be obliged to trade at the strike rate. This is because the market may reverse below the strike level in between when the barrier was breached and the expiry. This would make the knock-in instrument '*out-of-the-money*', hence worthless, while the plain vanilla option becomes '*in-the-money*'.

The Possible Outcomes of a Forward Extra

There are three possible outcomes at expiry for both the *window forward extra* and the *at-expiry forward extra*. When explaining the below outcomes, the author is assuming that the client is using this product to protect himself from downside FX risk. Hence, assume that the market needs to go upwards in price in order for the client to achieve a more advantageous rate in the spot market.

The possible outcomes for the *at-expiry forward extra* are as follows:

Possible outcome 1: If the spot rate at expiry is below the strike rate, then the client will have the right, not the obligation, to trade the notional amount, pre-agreed in the contract, at the strike rate which is better than the spot market.

Possible outcome 2: If the spot rate is above the strike rate but below the barrier level at expiry, the client will have no obligation and may wish to trade any amount in the spot market.

Possible outcome 3: If the spot rate at expiry is at or above the barrier level, then the client will have an obligation to trade, at the more expensive strike rate, the notional amount pre-agreed in the contract.

Possible outcome 1 of the *window forward extra* is similar to that of the *at-expiry forward extra*; however, due to the 'American' barrier, possible outcomes 2 and 3 differ. The first outcome is the same. The three possible outcomes of the *window forward extra* are as follows:

Possible outcome 1: If the spot rate at expiry is below the strike rate, then the client will have the right, not the obligation, to trade the notional amount pre-agreed in the contract at the strike rate.

Possible outcome 2: If the spot rate is above the strike rate at expiry and did not trade at or above the barrier level during the barrier level period, then the client will have no obligation and may wish to trade any amount in the spot market.

Possible outcome 3: If the spot rate is above the strike rate at expiry and has traded at or above the barrier level during the barrier level period, then the client will have an obligation to trade the notional amount pre-agreed in the contract at the strike rate which is at a worse rate than the spot market on expiry.

The Pay-off Diagram of a Forward Extra

In Fig. 1, one may see the pay-off diagram of the *Forward Extra*. This may be explained as follows: K and Q represent the strike rate and barrier level, respectively; the dark line represents the pay-off if the barrier level Q is not breached, whilst the light line represents the pay-off once the barrier level is breached. S represents a spot rate which is lower than the strike; such a spot rate would result in a profit P for the holder of the strategy. P is equal to $(S-K)*N$, where N is the notional amount of the contract. On the other hand, L is a loss level if the spot at expiry is equal to the barrier level Q. Hence, L is equal to $(K-Q)*N$.

Hedging

As described by Krapels and Pratt (1998), 'a hedge is a means of protection against a loss. There are various mechanisms in the financial markets that the owner of a financial asset could use to hedge its value. The oldest is

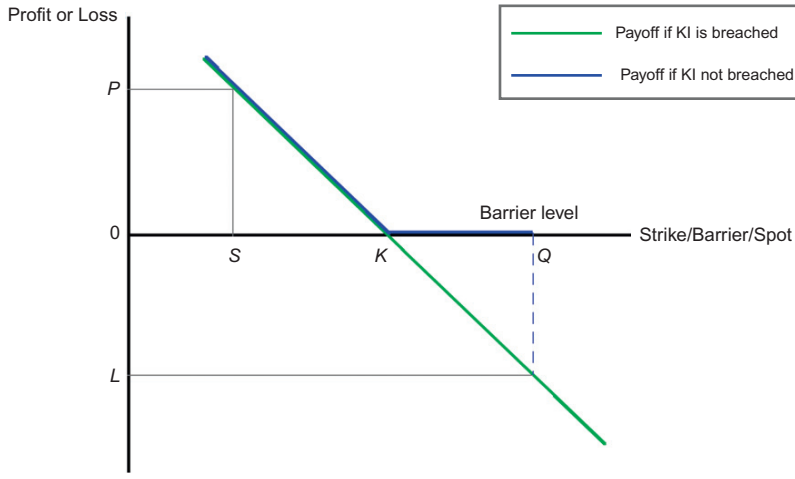

Fig. 1. Pay-off Diagram for Forward Extra.

insurance – a contract whereby one party undertakes to indemnify another against loss. Another mechanism is an organised futures market'. Krapels and Pratt (1998) continued by stating that 'Options contracts are an offshoot of futures whereby one of the parties in the transaction sells the other party the right to buy or sell a futures contract. Swaps and swaptions are outgrowths of futures and options'.

An article of *gtnews* by Sela (2011), who at the time was the Vice President of a large company called Numerix, presented a survey which showed that '94% of the world's largest corporations reported using derivatives to manage business and macroeconomic risks. Furthermore, another study conducted amongst Fortune 500 corporations reveals that FX and interest rate derivatives are the most widely used instruments among large global corporations'. The article by Sela (2011) in fact shows that derivatives are used as follows: Equity 30.3%, Credit 21.4%, Commodity 50.9%, Forex 93.6% and interest rate 88.3%.

According to Maciulis (2008), risk managers may employ three types of hedging – 'natural hedging', 'operational hedging' and 'financial hedging'. Natural hedging, which is also called a cash-and-carry strategy. This strategy is the simplest approach. This involves techniques such as financing operations in the corresponding currency. Operational hedging through the creation of flexibility represents a strategic complement to any variance-minimising hedge. Such hedging is less flexible than financial hedging.

Financial hedging is the most flexible and attractive alternative for short-term foreign exchange risk management. In fact, research conducted by Maciulis (2008) found that 'exporters and importers who are exposed to sudden and unexpected foreign exchange fluctuation risk, should hedge using put and call options'.

Naylor and Greenwood (2008) researched whether, and how, firms hedged in New Zealand. Interestingly they found that, despite their small size, 65% of their sample firms used derivatives to manage their FX risk. They also noted that when broken down on a size basis, New Zealand firms, Swedish and Asian firms are found to use derivatives more than United States, Dutch, or German firms of a comparable size. Furthermore, it was found that, on average, firms hedged 82% of their net transactions exposure, and lesser percentages of other exposures.

On the other hand, in another interesting study by Marshall, Kemmitt, and Pinto (2013) where they analysed the FX hedging decisions of firms listed on the UK Alternative Investment Market (AIM), it was found that 33% of firms within their sample actively hedged their FX exposure, while 67% of firms did not hedge at all.

The researchers acknowledged that such a result was much lower than the results obtained from any studies previously done by researchers world-wide. The researchers commented that such results may be explained by the negative relation with the extent of managerial ownership of firms and the hedging decision; this was also discovered throughout their research. Through their sample, they also found that larger AIM firms hedged more than the smaller firms. This may indicate that economies of scale are important for the hedging decision or that despite FX risk exposure, some of the smaller firms can lack financial knowledge and/or expertise to deal with potential FX risks.

Long-Term and Short-Term Hedging

Short-term hedging is understood as the hedging of an underlying asset using a financial instrument such as, a forward contract, swaps, futures or options, with a maturity of less than one year.

Long-term hedging is understood as a hedge taking place for a period of one year or more. One should note that long-term hedging in practice is limited due to credit risk mitigation applied by brokers and market makers. Normally, brokers would limit their exposure up to 18 or 24 months;

however, there are exceptions to this rule depending on the level of trust between the two parties agreeing through a contract.

Charvin et al. (2013) noted that it is worth more for firms to adopt a long-term FX hedging with an option. In fact, they found that long positions in 12-month options provided more value than shorter term options. In addition they noted that, generally, the longer the tenor the better, although a 12-month contract appeared to offer good value. There are a number of possible reasons for such findings. For instance, the desk selling a long-term option may treat it as a forward for much of its life. This would make the costs of managing the risk of such an option minimal. On the other hand, should it have been a short-term option, the desk would have to adjust their hedges daily in a volatile market and such efforts cost money.

Another reason for cheaper long-term options is related to choice. Short-term options are usually bought to cover short-term unexpected risks, meaning that it would be priced for buyers who have less choice than usual. On the contrary, in the longer term options, buyers would have more time to think about their hedging strategies. The most important contribution to the difference in value between long- and short-term options is simply that it is human nature to be too focused on near-term risks. Charvin et al. (2013) noted that 'the market fears the risks of tomorrow more than it should and remains blasé about what the longer term future can bring'. Keeping this in mind, I built my research on one-year tenor options.

AIM AND METHODOLOGY

This chapter aims to answer the following questions: *What is the optimal portfolio when it comes to the best outcome for the holder of an FX instrument being a combination of Spot, Forwards and FX option strategy? And are such outcomes statistically significant?* One of the fundamental issues of hedging is the possibility of finding the best possible outcome without taking excessive risk. The first part of this chapter highlights returns from different hedging methods. Such returns are then statistically tested to see whether difference between returns is statistically significant.

1. *What is the risk (standard deviation) of each portfolio? Does portfolio diversification reduce risk?* Finding an optimal way to hedge is not enough. The author looks into analysis of underlying risk of each

portfolio which would include portfolios made up of 100% FX Option strategies, 100% Forward Contracts and 100% Spot (non-hedged).

Is there a relationship between the outcome of portfolios and the VIX level when it comes to EURUSD portfolios? And are such results statistically significant? This chapter also highlights the importance of volatility and how this affects the outcome of hedging strategies. For this reason, part of this chapter analyses the outcome of the EURUSD portfolios under different levels of the VIX.

2. *Do portfolios' histograms and distribution curves share similar patterns and similar Kurtosis?* This chapter also looks at a visual analysis of portfolios' returns and their respective kurtosis.

Data Used

There are three currency pairs used in this chapter; EURUSD – the Euro against the US Dollar; EURGBP – the Euro against the British Pound; EURJPY – the Euro against the Japanese Yen. The selection of these three currency pairs was in line with a number of factors, namely, they represent different markets, their volatilities are somehow different especially with the Japanese Yen, and they are the most common currency pairs used in the domestic market.

Data such as the historical spot rates were noted from January 2007 through to December 2014. The Bloomberg terminal provided all the necessary data to perform the valuation of options through its OVML pricing model, hence, data such as implied volatilities, spot and forward rates were available.

The author decided to use this period in order to capture the recent financial crisis and also the recovery period thereafter. The expiries of the options had a tenor of one year and are rolled monthly. The main reasons for such tenor are to capture the theta value in the options while gaining long-term value.

To enhance the reader's understanding on how the rolling takes place, the timeline in Fig. 2 is provided. (*Please note that timeline is not to scale and represents only a sample of the actual period which is being analysed.*)

As shown in Fig. 2, each option starts at the end of each month and expires a year later. However, note that due to bank holidays, national holidays or weekends, some expiries may not start or end at the end of the respective month. In such cases, the expiry will be rolled over to the next working day. Fig. 2 clearly shows that by using such a method, the first

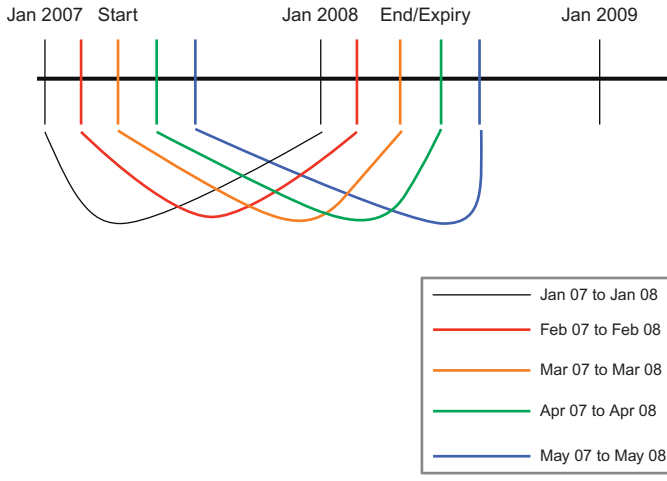

Fig. 2. Back-Testing Strategy.

year of the analysis (January to December 2007) will not have any expiries, while from January 2008 to December 2014, expiries will take place on a monthly basis.

Creating Portfolios

A substantial part of this chapter includes the creation of different portfolios made up of spot, forwards and options, together with combinations of these instruments, and analysing their outcome throughout the seven-year period. It was more convenient to create and analyse these portfolios using MatLab. For simplification reasons only, the outcomes from the 'European' barriers having a built-in premium of 0% were used. The main reasons for this were the fact that the aim of this chapter would be achieved by using only one sample, and that the 0% built-in premium would be used since it represents the 'market value' of the option strategy, which is then compared to the market value of the 'forward contract' and 'spot' which are extracted from the Bloomberg raw data as noted earlier.

The following portfolios were created:

- 100% Option strategy
- 100% Forward Contract

- 100% Spot
- 50% Spot and 50% Forward
- 50% Option strategy and 50% Forward
- 25% Option strategy, 25% Forward and 25% Spot
- 50% Option strategy, 25% Forward and 25% Spot

Portfolio Coding Sample

Before creating the portfolios, the author is required to find the value of each expiry using the spot, forward and option strategy (vide Appendix A).

The above-mentioned code is repeated for the EURGBP and EURJPY. Following such stage, the values for Spot, Forwards and Option strategies were achieved through the code in Appendix B.

At this stage, the value of each type of instrument for all expiries throughout the seven-year period was known. Hence, the author was able to create portfolios and break down these values accordingly. The coding used to achieve such results can be seen in Appendix C.

Thus, the code above was used to obtain results indicating the value of each portfolio which shall be discussed in this chapter.

VIX Chart Analysis

The author used the VIX to analyse further the EURUSD portfolios. The first step is to obtain a VIX chart which may be downloaded from internet sources. The second step is to identify the area of the VIX chart which represents the period being analysed. Third step is dividing the chart into sub-sections depending on the VIX level. This can be seen in Fig. 3.

Plotting Histograms

Histograms are plotted through Excel for the portfolios created. In order for such histograms to be created, the variance for each expiry is calculated together with the mean of all variances of each portfolio and the standard deviation. The standard deviation would indicate the level or risk for each portfolio which can then be compared with the market, that is, the 100% spot portfolio. The histograms are created by using the 'data analysis' plug-in in Excel. The variances created for each portfolio, that is, seven

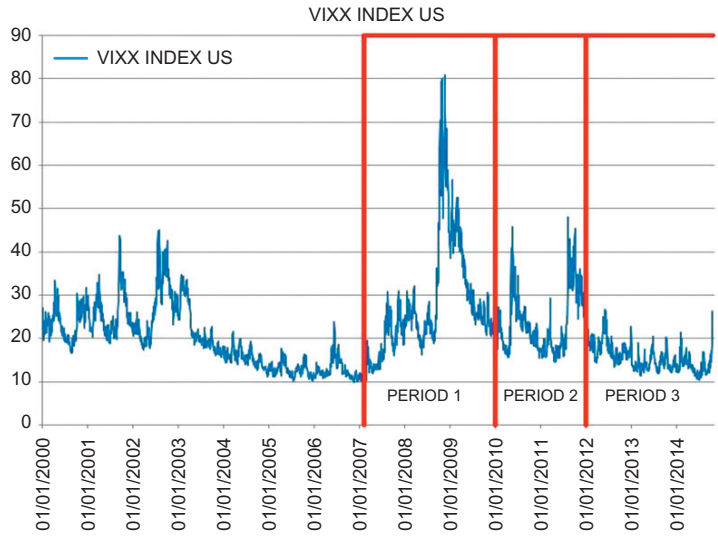

Fig. 3. VIX Diagram.

portfolios for each currency pair, are used for the histogram to be created. These are first selected, then 'data analysis' is selected from the analysis section, followed by 'histogram'. This is repeated for all portfolios. The distribution curve is then extracted from the histogram for a more visual representation.

FINDINGS

Following the creation of portfolios, the following results using a combination of spot, forward contracts and the 0% built-in premium At-Expiry Forward Extra strategy, are available in Table 1: Different combinations of these three financial instruments are used in order to analyse their respective effect on the total outcome of the portfolio. Table 1 shows a summary of results achieved from such portfolios for the EURUSD, EURGBP and EURJPY.

Table 1 shows the derived value in the underlying currency terms being USD, GBP and JPY for each combination of the portfolio. The aim of this section is to examine the optimal portfolio return when using different financial instruments or a combination of these instruments. As can be seen

Table 1. Derived CCY Value Using Portfolios.

Portfolio	Derived Value in CCY Using Portfolio		
	EURUSD	EURGBP	EURJPY
100% Option	109,795,300	100,945,579	10,800,920,000
100% Forward	109,409,800	100,745,934	10,673,860,000
100% Spot	108,625,300	98,562,317	10,570,800,000
50% Forward, 50% Spot	109,017,550	99,654,125	10,622,330,000
50% Option, 50% Forward	109,602,550	100,845,756	10,737,390,000
25% Option, 25% Forward, 50% Spot	109,113,925	99,704,037	10,654,095,000
50% Option, 25% Forward, 25% Spot	109,406,425	100,299,852	10,711,625,000

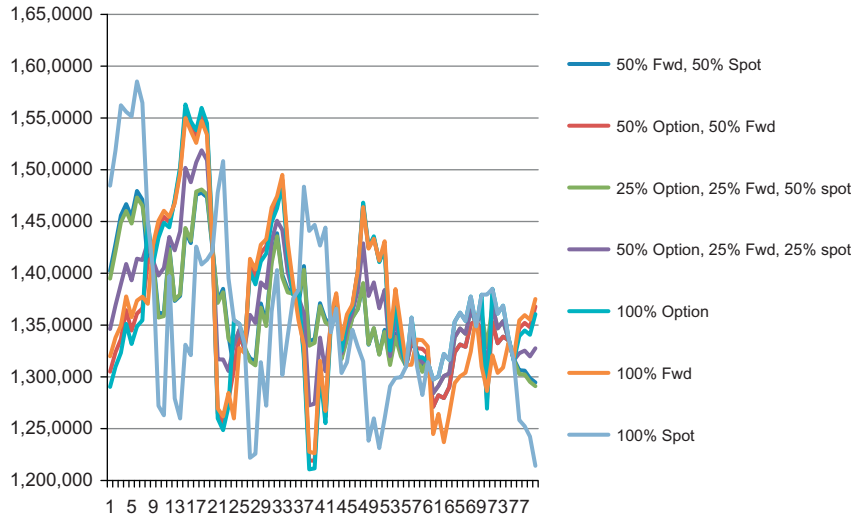

Fig. 4. EURUSD Portfolios' Returns.

from Table 1, in all cases the best value was derived when using the 100% Option strategy portfolio. This applies for the EURUSD, EURGBP and EURJPY portfolios.

Fig. 4 clearly shows the movement of the three main portfolios for the EURUSD currency pair, that is, the 100% option strategy, 100% forward contract strategy, and 100% spot market strategy. The author also included other portfolios in order to capture outcome movements through diversified portfolios. The *y*-axis shows the value of the portfolio in USD terms, while the *x*-axis shows the expiry number given to each

Table 2. Standard Deviation (Risk) of Portfolios.

	Standard Deviation (Risk)		
	EURUSD (%)	EURGBP (%)	EURJPY (%)
100% Option	3.55	3.85	4.94
100% Forward	3.13	2.56	4.41
100% Spot	3.75	2.79	4.32
50% Forward, 50% Spot	2.15	1.90	2.92
50% Option, 50% Forward	3.11	2.94	4.57
25% Option, 25% Forward, 50% Spot	2.14	2.04	3.00
50% Option, 25% Forward, 25% Spot	2.37	2.52	3.58

expiry in order to facilitate the tracking of each expiry between different stages of this research. Such expiry numbers replaced time which started from January 2007 and ended on December 2014.

Analysing the Portfolios' Risk

The author also analysed the risk of each portfolio in EURUSD, EURGBP and EURJPY as indicated in Table 2.

The results in Table 2 clearly show that diversification plays a crucial role when it comes to decreasing risk (volatility). One may also note that reference for hedging through this chapter does not always mean a decrease in volatility or risk. In fact, with reference to the EURGBP and EURJPY portfolios, one may note that the market standard deviation was at 2.79% and 4.32% for the EURGBP and EURJPY, respectively. Simultaneously, the standard deviation of the option strategy amounted to 3.85% and 4.94% for the EURGBP and EURJPY, respectively. Hence, under the conditions and period of such analysis, the introduction of hedging, although as described earlier in this chapter resulted in a better outcome on average, also increased the level of risk for the EURGBP and EURJPY. On the other hand, it decreased the level of risk for the EURUSD from 3.75% to 3.55%.

Table 2 also shows that the lowest risk was available when using the 25% option, 25% forward, and 50% spot for the EURUSD, which resulted in a standard deviation of just 2.14% when compared with a high of 3.75% on the spot market. The EURGBP and EURJPY portfolios have the lowest standard deviation level when using the 50% forward and 50% spot portfolio, which amounted to 1.90% and 2.92%, respectively, when

compared with a high of 3.85% and 4.94%, respectively, which were both for the 100% option strategy portfolio.

Hence, one may conclude that, in order to decrease risk, diversification is a key tool; however, as seen in this chapter, the 100% option strategy (which appears to be the riskiest in most cases) resulted in the best outcome in currency terms throughout the period of analysis.

Testing the Statistical Significance of Portfolios' Outcomes

One should note that since the underlying asset is the FX market, results shown in Table 1 are highly correlated, making the final results in currency terms be marginally close to each other. In order to see whether such results are statistically significant, the author executed a paired sample *t*-test between the changes of outcomes of different portfolio combinations.

Table 3 shows an abstract of the paired sample *t*-test result by indicating the change in mean between portfolios and the change in standard deviation. This is provided for the three portfolio combinations available, that is, between option strategy and forward contracts, between option strategy and spot, and between spot and forward contracts. Moreover, Table 4 shows the *t*-values and *p*-values (significance) of the paired sample *t*-test.

Table 4 shows that in most cases, the changes of outcomes between portfolios were statistically insignificant. In fact, for the EURUSD all results were statistically insignificant; however, for the EURGBP results were statistically insignificant for changes between the option strategy and forward contract, while being significant at the 95% level for changes in outcome between option strategy against spot and between spot against the forward contract. For the EURJPY, the changes of outcome between option strategy and forward contract were statistically significant at 99%, while the other two portfolios were both statistically insignificant. Hence, one may conclude that, on average, due to the high level of correlation between underlying assets of portfolios, changes in outcome are statistically insignificant.

EURUSD Portfolio and the VIX Level

The author further analysed the EURUSD portfolio during different periods in line with the VIX level. This was split into three main periods

Table 3. Paired Sample *t*-Test for Portfolios – Mean and Standard Deviation.

Pairs	Mean			Standard Deviation		
	EURUSD	EURGBP	EURJPY	EURUSD	EURGBP	EURJPY
Option versus Forward	4,819	2,852	1,512,619	30,199	31,403	2,903,053
Option versus Spot	14,625	30,567	2,739,524	128,788	109,329	18,983,814
Spot versus Forward	9,806	27,715	1,226,905	128,327	101,682	18,200,769

Table 4. Paired Sample *t*-Test for Portfolios – *t*- and *p*-Values.

Pairs	*t*-Values			Significance (Two-Tailed)		
	EURUSD	EURGBP	EURJPY	EURUSD	EURGBP	EURJPY
Option versus Forward	1.427	.832	4.775	.157	.408	.000
Option versus Spot	1.016	2.562	1.323	.313	.012	.190
Spot versus Forward	.683	2.498	0.618	.496	.014	.538

Table 5. Portfolios' Returns vis-a-vis the VIX Level.

VIX Level	EURUSD Portfolios						
	50% Forward & 50% Spot	50% Option, 50% Forward	25% Option, 25% Forward, 50% Spot	50% Option, 25% Forward, 25% Spot	100% Option	100% Forward	100% Spot
Period 1 (high VIX)	49,052,050	49,347,300	49,025,300	49,172,925	49,293,800	**49,400,800**	48,703,300
Period 2 (medium VIX)	26,993,650	27,106,800	26,964,300	27,020,875	27,048,100	**27,165,500**	26,821,800
Period 3 (low VIX)	32,971,850	33,148,450	33,124,325	33,212,625	**33,453,400**	32,843,500	33,100,200
Total	109,017,550	109,602,550	109,113,925	109,406,425	**109,795,300**	109,409,800	108,625,300

representing a high VIX level, an average VIX level, and a low VIX level. Results can be seen in Table 5.

Table 5 shows a summary of the outcomes of different portfolios used for the EURUSD currency pair. The author is using the 0% built-in premium EURUSD option strategy with a European barrier in the above portfolios. The main reason is to compare such strategy with other

Table 6. Paired Sample *t*-Test – Portfolios' Return vis-a-vis VIX Level: Mean and Standard Deviation.

Pairs	EURUSD Portfolios					
	Mean			Standard Deviation		
	High VIX	Medium VIX	Low VIX	High VIX	Medium VIX	Low VIX
Option versus Forward	−3,057	−5,870	24,396	26,619	10,616	36,386
Option versus Spot	16,871	11,315	14,128	163,343	135,335	47,773
Spot versus Forward	19,929	17,185	−10,268	157,716	131,113	68,878

Table 7. Paired Sample *t*-Test – Portfolios' Returns vis-a-vis VIX Level: *t*- and *p*-Values.

Pairs	EURUSD Portfolios					
	t-Values			Significance (Two-Tailed)		
	High VIX	Medium VIX	Low VIX	High VIX	Medium VIX	Low VIX
Option versus Forward	−0.679	−2.473	3.352	.501	.023	.003
Option versus Spot	0.611	.374	1.479	.545	.713	.152
Spot versus Forward	0.748	.586	−0.745	.460	.565	.463

financial instruments such as the forward contract and spot market, without inflating them with any premiums, spreads or commissions.

The summary clearly shows that when the VIX level is at a high or medium level, the optimal portfolio was the 100% forward contract – this is shown by bolded values. On the other hand, when the VIX is at a low level, the 100% option strategy resulted in being the optimal strategy as it provided the best output in USD terms.

Table 6 shows a summary of the paired sample *t*-test results when it comes to changes in mean and standard deviation. Table 7 shows the *t*- and *p*-values (significance) as resulted from the tests.

As seen in Table 7, the author obtained a mixture of results, most of which are statistically insignificant. This is expected as it is in line with the results already mentioned earlier; however, there are still some statistically significant results, such as the change of outcome between option strategy and the forward contract at the medium VIX level, which is statistically

significant at the 95% level. Furthermore, such portfolio is also significant at the 99% level during a low VIX period. Hence, one may conclude that even when splitting up the research into three periods, results are similar, on average, to those performed throughout the whole seven-year period.

Portfolios Histograms and Distribution Curves

A more visual method to understand the changes and movement in portfolio outcomes (outputs) for all three currency pairs is also used. This is achieved by creating histograms from changes of returns for different strategies. The results are then plotted in order to achieve a distribution curve. As described in previous sections, the option strategy within these portfolios is the 0% built-in premium European barrier strategy. It is also noted that the below histograms are titled Portfolios A−G for convenience (Figs. 5−7).

These portfolios titles correspond to the following:

Portfolio A: 50% Forward + 50% Spot
Portfolio B: 50% Option strategy + 50% Forward Contract
Portfolio C: 25% Option strategy + 25% Forward Contract + 50% Spot
Portfolio D: 50% Option strategy + 25% Forward Contract + 25% Spot
Portfolio E: 100% Option strategy
Portfolio F: 100% Forward Contract
Portfolio G: 100% Spot

Interpretation of Histograms

Interpreting the above histograms is not straightforward, because there is no apparent trend in the histograms' style between portfolios. One may note that, on average, the distribution curves seem to be close to the normal distribution curve, that is, with a higher probability close to the mean, and a lower probability on the tails on both the positive and negative sides. With reference to the EURUSD − Portfolio G and EURGBP − Portfolio E distribution curves, one may note their similarity to a normal distribution. These represent the EURUSD 100% Spot strategy and EURGBP 100% Option strategy, respectively. The EURGBP and EURJPY, although somewhat similar, seem to be skewed to the left which shows a greater probability of a negative movement. In fact, one may highlight that in most cases distribution curves are skewed to the left while there does not seem to be any curve which is apparently skewed to the right.

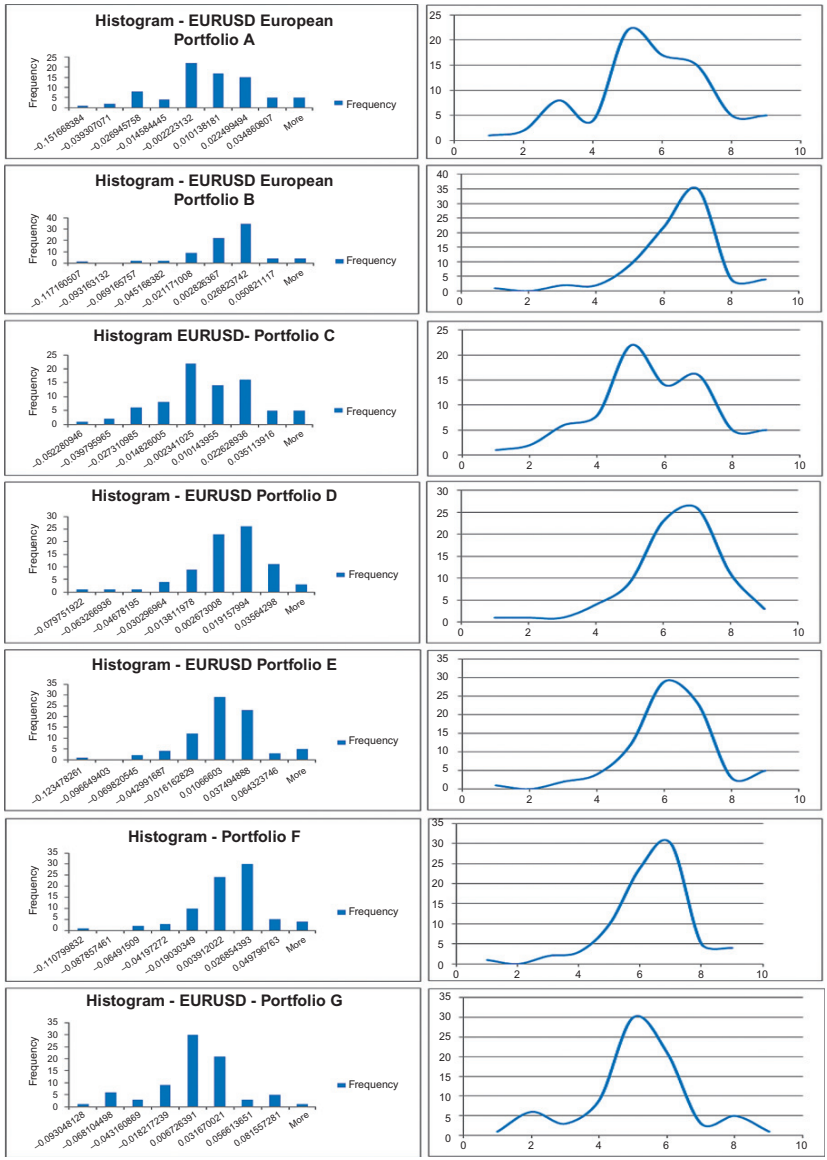

Fig. 5. EURUSD Histograms and Distribution Curves.

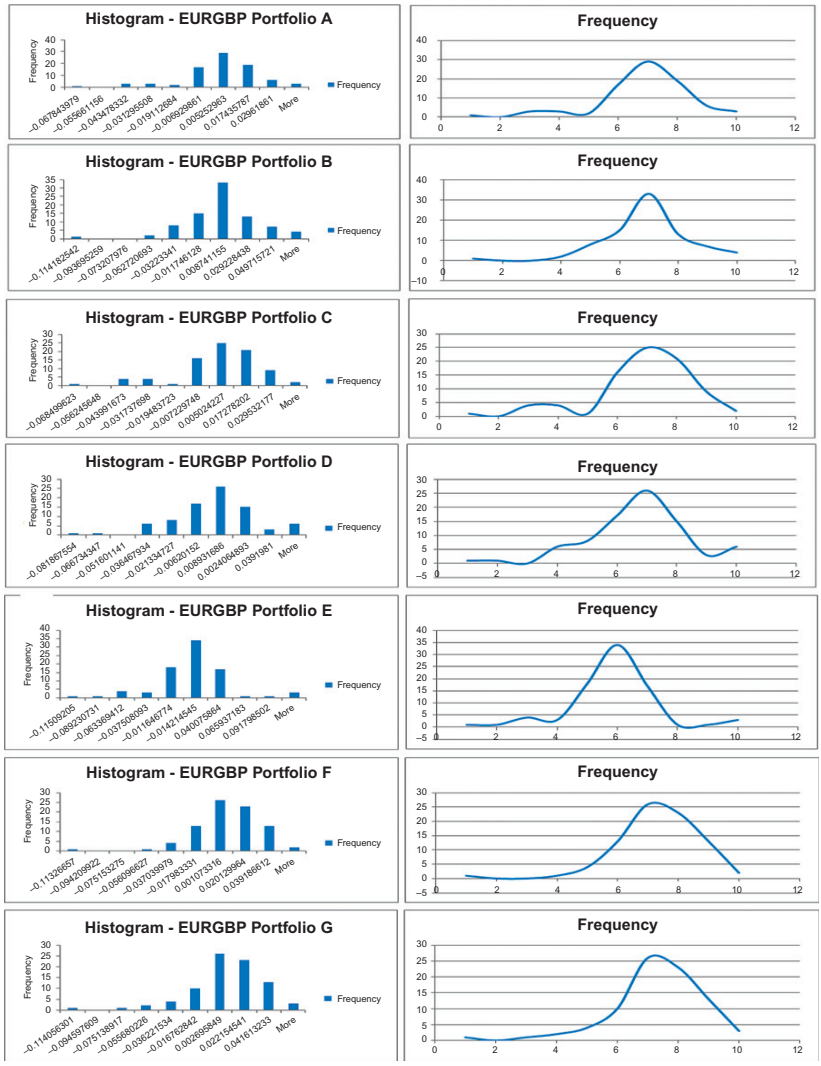

Fig. 6. EURGBP Histograms and Distribution Curves.

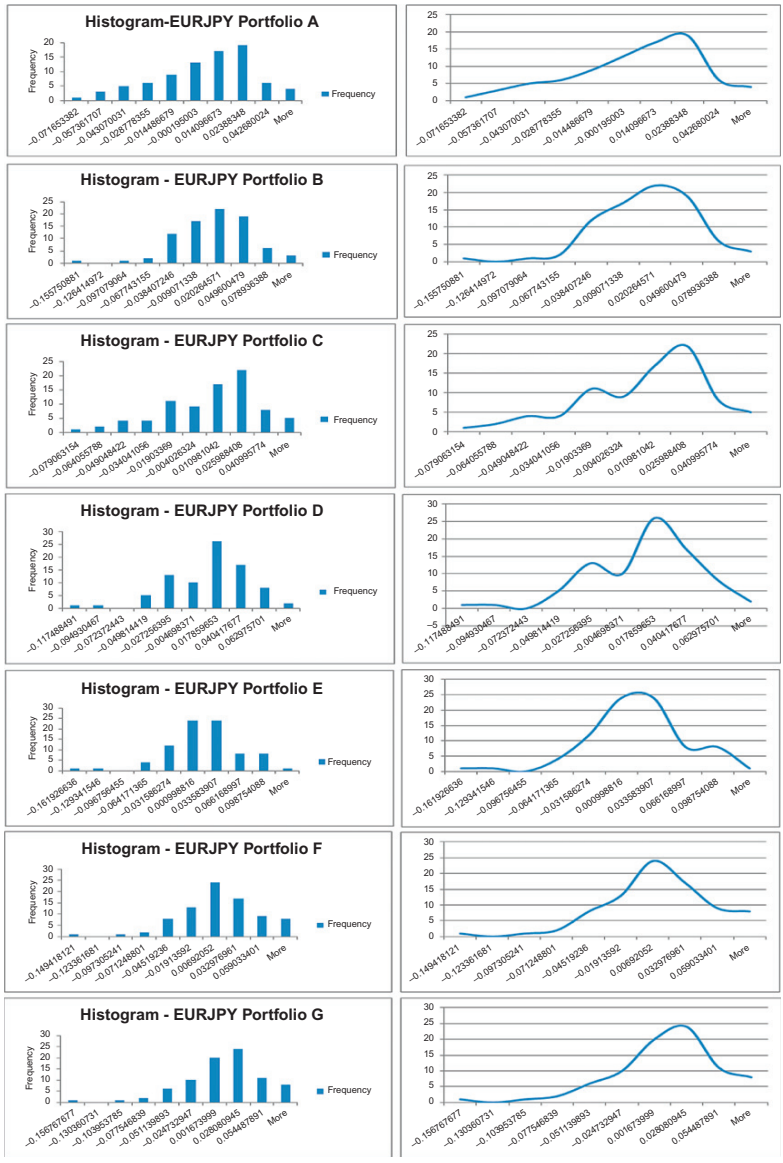

Fig. 7. EURJPY Histograms and Distribution Curves.

Kurtosis Analysis

Table 8 provides the Kurtosis levels for each portfolio that were analysed in the previous sections of this chapter. The Kurtosis of a 'normal distribution' is known to be 3, yet in Table 8 some of the levels differ substantially from the 'normal distribution' Kurtosis level. In fact, the EURUSD portfolios resulted in a highest Kurtosis of 5.72 related to Portfolio B and a lowest Kurtosis of 2.92 related to portfolio C. The EURGBP portfolios resulted in a highest Kurtosis of 6.33 in portfolio F and a lowest of 4.04 in portfolio D. The EURJPY portfolios resulted in a high of 4.42 in portfolio G and a low of 2.87 in portfolio C.

Summary of Findings

The author used the 0% European barrier strategy and combined it within portfolios made up of FX option strategies, forward contracts and spot. Several different combinations were used and tested for the optimal outcome. The chapter finds that the option strategy was the best performing strategy for all three currency pairs under analysis; however, when such a result was tested through the paired sample *t*-test, most results were statistically insignificant. The risk profile of each portfolio was also taken into consideration leading to the conclusion that, on average, diversification decreased the risk profile of the portfolio even though this did not result in the best return.

The EURUSD 0% built-in premium option strategy was also used and compared against the VIX level during the seven-year period; findings were

Table 8. Kurtosis Analysis.

Portfolio	Kurtosis Level		
	EURUSD	EURGBP	EURJPY
A	2.99	4.67	2.92
B	5.72	5.17	4.00
C	2.92	4.16	2.87
D	4.46	4.04	3.91
E	4.99	5.54	4.16
F	5.07	6.33	3.95
G	3.91	6.11	4.42

segregated in three parts depending on the VIX level – the periods captured a high VIX, medium VIX and low VIX level. Results revealed that during a high VIX level, the 100% forward contract strategy gave the best results. On the other hand, when VIX was at a relatively low level, the 100% Option strategy gave the best result. However, this chapter finds that when taking the analysis period as a single study, the 100% option strategy also resulted in being the best performer.

The creation of histograms and plotting of distribution curves of each portfolio was also analysed. Results show that most strategies' distribution curve is similar to a normal distribution, although it cannot be concluded that these portfolios are following a normal distribution, even though this had to be assumed in order to perform the necessary *t*-tests. It was also noted that some portfolios were skewed to the left side which may indicate a larger tendency on fatter negative tails. Furthermore, the kurtosis level of each portfolio was analysed and interpreted.

RECOMMENDATIONS AND CONCLUSIONS

When working on such paper, time and resources are limited which create limitations as to the amount and depth of analyses performed and concluded. The following recommendations should be noted.

Recommendations for Professionals

This chapter may provide important information for professionals who are exposed to or offer Foreign Exchange. The use of FX 'zero-premium' Options strategies is a relatively new area especially for certain markets. Hopefully this chapter will shed light on this important tool especially when it comes to hedging FX exposures.

Introducing Additional Strategies

It would be ideal to introduce additional strategies in future studies. The aim is to introduce additional risk within strategies such as Knock-outs and Leverage (Ratios). When it comes to introducing knock-outs, especially, things will become more complicated due to an additional variable

in the back-testing results. The idea is to see whether such additional risk would have an adverse effect on the outcome of the strategy. Such results may then be compared to the results shown in this chapter.

Furthermore, ratios may be introduced in strategies, which would be less complex than the introduction of knock-outs as no additional variables will be added. In fact, the ratio will be applied by doubling the notional amount on the 'sell' side of the option strategy which is the barrier (knock-in). In other words, if the barrier is breached, the holder of the option will have an obligation to transact double the amount at the strike rate. Hence, when introducing such leverage, the potential loss would be double. One may then see whether such additional risk results in a better outcome due to better barrier levels.

The author recommends that the portfolios created in this study could be introduced to other portfolios including equities and fixed income instruments. The aim would be to analyse how introducing FX hedging strategies would affect the outcome of the portfolio. Furthermore, the knock-outs and leverage instruments could also be introduced in portfolios and results may be compared to the results achieved from this chapter. Through such analysis one may find how adding risk throughout the period of analysis affects the total return. Due to limitations, the author only used the 0% built-in premium European barrier option strategies within the portfolios.

Portfolios Risk

This chapter measured the standard deviation of each portfolio as a measure of risk. After the recommended portfolios are added, it is also recommended that a risk-adjusted set of returns is calculated and compared to the results of this chapter. The aim would be to adjust the risk with a risk-free rate of return which would be possible after including other non-FX instruments within a portfolio.

This chapter also found that results between portfolios were mostly statistically insignificant. Due to limitations, it was assumed that this is due to two things: not enough volatility in the market and high correlation of returns between portfolios. It is recommended that a deeper analysis is performed to explore the reason why such portfolio returns resulted to be statistically insignificant. Special attention should be given to market conditions and correlation level between portfolios.

Segregating Portfolios

In this chapter, the EURUSD 0% European barrier (as part of the portfolio) was segregated into three periods in line with the VIX level. It would be ideal if such segregation is performed on each EURUSD portfolio using different levels of built-in premium. Furthermore, it is recommended that other non-USD portfolios are segregated using different criteria such as either spot movement direction or volatility level. The aim would be to analyse the outcome of the strategies in different market scenarios and to try and highlight a possible optimal strategy or portfolio for different market conditions. Each segregated part of portfolios should then be tested for significance using the paired sample *t*-test.

Histograms

Due to time constraints, kurtosis analyses were minimal. Further analysis on this area may open up new opportunities for further studies about how changes in the risk level of portfolios together with the corresponding market scenarios affect the kurtosis and *skewness* level of a portfolio. Such results may help analysts understand with better accuracy the probability of returns for certain portfolios under specific market conditions and level of risk.

Recommendations for Clients

This chapter also provides interesting results for clients using FX options, forwards or dealing in the FX spot market. Findings show that clients may be more comfortable using FX 'zero-premium' options strategies for various reasons. Creation of portfolios shows that the client was better off using the FX Options strategies throughout the back-testing period. In fact, this was correct for all tests performed.

One may note that this does not mean that the Option strategy provided the lowest risk scenario. In fact, this chapter shows that to lower the risk, corporates should opt for a more diversified portfolio between FX options, spot and forward contracts. Hence, it may be ideal for FX users to consider using FX options strategies such as the Forward Extra as part of a portfolio of hedging instruments as this clearly provides a number of benefits especially when it comes to outcome and flexibility.

CONCLUSION

Portfolios were created in order to analyse how such strategies would have an effect on a portfolio made up of Spot, forward contracts and the option strategy. It was found that the option strategy resulted in the optimal return throughout the seven-year back-testing period. However, further analysis showed that such results were statistically insignificant.

The EURUSD portfolio was segregated in three periods in line with the VIX level. Results were very similar, however, it was found that with low and medium VIX, the 100% forward contract returned the optimal result, while in high VIX level, the 100% option strategy returned the optimal result. Finally, the histograms of portfolios were constructed which gave the reader a more visual explanation on each portfolio's returns. The kurtosis levels of portfolios were also calculated and found to differ from that of a normal distribution in most cases.

This chapter may conclude that foreign exchange hedging using premium-free options is an important risk mitigation technique. Although results show that the difference between hedging techniques is not statistically significant, it also shows that when introducing different hedging mechanisms, the total risk of the portfolio decreased significantly. Therefore, it is recommended that foreign exchange risk is managed not only through simple forward contracts but also through more innovative products such as premium-free options strategies.

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APPENDIX A

```
close all
  clear all

  dollar = xlsread('dissertation    data    EURUSD.xls','AEFE
0 percent EURUSD');
  strike_usd = dollar(:,6);
  barrier_usd = dollar(:,8);
  spot_usd = dollar(:,13);
  spotexpiry_usd = dollar(:,18);
  notional_usd = dollar(:,11);
  forward_usd=dollar(:,15);
  value_option_usd=zeros(1,84);
  value_forward_usd=zeros(1,84);
  value_spot_usd=zeros(1,84);
  ...
  result = zeros(84,10);

  for i = 1:84

           if  spotexpiry_usd(1+(3*i))>strike_usd(1+(3*i))
&&spotexpiry_usd(1+(3*i)) < barrier_usd(1+(3*i))
             value_option_usd(i)=(spotexpiry_usd(1+(3*i)))*
(notional_usd(1+(3*i)));

    elseif spotexpiry_usd(1+(3*i)) < strike_usd(1+(3*i))

       value_option_usd(i)=(strike_usd(1+(3*i)))*(notional_
usd(1+(3*i)));

    elseif spotexpiry_usd(1+(3*i))>= barrier_usd(1+(3*i))

       value_option_usd(i)=(strike_usd(1+(3*i)))*(notional_
usd(1+(3*i)));

    end
  end
```

APPENDIX B

```
for i = 1:84


value_forward_usd(i)
  = (forward_usd(1 + (3*i)))*(notional_usd(1 + (3*i)));
value_forward_gbp(i)
  = (notional_gbp(1 + (3*i)))/(forward_gbp(1 + (3*i)));
value_forward_yen(i)
  = (forward_yen(1 + (3*i)))*(notional_yen(1 + (3*i)));


  end

  for i = 1:84


value_spot_usd(i)
  = (spotexpiry_usd(1 + (3*i)))*(notional_usd(1 + (3*i)));
value_spot_gbp(i)
  = (notional_gbp(1 + (3*i)))/(spotexpiry_gbp(1 + (3*i)));
value_spot_yen(i)
  = (spotexpiry_usd(1 + (3*i)))*(notional_yen(1 + (3*i)));


    result(i,1) = 2 + (3*i);
    result(i,2) = value_option_usd(i);
    result(i,3) = value_forward_usd(i);
    result(i,4) = value_spot_usd(i);
    result(i,5) = value_option_gbp(i);
    result(i,6) = value_forward_gbp(i);
    result(i,7) = value_spot_gbp(i);
    result(i,8) = value_option_yen(i);
    result(i,9) = value_forward_yen(i);
    result(i,10) = value_spot_yen(i);


  end
```

APPENDIX C

```
close all
clear all

  res=xlsread('Port_results.xls','portfolio_analysis');
  value_option_usd= res(:,2);
  value_forward_usd= res(:,3);
  value_spot_usd = res(:,4);


  portfolio_res=zeros(84,8);

  portfolio_a=zeros(1,84);
  portfolio_b=zeros(1,84);
  portfolio_c=zeros(1,84);
  portfolio_d=zeros(1,84);
  portfolio_e=zeros(1,84);
  portfolio_f=zeros(1,84);
  portfolio_g=zeros(1,84);

  for i= 1:84

  portfolio_a(i)
    = (value_forward_usd(i))*0.5 + (value_spot_usd(i))*0.5;
  portfolio_b(i)
    = (value_option_usd(i))*0.5 + (value_forward_usd(i))*0.5;
  portfolio_c(i)
    = (value_option_usd(i))*0.25 + (value_forward_usd(i))*0.25
      + (value_spot_usd(i))* 0.50;
  portfolio_d(i)
    = (value_option_usd(i))*0.50 + (value_forward_usd(i))*0.25
      + (value_spot_usd(i))* 0.25;
  portfolio_e(i)= value_option_usd(i);
  portfolio_f(i)= value_forward_usd(i);
  portfolio_g(i)= value_spot_usd(i);
```

```
portfolio_res(i,1)=2+(3*i);
portfolio_res(i,2)=portfolio_a(i);
portfolio_res(i,3)=portfolio_b(i);
portfolio_res(i,4)=portfolio_c(i);
portfolio_res(i,5)=portfolio_d(i);
portfolio_res(i,6)=portfolio_e(i);
portfolio_res(i,7)=portfolio_f(i);
portfolio_res(i,8)=portfolio_g(i);

end
```

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DIRECTOR TRADING IN MALTA: AN ANALYSIS OF RETURNS

Yanica Caruana

ABSTRACT

Purpose – *The purpose of this chapter is to establish whether director trades provide information to investors about the future prospects of the company they form part of and thus reduce the information asymmetry beyond what is already conveyed in the financial statements.*

Methodology/approach – *Director Dealings were dealt with as an investment strategy by looking at past transactions of directors executed between January 2005 and December 2014 on the Malta Stock Exchange (MSE) and evaluating whether there was an increase in returns for investors who copy director trades. The study focused on whether short-term abnormal returns for up to 12 months after the transaction date, being either a buy or a sale, were made by directors in Malta when trading in their own companies.*

Findings – *The results show that in the short-term period of up to 12 months after the transaction date, Maltese directors do transmit information to the market both when they purchase shares in their own companies and also when they sell shares. The interesting fact about the study is that in Malta sale transactions are more valuable to the outsiders than*

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purchase transactions. Apart from this, the results also show that some companies which are listed on the MSE are more indicative as to their future performance than others. It was ultimately concluded that even though there are informational asymmetries between directors in a company and outsiders, an outsider cannot trade solely by following director trades. The implications of the findings are discussed.

Originality/value — *This study attempts to determine the level of significance that each insider trade has on the Maltese market, what each director trade conveys to the said market and if these trades are valuable to the outside investors even though such investors do not have knowledge of the grounds upon which the directors trade.*

Keywords: Director trades; legal insider trading; market efficiency; outside investors; abnormal returns

INTRODUCTION

The regulation of insider trading on the securities market has been an area of constant discussion and interest for several groups including regulators, investors and also the general public. Public companies which are listed on a stock exchange have the advantage of being able to raise more capital as well as the disadvantage of being predisposed to abuse by the officers which are trusted with their management. The said insiders might trade the securities of the company through inside and confidential information thus making a profit or avoiding a loss at the expense of the investors. Trading with non-public information can also affect the financial market's performance. This has led to the introduction of various regulations by policy makers in an attempt to keep trading as fair as possible and also to minimize the impact on the performance of the markets.

Although as noted below there are various studies on insider trading in countries such as the United States, United Kingdom, Hong Kong, Australia and Germany, the empirical research on Malta is lacking. This study attempts to make up for this by firstly examining if directors earn abnormal profits when trading in their own companies and subsequently whether the investor can imitate these trades to also earn abnormal returns. The idea is simple and stems from the fact that if directors do have

information on the basis of which they trade and earn abnormal profits as a result, the general investor will be more inclined to follow suit. This idea is based on the fact that in general, individuals are more willing to copy successful individuals and try to emulate their success. This can be said to be the same in the financial sphere, and outsiders mimic the investments of insiders as they are perceived to have more information about a particular stock. This study attempts to answer whether this is a profitable trading strategy.

This chapter starts off with the premise that when directors trade, they base their trades on information; in that when they buy they know that the value of the shares will increase and when they sell it is because they know that the share price will decrease. The idea is for an outsider to follow their trades and to see whether such an outsider would ultimately make an abnormal return. If the results are positive then we would have a viable trading strategy.

Aim of Study

This study will analyse the stock price reactions following that the director's transactions are reported and disclosed to the public. It will delve into whether the said-directors make abnormal profits and whether outsiders can avail themselves of the publicly available information on director trades in order to earn abnormal profits by following the same strategy.

Previous studies in the United States, United Kingdom and Germany (Friederich, Gregory, Matatko, & Tonks, 2002; Jaffe, 1974a, 1974b; King & Röell, 1988; Seyhun, 1986) have shown that insiders do have inside information and are able to earn abnormal returns. Therefore, it is pertinent to determine whether the same will be evidenced in Malta and whether investors that apply the same trading strategy will generate a higher return on their investment.

The Malta Stock Exchange (MSE) is still considered as being a 'young institution' having been created by the enactment of the Malta Stock Exchange Act in 1990 and having started its trading operations in January 1992. It is considered as being both small and illiquid. The investors' base in Malta is said to be heavily retail in nature and this has a lot to do with the fact that Malta is relatively small in size and the Maltese culture has always been described as one of a buy to hold, and not to trade (Muscat, 2013).

LEGISLATIVE FRAMEWORK AND NOTIFICATION OF TRANSACTIONS BY DIRECTORS IN MALTA

Insider trading entails the buying or selling of securities in a company by an individual who is closely connected to it such as a director, shareholder or an employee while in possession of specific information related to those securities which is not known to the general public but if made known would have a significant effect on the price of the securities. It is pertinent to point out that the term 'insider trading' has been made subject to a lot of different definitions; however, it is a term that encompasses both legal and illegal activity.

Regulations prohibiting insider trading have in fact been in force for a number of years and the study carried out by Bhattacharya and Daouk (2002) suggests that the existence and enforcement of regulations against insider trading arose in the 1990s. Nevertheless, the purpose of this study goes beyond the concern of whether insider trading causes investors to undermine their confidence in the market or whether the use of privileged information when dealing in securities should be regulated or not. Rather, this study seeks to identify whether insider trading is frequent in the market. From the results of the study one can then conclude whether directors abide by the regulations which govern trading on the stock exchange.

The first rules enacted to prevent insider trading were introduced by the Malta Stock Exchange Act in 1990. The regulatory role has since then been entrusted to the Malta Financial Services Authority (MFSA) and the Financial Services Tribunal set up under the MFSA has been incorporated with those obligations and duties which were prior to its enactment vested in the Malta Stock Exchange Tribunal.

The offence of insider dealing firstly appeared in the Maltese statute books in 1994 with the enactment of the Prevention of Insider Dealing Act, making insider trading a criminal offence. With its accession in the European Union, Malta had to be in line with European Union legislation and transposed the Market Abuse Directive (2003/6/EC) of the European Parliament and of the Council of 28 January 2003 on insider dealing and market manipulation. This was done by replacing the Prevention of Insider Dealing Act with The Prevention of Financial Markets Abuse Act 2005 (PFMAA), which came into force on 1 April 2005.

The Maltese legal framework allows what is known as legal insider trading which can be said to be the trading by a director in his own company securities. This is permissible only in those cases where the insider trades without the possession of inside information.

The PFMAA (The Regulatory Framework of Director Trading under the Prevention of Financial Markets Abuse Act) imposes a duty onto any person discharging managerial responsibilities within an issuer of financial instruments and, where applicable and persons closely associated with them to notify to the MFSA as the competent authority of any transactions that they may have 'conducted on their own account relating to shares of the said issuer or to derivatives or other financial instruments linked to them'.

Further regulations were set to regulate disclosure and notification of legal insider trading by imposing further requirements on the issuers of financial instruments, persons involved with such issuers and persons professionally arranging transactions, such as the requirements on disclosure of inside information and the compiling of a list of insiders. The persons that have to submit notifications to the MFSA can be said to be twofold; being the persons discharging managerial responsibility within an issuer and those persons closely associated with a person discharging managerial responsibility within an issuer.

LITERATURE REVIEW

The first studies relating to director trading focused on the profits earned and were carried out in the late 1960s and early 1970s. Rogoff (1964) studied 45 different companies in which insiders amounting to three or more buy the company's stock and retain the same stock. The study concluded that in the six months that followed the transaction, the said insiders made on average a return of 9.5% higher than the return generated to the stock market as a whole.

Another early paper on this subject was published by Lorie and Niederhoffer (1968) in which they tried to identify whether insiders were more apt at identifying future prices of stock. Their study was conducted on a sample of 105 companies listed on the NYSE from January 1950 to December 1960. Their study is based on intensive trading criteria and it attempts to identify an intensive selling or buying month, following which, the price movement in the subsequent six months is measured. Their conclusions held that insiders will do better in the next six months following the event and therefore outperform the market.

During this time, the Efficient Market Hypothesis was being developed by Fama (1970), which became the central proposition in finance for nearly 30 years. This theory, coined as EMH, holds that a market in which prices

fully reflect available information is called 'efficient'. The implications of this theory are that no person can earn abnormal returns. The assertions of this theory are that all available information is already reflected in the price of a security and therefore insiders cannot make abnormal profits. Moreover, prices can change because of unforeseen news nevertheless once there is a new development, prices will adjust automatically. In simple terms this hypothesis claims that an average investor cannot time and again beat the market and using resources to analyse stock are efforts in vain.

The theory behind the EMH lies on three arguments being firstly that investors are assumed to be rational. Secondly, if investors are irrational their trades will cancel out each other and therefore will have no effect on prices. Thirdly, if a number of investors are irrational in akin ways, then the rational arbitrageurs in the market will extinguish their influences on security prices.

With regards to this, Fama proposed three classifications of market efficiency based on the 'available information' being the weak-form, semi-strong-form and strong-form market efficiency. Each of these differs with regards to the information that is reflected in the stock prices.

Studies following the efficient markets paradigm have tried to test its pronouncements. The study on whether directors make abnormal profits from their trades allows for testing on the strong form of market efficiency whereas the study on whether outsiders mimicking these trades can make an abnormal profit tests for the semi-strong form of efficiency. These tests are performed by means of event studies. Event studies for the profitability or otherwise of director trading use the transaction date as the event date. Moreover, the tests performed for mimicking trading strategies of directors use the date of disclosure of director trading as the transaction date.

Jaffe (1974a, 1974b), in analysing whether insiders earn abnormal profits or not, found by using intensive trading criteria and after taking into account transaction costs that insiders do produce a significant abnormal return for stock held for at least eight months. In his conclusions Jaffe held that outsiders can too obtain such a profit when trading as an insider even after he took into consideration the transaction costs.

In his study Finnerty (1976) claimed that he was in disagreement with the results of Jaffe as the latter's study was based on intensively traded stocks only. By using intensive trading stock only, Finnerty held that a significant number of trades are lost and therefore not accounted for. In his opinion one could not conclude whether outsiders mimicking such trades could make a profit only by studying solely these types of stocks. For his study Finnerty was not selective and took a wider stock selection.

The conclusions of this study sustained the results propounded by Jaffe in that insiders did make abnormal returns on both purchases and sales in the first six months. In this study, however, Finnerty did not make any considerations for transaction costs.

Givoly and Palman (1985) considered the hypothesis of whether the abnormal gain of insiders resulted from price changes when they disclosed information about the company. Their findings suggested that notwithstanding the fact that the abnormal returns of insiders were generated in the days after the transaction was effected, this had nothing to do and was not linked to the divulging of news on the company. They explained these abnormal returns by holding that outsiders, when mimicking the trading of insiders, increased the value of shares. Givoly and Palman recognized however that the large abnormal returns reported by them could be due to the size of the firms they selected.

Seyhun supplemented the studies of Jaffe and Finnerty and investigated their findings which go against the theory propounded by Fama. Seyhun's work was classified as a milestone on this topic for many years and his work is recognized by many authors as being the most comprehensive study on the topic. In his study Seyhun (1986) took into consideration the size of firms as well as liquidity and examined the profits of more than 60,000 transactions between the period of 1975 and 1981. He examined the abnormal returns from the period of 250 days prior to the event and then 100−300 days after the event, the event day being the last day on which insiders trade each month. Through his study Seyhun demonstrated that when directors purchased stock they earned abnormal returns of 4.3% whereas when they sold the losses avoided by them ranged to 2.2%. The results show that after insider purchases stock in his own firm there was an abnormal positive price reaction whereas after an insider sale there were abnormal negative price reactions.

Seyhun claimed that insiders traded on more profitable information and coined the term 'information hierarchy hypothesis' which holds that 'insiders who are more familiar with the overall operations of the firm trade on more valuable information.' This theory assumes that the information content in director trades depends on the type of director doing such a transaction. In line with this hypothesis, those directors who are more hands down in a company and have more knowledge of the day-to-day business of the company they form part of, trade on more valuable information than those who do not.

By using an event study that applied daily cumulative abnormal returns (CARs), Seyhun examined the extent of the ability of insiders to predict the prices of their stock. The dependent variable in this study consisted

of estimate insider trading whilst the independent variables consisted of dummy variables for types of insiders. The results of this study demonstrated that those insiders who are involved in the day-to-day decision making and running of the company do trade on more valuable information. Seyhun categorized insiders under five different headings being officers, directors, officer-directors, chairmen of the board of directors and large shareholders. His study concluded that the group with the most frequent trades was that of the officers, followed by directors, large shareholders, officer-directors and chairmen of the boards of directors. It was also concluded that the coefficient of the officer-director heading was positive at 1% which suggested that officer-directors do trade on more valuable information.

With regards to mimickers of insider trades, Seyhun found that these cannot earn abnormal profits by following director trades and this after taking into account transaction costs.

Bettis, Vickrey, and Vickrey (1997) investigated if mimickers of insider's trading could earn abnormal profits through public available information. Their study showed that outsiders could earn abnormal returns after deducting transaction costs for both long and short periods of stock held.

King and Röell (1988) reproduced a portfolio which consisted of 109 insider purchases and 269 insider sales by using transactions which were reported in the Financial Times between 1986 and 1987. Their results showed that the purchase portfolio produced an abnormal profit of 2.47% after just one month and in the 12 months that followed the return amounted to 53%. With regards to the sell portfolio they concluded that after one month the return amounted to 1.18% which moved up to 7.56% in the 12 months that followed.

Pope, Morris, and Peel (1990) used a sample of 275 insider purchase and 289 insider sales for the period between 1977 and 1984 and this was done from samples from the Stock Exchange Weekly Intelligence. The whole sample provided an abnormal return of 4.85% and an avoidance of abnormal losses of up to 6.69%. It was concluded that the sales showed a negative signal whereas for the purchases, even though they showed a positive signal, the returns were not significant.

Gregory, Matatko, Tonks, and Purkis (1994) also revealed that directors were able to generate abnormal returns both when purchasing and also when selling and this by studying transactions through an event study methodology. However, their study concluded that a major part of these abnormal returns resulted in small- and medium-sized companies. In a further study of Gregory, Matatko, and Tonks (1997) they focus on the firm size and the definition of insider trading signals. Insider trading signals

were based on the value of the shares traded, the number of transactions which were done and the size of the net transaction volume. They also provided for an investment strategy whereby purchases and sales of insiders were mimicked. Their conclusions show that for a 3-month holding period, unadjusted profits ranged from −4.29% to −6.24% for insider sales; this was however dependant on the definition of insider trading signals used. On the other hand, for purchases the abnormal returns were in negative and ranged from −1.20% to −2:49%. Nevertheless, this study of 1997 failed to take into consideration transaction costs.

Brown, Foo, and Watson (2003) covered transactions during the period from 1 January 1996 to 30 June 2000. The speculation in the study was that directors act as contrarian investors; therefore they use inside information to both sell securities when they are overpriced and buy securities when they are underpriced. Their results suggest that directors in the Australian market were able, on average, to achieve abnormal profits when trading in their own companies. These abnormal returns are generated more when directors sell shares and this predominantly in resource type companies. Through the selling of shares directors were able to avoid future losses. This study concluded that directors were not able to generate abnormal profits when purchasing shares. In their conclusions it was also pointed out that the size of the company did not have any effect on the abnormal returns.

Further studies that were carried out in the Australian market conclude that trades of directors do in actual fact render an abnormal profit making this trading strategy profitable for imitators such as Hotson, Kaur, and Singh (2007), Chang and Chopra (2007) and Uylangco, Easton, and Faff (2010).

Betzer and Theissen (2009) assess CAARs before insiders report their trades and the results show that both negative excess returns to purchase and positive access returns to sales existed. These results however were reversed after the reporting of the trades by directors occurred. This resulted in the conclusion that prices are distorted in the time period between when the trade by the insider is executed and the date in which the same trade is reported. They reported that the market reacted more strongly when it came to trades of directors in those companies that follow international accounting standards. Their findings also indicated that outsiders, by copying insiders' trades, could make an abnormal profit.

Impact of Purchases and Sales to Outsiders

There are conflicting views on whether both the selling and the buying of securities provide signals to the market of either being positive or negative.

In a study carried out by Nair (2008) it was suggested that when directors sell they do not convey a credible message to outsiders as the buying signal does and this resulted because there are various reasons for which directors sell stock such as to have more cash in hand. On the other hand when directors buy stock, this is done in an attempt to make a profit in the future. Contrary to this, Mordant and Muller (2003) held that imitators are more eager to follow directors when they sell shares and therefore short the stock which in turn might result in a fall of the stock price.

Impact of Volume of Trades

Jeng, Metrick, and Zeckhauser (2003) focused on whether abnormal returns could have a relationship with the 'intensity' of insider trades in both purchases and sales. Their study analysed purchase and sale portfolios which they built on various basis one of them being the volume of trades. Basing themselves on results of Seyhun (1986), Pascutti (1996) and Seyhun (1998) they wanted to test whether results of past research purporting that there is a positive connection between trade volume and insider information subsisted. They rank the purchases and sales under three different categories based on trading sizes being 'low-volume', 'medium-volume', and 'high-volume' and formed portfolios for each category. Their findings suggest that there is a statistically significant positive correlation between trade-volume and short-term returns. Their results suggested that this relationship also existed for long-term abnormal returns; however there was no statistical difference between medium and high-volume trades for long-term abnormal returns.

RESEARCH QUESTIONS AND HYPOTHESES

This study will investigate the following questions:

(a) Does the trading of company directors in their own companies enable them to earn abnormal return?
(b) Does the size of a director trade, that is the trading volume, have an effect on this?
(c) Is it possible to earn abnormal profits by following a strategy based on insider purchases?

It can be assumed that directors as insiders have better quality information and better knowledge in their company and this is because they are more familiar with the day-to-day business of the said company. Since the trades of directors are based on this type of information, directors should be able to predict the future performance of the company better than an outsider. This stems from various studies that suggest that insiders have the possibility of earning a positive abnormal return when trading in their own firms' securities such as King and Röell (1988), Pope et al. (1990), Gregory et al. (1994) and others.

The motives behind trades of insiders in their own companies can be said to be either for liquidity reasons or because they possess non-public information that will have an effect on the future performance of their company. If the trades are executed because of liquidity reasons, the market should adjust quickly and no viable market reaction should be deduced. Nevertheless, if a trade by a director is performed because the directors possess non-public information about the company, this may provide a signal to the outsiders with regards to the value of a firm. Researchers have found that purchase transactions are more likely to convey information to outsiders as opposed to sales. It can be concluded that sales could portray somewhat less valuable information to an outsider as opposed to purchases and given the different theories, the difference of abnormal returns earned by directors through their sales and purchases of equities in their own firm will be evaluated.

The trading volume of a director's trade could affect the abnormal returns earned by directors when they trade in their own shares also this could help signal to investors the strategy to take. This concept arises from the idea that there should be a correlation between the confidence that directors have in their own company and their willingness to invest in it. With this reasoning one would expect that the higher the trade in volume, the more informed the transaction is and the larger the abnormal return earned.

METHOD

This study has been carried out on trades by directors reported to the MFSA as from 1 January 2005 up to 31 November 2014. In Malta, the only source that lists the data on trading by directors is the MFSA which maintains a publicly accessible online list of all the transactions carried out by persons discharging managerial responsibility within an issuer and those

persons closely associated with a person discharging managerial responsibility within an issuer. The online database contains a total of 696 entries for the period studied which were reported from 24 different companies listed on the MSE. This data is divided under different headings and includes the name of issuer, the person trading, the date of the transaction, the instrument type, the nature of transaction, the place of transaction, the currency, the price, the volume and other information which relates to the relationship between the insider and the directors of a company.

The primary source on the daily closing prices in Malta is the website operated by the MSE. This website keeps an archive of closing prices under different methods and these are published either on a monthly or quarterly basis.

SAMPLE SELECTION METHOD AND DATA ADJUSTMENTS

1. The first sample selection criterion related to the instrument type of the transactions. This study is only concerned with the trading of equities and therefore those transactions reported that had as the instrument type the buying or selling of a bond/fixed interest security were eliminated from the study.
2. The second sample selection criterion related to the type of person trading. Those transactions where the person discharging managerial responsibility or persons closely associated to it was a Limited Liability Company, a Public Listed Company or a Holding Company were omitted from this study.
3. The third sample selection criterion related to initial public offerings (IPO).

After the data selection was completed, a total of 527 entries from 19 different companies listed on the MSE remained in the sample for the analysis of the hypotheses, with 239 being purchases of equities and 288 being sales of equities.

The closing price of the month at which the transaction was executed was taken, in order to track for the share price in the 3-month, 6-month and 12-month window following the transaction, the closing price of the event date was taken together with the closing price of the closing prices of the 3 months, 6 months and 12 months following the transaction.

After the values were obtained, the results were computed by checking what happened after the event date. The results of the share price movement were taken to be as '1' whenever the share price moved in the same direction and '0' when it moved in the opposite direction. For all transactions where the closing share price in the 3-month, 6-month and 12-month window remained the same as the closing share price of the event date it was taken as a no movement and therefore constituted a '0' for this study.

When all the data was worked the proportion of '1s' out of all the transactions was calculated. This was calculated by adding up all the '1s' under the column 'Share Price Movement 3 month', 'Share Price Movement 6 month' and 'Share Price Movement 12 month' separately. After this exercise was completed, the number of '1s' was divided by the total number of transactions and subsequently multiplied by 100 in order to obtain a percentage of abnormal return. The same exercise as above was carried out for Sales transactions and purchase transactions separately and per company (for each of the 19 companies).

The trades studied were then categorized into two different categories based on trade volume. For this, the median of the volume of trades was used, since the data provided was not symmetrically distributed and therefore the median gave a more accurate reflection of the average volume or shares. The median was calculated as being 5,708 shares. The data was then divided into two, one listing those entries which had as volume of shares traded less than 5,708 shares and the other one being entries which had as volume of shares traded more than 5,708 shares. After this exercise was completed, the proportion of '1s' out of all the transactions was calculated as above.

Following this the return and average return was calculated using the closing price of the month at which the transaction was executed as well as the closing price for the same equity in the 3-month, 6-month and 12-month window following the transaction was used. The following formula was used: $\text{Return} = \frac{T_1 - T_0}{T_0}$.

RESULTS AND DISCUSSION

It can be concluded that the results of the proportions of the share price movement after 3, 6 and 12 months are mixed with marginally indicative results in the 6 month period. The results indicate that directors, in general, for both buy transactions and sell transactions, did not consistently beat

the market. In the 3-month and 12-month window the results show that directors were able to predict the prices of the stock less than 50% of the time with the results being very close to each other. The percentage proportion after 3 months of the transaction resulted to be 47.2% whilst the percentage proportion after 12 months of the transaction amounted to 47.4%. A slightly indicative result is the 6-month window after the date of transaction which shows that more than 50% of the time the directors were able to forecast the stock prices and therefore were able to beat the market. In fact the results for the 6-month period amount to 53.8%.

The results are not in line with the expectations and predictions. The results show that on average in the 3-month and 12-month period subsequent to a purchase or sale transaction, insiders do not outperform the market as the results of their trades show that either the share prices did not move or that they went in the opposite as to the type of trade executed. The expectation for this hypothesis was that on average, the percentage proportion of '1s' should have been more than 50% in all the three event windows tested. Weak evidence is reported and insiders seem to underperform the market in the 3 months and 12 months following their trade. There seems little evidence to suggest that insiders are able to predict the future performance of their company better than an outside investor. Nevertheless, these results could be impacted by the fact that both sales and purchases were taken together.

Furthermore, it can be concluded that sale transactions are more indicative to the general public as opposed to purchase transactions. The fact that the directors were able to decrease their losses more than 50% of the time shows that directors sold the stock of the companies they form part of from information that the company had problems. The results of the proportions of share price movement after 3, 6 and 12 months are nearly all above 50% with the proportion of share price moving in the same direction as the sales being 49.3% after 3 months of the transaction by a director, 63.3% after 6 months of the transaction by a director and 64.3% after 12 months of the transaction by a director. In the majority of cases the director's trades were indicative as to the future of the company's equity prices. These figures indicate that the equity values subsequent to directors' sales went down for the period of up to 12 months following a sale. These results as reported suggest that in Malta when directors sell they convey significant information to the market.

From the results of purchase transactions it can be concluded that for the 3, 6, and 12-month window after a trade the price moved in the opposite direction more than 50% of time. The results show that after 3 months

of a purchase the prices increased 44.8% of the time, after 6 months of a purchase the prices increased 42.4% of the time and after 12 months of a purchase the prices increased 25.9% of the time. This indicates that a weak relationship exists between the purchase transactions of directors and the future performance of the company.

The results show that after segregating sale and purchase transactions, buy transactions are more difficult to predict and therefore there is less chance to beat the market and make an abnormal return. The sale transactions show a much higher rate of avoiding a loss. Nevertheless, it has to be pointed out that for this study no difference has been made between routine and non-routine sale trades which could have affected the result. These results do not support the hypothesis as proposed as the expectation of these results was that the purchase transactions would convey more information to the outsiders as compared to sales.

It can be said as a general comment on all the companies studied that for the majority of companies the results for the percentage proportions after director trades are close to 50% however this does not constitute a definite conclusion. It has to be pointed out that for this hypothesis the purchase and sale transaction were not segregated and this mainly due to the small number of transactions that were available for the study. These results do however support the hypothesis as proposed as the expectation was that different companies would portray different signals to the market and the results confirm this and portray knowledge as to whether short-term strategies or long-term strategies can be employed.

After evaluating trading volume the results show inconsistency with the expectation. It can be seen that the percentage proportion of times where the price decreased after a sale and increased after a purchase is 39.2% after 3 months of the transaction by a director, 49% after 6 months of the transaction by a director and 39.2% after 12 months of the transaction by a director. On the other hand, with regards to the below median transactions the percentage proportion of times where the price decreased after a sale and increased after a purchase is 55.5% after 3 months of the transaction by a director, 58.8% after 6 months of the transaction by a director and 55.6% after 12 months of the transaction by a director. This means that the low-volume transactions in Malta are more indicative to outsiders when compared to high-volume transactions. The low-volume trades are more significant in all the event windows examined.

This could be however because these numbers include both sale and purchase transactions. The numbers could be affected because no distinction

was made between the nature of transaction. Another factor that could have affected the result is the fact that the trades were divided into two as to only include above and below median transactions. The studies that were discussed from literature review hold that medium-sized transactions could be the most indicative ones as directors might opt to not trade in large volumes so as not to attract attention. The author did not however cater for medium-sized transactions and the main reason behind this was that the total number of workable transactions which could be studied was not a lot.

For purchase transactions, when the averages are in negative it means that the directors would have made a loss for the aggregate purchase transactions for the periods of 3 months, 6 months and 12 months after the purchase trade for a particular company and vice versa. For sale transactions, when the averages are in negative it means that the directors would have avoided a loss for the aggregate sale transactions for the periods of 3 months, 6 months and 12 months after the sale trade for a particular company and vice versa.

It can be concluded that some companies did make on average a high return after purchasing stock for the periods tested whilst for others it was the contrary. The results show that 62.5% of the companies did not make an abnormal return for purchase transaction leaving only 37.5% of the companies in making an abnormal gain. 46.6% of the companies did on average avoid a loss after selling stock for the periods tested whilst for 53.4% it was the contrary and a loss was reported.

The results show that directors were able to avoid losses and make gains from the returns as calculated. The results therefore confirm the expectations of the hypotheses being that directors can avoid losses and earn abnormal returns following sale and purchase transactions in their own firms. The results in Malta seem to be consistent with international results in that average abnormal returns and avoidance of losses are reported. Nevertheless, attention has to be drawn to the fact that the study as proposed did not take into consideration transaction costs which would have to be paid by the outsider in order to execute the transactions.

CONCLUSION

When looking at the results, it can be said that Maltese directors do convey information to the market both when they purchase shares in their own companies and when they sell shares. In fact, it can be said that sale

transactions provide more indicative results and show that when directors sold shares in their own companies the price of the equity decreased in more than 50% of the time. This cannot be said, however, to be the general rule and results vary. By looking at the volume of shares it was concluded that in Malta smaller trades portray more information than larger trades which was inconsistent with the expectations. It was also concluded that particular companies in Malta are more indicative than others with regards to the information they signal to the market. The results of the study are on the whole consistent with international studies on the subject. Nevertheless, Malta has some anomalies in that the international studies reviewed overall determine that buy transaction should be more indicative than sale transactions, which is not the case for Malta. There are a number of explanations that come out from this result one of them being that the sample that was available did not contain a large number of transactions.

The results reveal that in spite of the fact that insiders do have more knowledge about the prospects of their company than the average investor and that the information that their trades portray is valuable, an outsider cannot trade blindly. It can be said from the results obtained that certain trades are more indicative than others and that certain companies are more reliable than others. A trading strategy based solely on mimicking insider trades will not produce favourable results if the outsider does not know how to interpret the data to make a rational investment decision. Outside investors should not assume that every purchase transaction means that the company will make profits and inversely that every sale transaction means that the company is not doing well. This is because the underlying reasons as to why a director buys or sells shares in his own company cannot be determined.

The implications that result are that outsiders should not rely completely on the trading of directors as an investment strategy and that they should be prudent when it comes to using this data. The other implications that arise from the results of the study are twofold. The fact that directors are able to beat the market when they trade goes against the theory of Efficient Market Hypothesis advocated by Fama (1970). The same can be said in respect of viable trading strategies based on the fact that outsiders would be also able to beat the market by following director trades. Nevertheless, this theory cannot be discarded. This is because it is very hard to interpret each and every transaction of a director and therefore the prices will eventually incorporate the information.

Limitations and Recommendations for Future Research

There are some limitations to the findings that must be noted. This study was conducted on trades of directors in their own companies. The number of transactions recorded was low when compared to similar studies performed on an international platform. This was mainly due to the fact that the Maltese market is considered as small and illiquid.

The transactions carried out by persons discharging managerial responsibility within an Issuer and those persons closely associated with a person discharging managerial responsibility within an issuer, started being archived and made available to the public only with the enactment of Chapter 476 of the Laws of Malta. Therefore, no data was available with regards to those transactions carried out prior to 1 April 2005.

The entries that were used for this study were only available from one source being the MFSA's website. Therefore, there was not the possibility of double checking whether the data entered was all correct. It is pertinent to point out that after the data was extracted, MFSA updated its website and to the day of publication of this study, the data available with regards to director trades is now from 2010 to date. With regards to the quality of the data available, it can be said that it was of generally good quality even though some parts of the data recorded on the website was incomplete. The data collected was not aggregated therefore there were transactions, in a particular day by the same director, which were divided and reported as separate transactions.

The data was that the connection of the person carrying out the transaction to the company was not available for nearly all transactions. For this reason the author could not delve into a hypothesis based on the impact of each individual director trade based on his position in the company and whether or not the information content of transactions varies according to the position of the director trading. Therefore, no distinction was made between the types of directors being for example an executive or non-executive one.

The term director had to take a broad definition including persons discharging managerial responsibility within an issuer and persons closely associated with a person discharging managerial responsibility for two reasons highlighted above being that the number of transactions in total was low in order to select exclusively transactions carried out by directors and apart from this data on the relationship between the person carrying out the transaction and the issuer was missing for most of the transactions.

To the best of the author's knowledge, this is the first study in Malta on director trading. It is believed that research on this topic can be extended in

various ways. This research was carried out by looking at the price movements of shares once these were either bought or sold for the periods of 3, 6 and 12 months post transaction date. It would be interesting to study whether, for those companies which results went contrary to the predictions, the directors had a long-term trading strategy in mind. This would entail observing the share price movements after longer periods of time or making a qualitative study by interviewing the directors themselves.

There are various other hypotheses that arise from previous literature which would complement this study and which could be studied with the data collected for this study and add to the results. The hypothesis proposed by this study with regards to the difference in the signals between buy and sell transactions could be extended as to differentiate between routine and non-routine trades when it comes to sale transactions and to differentiate between the purchases of newly appointed directors and directors that have been in the position for a long period. Another extension of this study could be that of looking at trades by particular individuals in companies and differentiating between trades of different classes of directors and investigating the level of information that these trades depict. Another interesting research would be that of determining whether the trades of directors were made around news announcements of the company they form part of.

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EQUITY MUTUAL FUND PERFORMANCE EVALUATION: AN EMERGING MARKET PERSPECTIVE

Jana Hili, Desmond Pace and Simon Grima

ABSTRACT

Purpose – *The uncertainty as to whether investments in riskier and less efficient markets allow managers to* 'beat the market' *remains a question to which answers are required. Accordingly, the purpose of this chapter is to offer new insights on portfolios of the US, European and Emerging Market ('EM') domiciled equity mutual funds whose objectives are the investment in emerging economies, and specifically analyses two main issues: alpha generation and the influence of the funds' characteristics on their risk-adjusted performance.*

Methodology/approach – *The dataset is made up a survivorship-bias controlled sample of 137 equity funds over the period January 2004 to December 2014, which are then grouped into equally weighted portfolios according to the scheme's origin. The Jensen's (1968) Single-Factor model along with the Fama and French's (1993) and Carhart's (1997)*

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multifactor models are employed to authenticate results and answer both research questions.

Findings – *Research analysis reveals that EM exposed fund managers fail to collectively outperform the market. It thereby offers ground to believe that the emerging world is very close to being efficient, proving that the Efficient Market Hypothesis ('EMH') ideal exists in this scenario where market inefficiency might only be a perception of market participants as any apparent opportunity to achieve above-average returns is speedily snapped up by very active managers. Overall these managers take a conservative approach to portfolio construction, whereby they are more unperturbed investing in large cap equity funds so as to lessen somewhat the exposure towards risks associated with liquidity, stability and volatility.*

Furthermore, the findings show that large-sized equity portfolios have the lead over the medium and small-sized competitors, whilst the high cost and mature collective investment vehicles enjoy an alpha which although is negative is superior to their peers. The riskiest funds generated the lowest alpha, and thereby produced doubts as to whether investors should accept a higher risk for the hope of earning higher returns, at least when aiming to gain an exposure into the emerging world.

Originality/value – *Mutual fund performance is not an innovative topic so to speak. Nonetheless, researchers and academia have centred their efforts on appraising the behaviour of fund managers domiciled primarily in developed and more efficient economics, leaving the emerging region highly uncovered in this respect. This study, therefore aims at crafting meaningful contributions to the literature as well as to the practical perspective.*

Keywords: Asset pricing models; emerging market exposed mutual funds; fund characteristics; performance evaluation; style analysis

INTRODUCTION

The unparalleled bull market and extended investor demand over the late twentieth century resulted in an explosive growth for the mutual fund industry (Fink, 2011). The second millennium ended with 8,155 mutual funds in the United States, holding over $6.96 trillion of assets, more than five times the $1.35 trillion at the end of 1980. The growth phenomenon

was worldwide and the year ended with 51,692 global mutual funds, managing $11.87 trillion of assets (Investment Company Institute, 2004).

Notwithstanding the 2003 mutual fund trading scandal and the 2008−2009 financial turmoil, the story of collective vehicles is far from over. The thought of pooling savings for investment purposes became a hot favourite amongst millions of investors who wish to access the capital markets but lack the time and financial sophistication. Today, collective investments have not only become the investor's '*vehicle of choice*' but also play an elemental part to the world's financial system (Morningstar.com, 2014).

The successful establishment of these instruments is no surprise to the economy. Because these structures provide built-in diversification and professional management, they present an advantage over holding an individual security. In particular, collective investments are transparent vehicles in that their underlying asset is clearly identifiable and the value of the fund is marked-to-market day by day and presented in its NAV. Additionally, collective vehicles assist in lessening the portfolio's volatility whilst offering investors to hold units in a professionally managed shared portfolio, thereby benefiting from economies of scale. Nevertheless, like investing in any security, investing in collective structures is no risk-free: investors may lose all their invested capital and above all mutual funds have no guaranteed returns.

Today investors are becoming more than ever concerned about fund selection, and thereby this has further encouraged interest and investigation onto the area. In particular, a number of research papers strive to probe the dynamics of mutual fund returns to perceive whether fund managers can produce some kind of added value for their investors and ways to succeed in this. Other studies also analyse the relationship between the mutual funds' characteristics and their performance so as to determine whether such performance can be justified by any specific characteristic. Nonetheless, factors such as the historical data available, the size and the maturity of markets has led to most of the research being performed on developed economies with the EM fund industry being left behind.

The limited findings surrounding the mutual fund industry's behaviour in the EM economies has not hindered growth in the fund sector. In truth, fund investments in this area have grown markedly at a faster speed than the developed economies have shown, much of which was driven by China (IMF.org, 2014a, 2014b). Facets like the growing middle class, the privatisation of pension systems and the improved market penetration of the insurance sector have further supported the expansion of mutual fund sales

(Ong & Sy, 2004). These motives together with the improved fundamentals in the EM economies now allow for research to be carried out.

Nevertheless, evaluating fund performance in EMs is not a straight picture. In particular, the unique characteristics of such economies, including investment restrictions, non-normality and the high volatility and trading costs, make it difficult to pick the ultimate winner (Borensztein & Gelos, 2001). Furthermore, there is also some uncertainty as to whether the traits recognised in advanced economies can also enlighten fund performance in the emerging world (Claessens, Dasgupta, & Glen, 1995; Fama & French, 1998; Rouwenhorst, 1999; Van Der Hart, Slagter, & Van Dijk, 2003 amongst others).

This chapter seeks to offer new insights on collective investment vehicles which place capital into the emerging world through addressing the following research questions and hypothesis:

Proponents of the EMH argue that, in efficient markets, no fund manager is ever able to outperform the market, and that the only way s/he can perhaps attain higher returns is by engaging into riskier securities. There is a general consensus that EMs by their very nature are riskier and less efficient along the world's spectrum (Fisher, 2014; Russell.com, 2013; Swedroe, 2014). Hence, is it practical to consider that managers allocating resources to the EM regions can actually '*beat the market*' over a period of time?

Secondly, mutual fund selection is an important task for both the investors, because it can be the first point of direction in choosing that scheme which matches their investment objectives, as well as to fund managers to administer their portfolio more efficiently. Recognising how the funds' characteristics influence their risk-adjusted performance is a major factor in such selection process. Hence, which attributes help in achieving superior or lower risk-adjusted returns than their peers?

The remainder of this chapter is organised as follows: The section 'Literature Review' carries a discussion on collective investment vehicles. The section 'Methodology and Data' presents the methodology and the sample selection. The section 'Results and Analysis' describes the empirical research of the chapter. The section 'Conclusion' contains the summary and draws conclusions to the salient points of the research.

AIM OF THE RESEARCH

The fast-growing importance of mutual funds as vehicles for investment has attracted substantial attention to investigate and evaluate their past

and present performance as a norm for investors' future choice, and particularly whether fund managers can actually outperform the market. The research aims to fill a gap in literature by comprehensively exploring the performance of the United States, European and EM domiciled collective structures which place their capital into the emerging world; seeing that studies on the EM region is mostly centred on a specific country, analysed through non-regression approaches and based on a small dataset over a relatively short timeframe.

Secondly, the research intends to investigate such collective structures' performance in light of their specific characteristics, and particularly analyse which characteristics generate higher risk-adjusted returns. The study draws on the evidence from four imperative attributes in the fund literature. These comprise: fund size, total expense ratio ('TER'), fund age and risk as measured by standard deviation. Additionally, the study compares the outcomes with evidence from the existing literature.

LITERATURE REVIEW

This section carries a discussion on collective investment vehicles. The first part of the section looks into the development of mutual funds and also presents a handful of statistical data. Other aspects include the performance measures as suggested in literature together with empirical results and evidence for both developed and emerging economies.

From 'Unity Creates Strength' to the World's Most Popular Investment Vehicle

The origin of collective structures goes back to year-1774 with the establishment of what's believed to be the first closed-ended fund by Dutch merchant Adriaan Van Ketwich. The purpose, as we know it today, was to offer investors who had smaller amounts of capital, the ability to pool their resources and thereby, to multiply their access to profitable structures whilst decreasing their investment risk through diversification. The scheme owned a variety of assets across Europe and America and survived for over twelve decades. Nevertheless, despite the early success of the so-called Eendragt Maakt Magt, which translates to 'Unity Creates Strength', mutual funds did not evolve to be a really popular investment vehicle until

the late 1920s. The closed-ended nature of the scheme restricted the redemption of shares, and therefore, was much less responsive to investor demand to liquidate their holding or place further monies.

In year-1924, the American 'Massachusetts Investors Trust' was developed as an open-ended CIS, which permitted for regular creation and redemption of shares. With the beginning of the Great Depression, closed-ended fund structures commenced to trade at high discounts to their underlying NAV causing investors to experience substantial losses, whilst open-ended fund structures allowed units to be bought or sold at NAV. Consequently, and as reality stands today, open-ended structures dominated the mutual fund marketplace whereas closed-ended ones were sidelined (Davidson, 2012).

EMs' CISs have existed since 1986, with the introduction of an EM fund for institutional investors by Capital International and the International Finance Corporation. A year later, retail investors were also able to place capital in emerging economies' structures, when Templeton launched its NYSE 'Templeton Emerging Markets Fund, Inc.'. Just then, no other US domiciled collective vehicle invested substantial percentage of their portfolios outside the States (Mobius, 2012).

The 1990s was the year where the mutual fund industry experienced remarkable evolution, maintained *inter alia* by strong economic growth, subdued inflation and low interest rates. Nevertheless, the novelty of CISs was then routed through uncertainties and challenges; the 1997−1998 Asian financial crises, the 2003 Late-Trading scandal and the 2008−2009 financial turmoil, which brought fear amongst investors. Even so their story has always been far from over. Mutual funds continue to be '*the investors' vehicle of choice by far*' especially since they '*have earned that unique trust in large part*' by having survived the uneven market conditions as well as sometimes also the heavy-handed regulations (Investor's Business Daily, 2014).

As a consequence to its popularity the demand for mutual funds around the world has gradually risen. Research estimates conducted by the Investment Company Institute (2004, 2014) evidence that in the US TNA of collective vehicles grew from $6.95 trillion in 2001 to $12 trillion in 2007 to over $15 trillion in 2013, making the States home to the largest fund industry. The European UCITS industry also expanded, though to a lesser extent then the US; from $3.17 trillion in 2001 to $8.93 trillion in 2007 to $9.37 trillion in 2013. Whereas the United States is the holder of merely 10% of the number of funds available worldwide, Europe owns over 45% of the schemes and thereby has a smaller average size of individual funds. The fund ownership also expanded inside the emerging economies, with

collective vehicles gaining more recognition following the crash of the Asian markets as market participants required more secure forms of investment – where CISs believed to be amongst these. Today EMs experience the all-time high of over $2.31 trillion managed assets from $1.87 trillion in 2007 and $0.42 trillion in 2001 and over 32% of the number of scheme available internationally, with the strongest growth being mirrored in Brazil, South Africa and Mexico.

Why Emerging Economies?

Investing in EMs through mutual funds offers investors the opportunity for an entry path without realising all the challenges encountered when entering the markets themselves. Investors want to invest in countries with growth prospects and indeed, emerging economies like China and India have experienced some of the highest economic growth rates in the world. Studies performed by the IMF show that in 2013, growth for emerging economies was 4.7% (anticipated to decrease to 4.6% in 2014 and then strengthen to 5.2% in 2015) versus a 1.3% for advanced economies (anticipated to increase to 1.8% in 2014 and then strengthen to 2.4% in 2015) (IMF.org, 2014a, 2014b). According to AXA.com (2011) and Blackman (2014) a portfolio allocation of 5–10% for EMs mutual funds can enhance returns at least in the long-term besides benefiting from geographic and investment diversification.

But along with the high potential of EMs comes along heightened risk. In particular, emerging economies' investments historically have been less liquid and more volatile than comparable investments in advanced markets. Such markets typically also face lower levels of regulatory and supervisory measures and have different clearance and settlement procedure where at times they are incapable of keeping up the quantity of dealings. Investments in overseas assets could also encounter heavier risks as a result of a number of other factors including changes in economic or monetary policies, currency fluctuations, political instability and limits on foreign investment and repatriation of capital, greater sensitivity to interest rate changes, pervasiveness of corruption, lack of uniform accounting reporting, practices and disclosure requirements.

Furthermore, like investing in any US or European collective structure, EM mutual funds have no guaranteed returns and investors may lose their entire investment funds. Additionally, shareholders have no control over their portfolio and have to rely on the investment wisdom of the fund manager.

To all this, the underlying case for placing capital in EMs may sometimes be confusing. The downside factors when investing in emerging economies are real and unsettling for investors seeking comfort in their investments. Nevertheless, the upside cannot be ignored. Accordingly, investing in a multi-asset approach is believed to be the best possible way to exploit the full potential of EMs whilst mitigating volatility amongst other risks.

Portfolio Performance Measures

Many researchers, amongst others are Jensen (1968), Grinblatt and Titman (1993) and Carhart (1997) have introduced new models for measuring portfolio performance in an attempt to discover a method which could offer accuracy and reliability. Notwithstanding the different measures put forward they all intended to offer a suitable approach by which to differentiate superior fund managers. Identifying the appropriate model to be employed may be quite tricky and this led others, such as Lehmann and Modest (1987), Kothari and Warner (2001) and Otten and Bams (2004), to question which models offer the best evaluation techniques. According to Suppa-Aim (2010), choosing the best model for measuring performance does not rest entirely on the method itself but also depends on the appropriateness of the measure to the data and the market being evaluated.

Evaluating performance through non-regression ratios only helps to compare whether a fund has performed superiorly or inferiorly to its competitions. It is unlikely to construe whether such indication of better or worse performance is statistically significant or have any financial meaning. Accordingly, the present work employs regression-based measures.

The Jensen's alpha or the so-called the Single-Factor alpha, as proposed by Jensen is one of the most popular performance measures. Based on theory of the pricing of capital assets, the Jensen's alpha evaluates how much a fund manager's forecasting talent plays a role in the collective investment vehicle's return. The Single-Factor alpha can be expressed as:

$$E\left(R_{pt}\right) - R_{ft} = \alpha_p + \beta_p\left[E(R_{mt}) - R_{ft}\right] + \varepsilon_{pt}$$

(*Source*: Jensen, 1968)

where $E\left(R_{pt}\right)$ is the expected return on portfolio p at time t, R_{ft} is the risk-free rate of return, β_p is the systematic risk of portfolio p, $E(R_{mt})$ is

the expected return on the market portfolio at time t, ε_{pt} is a random error term of the portfolio return at time t and α_p is an intercept of estimated regression, or the *Jensen's alpha*.

A positive alpha result ($\alpha > 0$) suggests that the collective structure has performed better than its beta would forecast and therefore the fund manager has an ability to predict portfolio prices. The opposite is true in case of a negative alpha ($\alpha < 0$).

For the reasons that the Single-Factor alpha has a benchmark, it permits portfolios that have different degrees of risk to be contrasted. Nonetheless, Jensen's alpha is yet concerned by Roll's (1977) critique of benchmark aptness. Ferson and Schadt (1996) show that this measure would bias average performance of mutual funds upwardly provided that beta is assumed to be fixed over the sample period. Others, such as Ross (1976) and Fama and French (1993) observe that expected returns cannot be explained by a single-risk factor and therefore portfolio performance measures have been extended to a multi-factor model.

Multi-factor models result in achieving better performance measurements because expected return can be explained by more than one variable and thereby comprise various risk dimensions. The factor model can be expressed as:

$$R_{pt} = \alpha_p + \sum_{K=1}^{k} \beta_{pk} F_{kt} + \varepsilon_{pt}$$

(*Source*: Le Sourd, 2007)

where R_{pt} is the return on portfolio p at time t, β_{pk} is the sensitivity of portfolio p's return to factor k, F_{kt} is the return of factor k at time t, ε_{pt} is a random error term of portfolio p at time t and α_p is the expected return of portfolio p, if the expected value of the factors equals zero.

Fama and French (1993) employ firm characteristics and construct variables which relate to size and book-to-market ('B/M') ratio, called SMB and HML respectively. In their study, the small-firm group (S) has firms with capitalisation below the NYSE median, whilst the big-firm group (B) comprises those firms with above the NYSE median capitalisation. Likewise, firms are ranked on the basis of their B/M ratio, where a low-ratio group (L) is the one with the 33% lowest B/M ratio (also known as growth firms), a medium-ratio group (M) is with the next 34% B/M ratio and a high-ratio group (H) is with 33% highest B/M ratio

(also known as value firms). The Fama and French (1993) three-factor model can be expressed as:

$$R_{pt} - R_{ft} = \alpha_p + \beta_{0p}\left(R_{mt} - R_{ft}\right) + \beta_{1p}\mathrm{SMB}_t + \beta_{2p}\mathrm{HML}_t + \varepsilon_{pt}$$

(*Source*: Fama & French, 1993)

where SMB is Small minus Big (or the return of small stocks in excess of returns of large stocks) and HML is High minus Low (or the return of stocks with high B/M ratio in excess of returns of stocks with low B/M ratio).

In addition to the Fama and French's (1993) three-factor model, Carhart (1997) applies an extra factor to capture Jegadeesh and Titman's (1993) momentum anomaly and construct his four-factor model. The inclusion of this factor is a response to the studies that demonstrate how stocks which perform best carry on performing well over the subsequent cycle (Jegadeesh & Titman, 1993). Carhart's momentum variable is the difference between the equally weighted average of the highest 30% performance firms and the equally weighted average of the 30% lowest performing firms, lagged one month. The four-factor model can be expressed as:

$$R_{pt} - R_{ft} = \alpha_p + \beta_{0p}\left(R_{mt} - R_{ft}\right) + \beta_{1p}\mathrm{SMB}_t + \beta_{2p}\mathrm{HML}_t + \beta_{3p}\mathrm{PR1YR}_t + \varepsilon_{pt}$$

(*Source*: Carhart, 1997)

where $\mathrm{PR1YR}_t$ is the difference in return between a portfolio of past winner and a portfolio of past losers.

Despite the critique that both Fama and French (1993) and Carhart (1997) multi-factor models are not established on any hypothetical structure, these models are frequently employed to evaluate portfolio performance. Many studies such as those of Fletcher and Forbes (2002) and Otten and Bams (2004) show the good job of these models as performance measurements.

Mutual Fund Performance

If a market is said to be efficient '*competition will cause the full effects of new information on intrinsic values to be reflected* "*instantaneously*" *in actual prices*', and thereby there is no way to produce excess profits by using this information (Fama, 1965). Evaluating the accomplishment of fund managers is an approach to examine market efficiency. Related research includes that of Jensen (1968) which estimates the predictive ability of 115

US fund managers between the periods 1955 to 1964 and 1945 to 1964. Evidence suggests that these managers were on average unable to forecast security prices sufficiently well to outperform the buy-the-market-and-hold strategy. Similarly, Grinblatt and Titman (1989) employ Jensen's measure to the quarterly holdings of a sample of collective vehicles for the period 1975−1984, and conclude that shareholders cannot take advantage of the fund managers' superior stock selection abilities by purchasing investor shares in their mutual fund portfolio. Also, Cumby and Glen (1990) utilise Jensen's and Grinblatt and Titman's PPW measures on 15 US based internationally diversified funds between 1982 and 1988 and likewise find no evidence of mutual funds superior performance.

Nevertheless, the study of Ippolito (1989), who evaluates the overall efficiency of the US mutual fund industry, reveals opposing conclusions and in particular find that estimated alphas, net of fees and expenses, are significantly greater than zero. On average, however, there is no evidence that turnover, management fees or expenses are coupled with inferior returns, net of management fees and expenses. In their recent research, Elton and Gruber (1999) document that the inclusion of a metric which inappropriately accounted for the performance of non-S&P500 assets as compared to that employed in Jensen's period, justifies the non-negative alpha found by Ippolito (1989). Following the correction, the conclusions obtained by Elton and Gruber (1999) are consistent with those of Jensen's.

Outside the United States, Blake and Timmermann (1998) use a larger dataset of 2,300 UK mutual funds for the period 1972−1995 and find underperformance of 1.8% per year. Cesari and Panetta (2001) employ Jensen's alpha and the PPW measure to estimate the risk-adjusted performance of Italian equity funds over an 11-year period. They find that using net returns mutual funds' performance is not significantly different from zero, however, with gross returns, performance is positive and statistically significant.

Otten and Bams (2000) study UCITS performance of five European countries, namely; France, Germany, Italy, UK and the Netherlands through the use of both conditional and unconditional versions of the Carhart (1997) four-factor model. In particular, they observe that the small cap schemes are competent to adding value to the portfolio as evidenced by their positive alphas, net of expenses. Furthermore, for the majority of the European markets, the alpha is also on average positive, but were only UK CISs outperformed significantly. A non-positive alpha was produced for Germany. Nonetheless, when management expenses are added back four out of the five countries produced considerable outperformance. Only German funds still underperformed, although insignificantly.

Whilst there is a wide collection of mutual fund literature on developed markets, very limited research has been performed on emerging economies. Roy and Deb (2003) analyse the consequence of including lagged information variables to examine the performance of 89 Indian CISs over the period 1999–2003. In particular, they conclude that the presence of conditioning information allows for alphas to shift towards the right and thereby lessening the number of non-positive timing coefficients. Consistent with the majority of the US and European fund performance literature, they find that Indian collective vehicles are unable to beat the market. Soo-Wah (2007) and Fauziah Md and Mansor (2007) (cited in Suppa-Aim, 2010) examine the performance of collective structures in Malaysia and in particular find inferior performance. Suppa-Aim (2010) studies the Thai market and investigates 230 mutual funds between the period June 2000 and August 2007 and also finds no signs of abnormal performance. Similar conclusions have been reached in Białkowski and Otten's (2010) research on 140 Polish mutual funds through employing the Carhart (1997) four-factor model. Their overall result also suggested that locally based funds outperform foreign investing mutual funds, which points at the informational advantage of home over international shareholders.

Soongswang and Sanohdontree (2011) examine 138 Thai open-ended collective vehicles during the period 2002 and 2007 and examine their performance using various methods, including Jensen's alpha. In contrast to the majority of EM fund literature, they reveal that Thai funds significantly outperformed the market for all time-period of investment, which abnormal returns are significant and persistent.

Determinants of Mutual Fund Performance

Other authors investigate variables that can impact the performance of collective vehicles. For instance, for a number of decades the fund's size has been one of the most researched variables but its relationship still puzzles practitioners and scholars.

Indro, Jiang, Hu, and Lee (1999) in their study of 683 non-indexed US schemes document that funds must reach a minimum size in an attempt to realise sufficient returns to make up for their costs of acquiring and trading on information. They document that size mirrors implicit transaction costs and consequently diminishing marginal returns. Grinblatt and Titman (1989) in examining US collective vehicles find that abnormal performance of mutual funds, based on gross returns, is negatively related to size. Chen, Hong, Huang, and Kubik (2004) also document that performance, both

before and after controlling for fees and expenses, worsens with lagged fund size. They find that this relationship is most evident amongst mutual funds that place capital in small and illiquid assets, thereby proposing that such adverse scale effect is associated to liquidity constraints. Ferreira, Keswani, Miguel, and Ramos (2011) find that this negative relationship is present only in the US market and affirm that the positive and significant effect between the size and performance for non-US funds is due to the size difference between US and non-US fund industry.

Using European collective vehicles' data, Otten and Bams (2000) show a significantly positive relationship between risk-adjusted performance and fund size, thereby suggesting the presence of economies of scale. Similarly, Annaert, Van Den Broeck, and Vander Vennet (2003) also investigate the relationship of European fund performance over the period 1995 and 1998 and conclude that mutual fund efficiency is positively related to size and historical performance.

In the emerging world, Prasomsak (2001) (cited in Suppa-Aim, 2010), examines 77 Thai mutual funds for the period 1998−2000 and claims that fund performance is negatively related to size. The results of Suppa-Aim are also consistent with the study of Prasomsak (2001). Nevertheless, these contrast the conclusions of Nitibhon (2004) (cited in Suppa-Aim, 2010) whose evidence supports a positive relationship. In addition, Shu, Yeh, and Yamada (2002) in examining Taiwan mutual funds finds that larger funds are better able to generate returns than small funds.

Analysing the relationship between the mutual fund's performance and its TER provides a test for the efficiency of the scheme. Costs and fees differ significantly from one collective investment vehicle to another. Nevertheless, it is likely that the scheme with higher internal costs also cover higher expense ratios. Using a dataset of US collective structures, some researchers observe a negative relationship of fees with net-fee performance (Carhart, 1997) and also before-fee performance (Gil-Bazo & Ruiz-Verdu, 2008).

Dahlquist, Engstrom, and Soderlind (2000) examine the Swedish mutual fund industry throughout the period 1992−1997 and find good performance amongst the low-fee equity and money market collective vehicles. Similarly, Otten and Bams (2000) find this negative relation for the German, the Netherlands and British domiciled funds. On the other hand, Bauer, Otten, and Rad (2006), who employ a survivorship-bias controlled sample of 143 New Zealand equity funds over 1990−2003 find that risk-adjusted performance is positively related to the expense ratio.

The Greek fund industry has been analysed by Babalos, Kostakis, and Philippas (2009) who interestingly evidence that fund managers alter their

expense ratio on a yearly basis so as to capture the returns they produced in excess of their peers. In addition, they document that a high TER is a significant forecaster of future negative performance. Also, Gottesman and Morey (2006) find the presence of a negative and significantly related relationship between the expense ratio and fund performance of all diversified emerging market funds.

The relation between fund's age and performance has attracted limited academic attention in previous studies. Chen et al. (2004) and Ferreira et al. (2011) find no relation between age and performance of US mutual funds. In addition, Ferreira et al. (2011) also evidence that younger funds appear to perform better than mature funds outside the United States.

Similarly, Blake and Timmermann (1998) reveal that CISs outperform during their first year of inception. Also, Otten and Bams (2000) find that newer funds perform better than mature ones, besides age to be negatively related to risk-adjusted performance in some of the European countries. Bauer, Koedijk, and Otten (2002), using a worldwide data containing 103 German, UK and US ethical mutual funds conclude that underperformance is justified by the exposure of newer collective structures to higher market risk whilst investing in lesser securities. They also find that due to their small size, younger funds' returns and rating are further susceptible to manipulation.

In contrast to the developed world studies, Suppa-Aim (2010) presents weak evidence that Thai younger funds perform better than older ones. Furthermore, consistent with the findings of Chen et al. (2004) and Ferreira et al. (2011), he finds that fund age cannot explain performance.

The theoretical asset pricing models support the notion that bearing relative risk in securities markets yields a positive reward. As it happens, Fama and MacBeth (1974) in their study using all common stocks trading on the NYSE through the period 1926−1968, did not reject the hypothesis that average returns reflect the efforts of risk-adverse investors to hold efficient portfolios and particularly that on whole there is a positive tradeoff between risk and return.

Nonetheless, Jensen, Black, and Scholes (1972) through employing similar data as Fama and MacBeth (1974) reveals that excess return on an asset is not strictly proportional to its risk. This negative relationship between risk and return was also observed by Baker and Haugen (2012) who analysed stocks in 21 developed countries and 12 EMs over the time period 1990−2011 as well as by Blitz, Pang, and van Vliet (2012) who examined emerging equity markets.

METHODOLOGY AND DATA

Researcher Fred Kerlinger asserts that '*there's no such thing as qualitative data. Everything is either 1 or 0*'. To this another researcher, Donald Campbell, alleges that '*all research ultimately has a qualitative grounding*'. Miles and Humber (1994) define such a situation as essentially unproductive and they, and many other researchers, such as Bryman (1988) argue for a '*best of both worlds*' method and propose that qualitative and quantitative analyses should be combined (cited in Hughes, n.d.). Each approach has its own positive characteristics. Nevertheless, the extent of research already performed in the subject of interest will determine whether the study will be quantitative or qualitative and hence exploratory, descriptive or explanatory.

Far-reaching literature already exist in the area of collective investment vehicles, yet academics still reach opposing conclusions when it comes to analysing the skill of fund managers to outperform the market and the fund-specific characteristics that influence performance. Accordingly, explanatory research is best appropriate for the present study. Even though fund literature on EMs is narrow and inconclusive, models already exist internationally and can be bespoke to the emerging world.

Sample Description

Data on collective structures is obtained from the Thomson Reuters Eikon Fund Screener. The sample, free of survivorship bias, restricts to equity funds and excludes alternative assets, fixed income, commodities, mixed assets, money-market securities and real estate, which have a geographical investment concentration on EM economies. The dataset is limited to 949 equity funds and is further narrowed to 137 when constrained to the US, European and EM domiciled funds, over the period January 2004 to December 2014.

In order to assess whether, on average, fund managers are able to collectively beat the market, the researcher takes an equally weighted portfolio approach and groups the individual fund's monthly NAVs into three portfolios according to the fund's origin.

The US domiciled portfolio characterize 76.32% of the sample in terms of size as measured by TNA but only 35.04% in terms of the total number of funds, whereas the European and EM domiciled portfolios

characterize 23.66% and 0.02% respectively, in terms of size and 62.04% and 2.92% respectively, in terms of the total number of funds. This is in some way consistent with the evidence in Otten and Bams (2000), Otten and Schweitzer (2002), Ferreira, Miguel, and Ramos (2007) and Ferreira et al. (2011), the fund industry in the United States with a focus on EMs is much superior than the European industry, whilst the number of funds is much higher in Europe, ensuing in a smaller average size of the individual collective vehicle in Europe.

The study also seeks to examine mutual funds' performance given different fund characteristics, namely: size as measured by TNA, TER which is calculated after deducting for reimbursements but before any expense offsets and brokerage service arrangements, longevity quantified from the fund's launch date and risk as represented by the fund's standard deviation for one-year to last month end.

This part of the research takes into account only the US and European domiciled funds, given that no complete data is available for the EM domiciled funds. Here, both the US and European collective structures are grouped into three separate equally weighted portfolios, specifically the lower and upper 30th percentiles as well as the middle 40th percentile, yielding a total of 24 equally weighted portfolios.

The rationale for taking on the percentile method is to capture the extreme values into the top and bottom percentiles, whilst the middle percentile can embody the '*standard*' investment structure. Thereby, for the size characteristic, the lower and upper 30th percentile incorporate the smallest and largest collective structures measured by the lowest and highest TNA respectively, whereas the middle 40th percentile comprises the medium sized structures indicated by an intermediate TNA. The same methodology is employed for composing the rest of the portfolios as based on their expense ratio, age and risk characteristics, as represented in the table below.

	Characteristics			
	Size	TER	Age	Risk
Equally weighted portfolios				
Lower 30th percentile	Small	Efficient	Mature	Lowest
Middle 40th percentile	Medium	Standard	Middle	Moderate
Upper 30th percentile	Big	Inefficient	Young	Highest

The table above reports average statistics of the mutual funds' equally weighted portfolios characterizing the equity dataset. In particular, the researcher observes that the States retains its name as the 'world's largest mutual fund market' also when it comes to placing capital in emerging economies; the US domiciled funds exhibit far larger TNA when compared to the European domiciled funds under each cap category, specifically small, medium and large. It is assumed that their large size further contributes to managing and operating the scheme in a more efficient way, possibly due to economies of scale, as shown by the lower TER. Furthermore, both the US and European domiciled fund portfolios seem to have entered the emerging world simultaneously; there is only a three year discrepancy between the mid-aged and the young US and European structures. With regards to the risk characteristic, the figures reveal that European domiciled funds are perceived to be less risky than the US domiciled funds for the past year. A likely explanation could be that being larger, the US fund industry covers a number of emerging countries pertaining to the EM universe, including the shady and risky areas, whereas on average European funds tend to be more risk averse and thereby avoid markets which are less understood or which impose barriers to entry such as regulatory aspects and legal costs. The smaller size of the European funds may in actual fact possess inadequate financial resources and expertise to access the risky and remote markets. It can therefore be concluded that, on average, US funds are larger and more efficient, but riskier, than the same aged European funds.

	Characteristics							
	Size		TER		Age		Risk	
	US	European	US	European	US	European	US	European
Equally weighted portfolios								
Lower 30th percentile	$95m	$11m	0.79%	1.56%	22 years	22 years	10.54%	8.73%
Middle 40th percentile	$664m	$83m	1.30%	2.02%	19 years	16 years	13.78%	11.12%
Upper 30th percentile	$5,579m	$1,021m	1.66%	2.82%	16 years	13 years	15.65%	13.46%

Analysing the research hypotheses through a portfolio approach assist in obtaining a global representation of collective investment vehicle performance as well as it directly allows the evaluation of any disparity between

fund managers domiciled elsewhere. In this regard, segregating the portfolios according to the fund's domicile is particular necessary because each country and thereby the fund manager, has its own style and rules to follow for how a collective structure is assembled, including the regulatory environment and investment restrictions, as described in the section 'Literature Review'.

The equity fund dataset employed in the present research takes in active, liquidated and merged funds, besides keeping that share class which Thomson Reuters Eikon identifies as primary fund to avoid multiple counting of returns, and thereby is not shaped by these biases. In addition, all 137 equity funds have survived the entire period of observation and therefore there is no way such phenomena could give rise to the appearance of higher performance.

Asset Pricing Models, Benchmarks and Proxies

One of the rationales for this surge of interest in investing in collective structures is the expectation of investment benefits that a fund manager may accomplish. Eventually, the manager's performance must be appraised in light of the outcomes. Nevertheless, this apparent clear-cut endeavour is misleadingly complex owing to two principal issues; namely the selection of model and the selection of benchmark.

Jensen (1968) is amongst the principal papers that broadly evaluates funds' performance. This Single-Factor model is the first measure employed by the present research to gauge how much a manager's investment ability contributes to the fund's return. Nevertheless, its method, as built on the CAPM, does not capture all risk factors which may result in alpha to be mis-specified (Fama & French, 1993).

Accordingly, the Fama and French's (1993) and Carhart's (1997) pricing models are also employed in the research. The former model enhances average CAPM pricing errors by adding size and book-to-market factors. In addition, Carhart (1997) adds a factor that captures the Jegadeesh and Titman's (1993) momentum anomaly. Finance literature proposes that small firms, as opposed to large, tend to have higher betas and thereby would anticipate receiving higher returns. Also, historically, securities with a high book-to-value ratio, or value firms, would appreciably achieve higher returns than securities with a low ratio, or growth firms. The momentum effect further proposes that securities that have performed well (poor) over the previous few months persist in experiencing high (low)

returns over the next month. Through employing these models, the noise in the alpha estimates is significantly reduced and thereby captures the true manager's skill, if any, to outperform the market. The SMB, HML and PR1YR variables for Asia-Pacific excluding Japan ('APeJ') region are obtained from Kenneth French's online data library. The APeJ factors are best appropriate for the present research provided that it aims at US, European and EM domiciled funds with an investment concentration in EMs. Unsurprisingly, the researcher, though also analysing the Fama and French's Global, Global excluding US and European factors observes that their explanatory strength for the equally weighted equity funds portfolios was less significant, yet not powerless, thereby implying a degree of global correlation amongst financial market.

Taking a different approach to the majority of existing studies, the present research also examines collective structures' performance in light of their specific characteristics through employing the three asset pricing models, namely Jensen's (1968) single factor model, Fama and French (1993) and Carhart (1997) multi-factor models.

Employing the three asset pricing models also comprise the selection of a market benchmark and a risk-free rate of return. In particular, given the subject of interest, the MSCI Emerging Markets Index is used. This benchmark is a '*free float-adjusted market capitalisation index*' and is intended to determine equity market performance in the global EM universe (MSCI.com, n.d.). The end-of-month trading price ('LTP') is obtained from the Thomson Reuters Eikon. The ask yield ('ASK') of the three-month US T-Bill, also obtained from the Thomson Reuters Eikon, is employed as a proxy for the risk-free rate.

Model Design in the Regression Analysis

The equity fund dataset is adjusted to fit the Jensen's (1968), Fama and French's (1993) and Carhart's (1997) pricing models, and generate alphas. The natural logarithm change, ln Δ, on the variables is taken to remove any non-stationarity and thereby to prevent violations of the model assumptions, as further described in 'The CLRM Assumptions' section hereunder. The models can be represented as:

$$\ln \Delta XR_{pt} = \alpha_p + \beta_{p1}(\ln \Delta XR_{mt}) + \varepsilon_{pt}$$

where $\ln \Delta XR_{pt}$ is the natural logarithm transformation on the excess return of portfolio p at time t, $\ln \Delta XR_{mt}$ is the natural logarithm transformation on the MSCI Emerging Markets Index excess return at time t, α_p is the mutual fund's alpha for portfolio p, β_{p1} is the sensitivity of the portfolios' excess returns to the independent variables and ε_{pt} is the residual term for portfolio p.

$$\ln \Delta XR_{pt} = \alpha_p + \beta_{p1}(\ln \Delta XR_{mt}) + \beta_{p2}(\mathrm{SMB}_t) + \beta_{p3}(\mathrm{HML}_t) + \varepsilon_{pt}$$

where SMB_t and HML_t are the Small Minus Big and High Minus Low risk exposures, respectively.

$$\ln \Delta XR_{pt} = \alpha_p + \beta_{p1}(\ln \Delta XR_{mt}) + \beta_{p2}(\mathrm{SMB}_t) + \beta_{p3}(\mathrm{HML}_t) + \beta_{p4}(\mathrm{PR1YR}_t) + \varepsilon_{pt}$$

where $\mathrm{PR1YR}_t$ is the momentum risk factor.

The CLRM Assumptions

Regression analysis is central to the present research, and thereby making sure that data meets the associated assumptions assists in precluding Type I and Type II error. Specifically, if the CLRM assumptions are violated, the Ordinary Least Squares ('OLS') estimator will be unable to produce a Best Linear Unbiased Estimator (BLUE) results.

The equity dataset is found to overall satisfy such fundamental assumptions, namely the zero-mean assumption through including a constant term in the regression model, stationarity as verified by the Augmented Dickey-Fuller ('ADF') and the Kwiatkowski–Phillips–Schmidt–Shin ('KPSS') tests, weak presence of heteroscedasticity and no serial correlation which was tested by the Durbin–Watson ('DW') statistic and the Breusch–Godfrey ('BG') test. Despite the data not being normally distributed, as evidenced by the Jarque–Bera ('JB') statistic, it is well-known that asset returns do not follow a bell-shaped distribution, and thereby such assumption may be relaxed.

At all times the legitimacy of the regression model rests on the CLRM assumptions. Nevertheless, in instances where at least one assumption has been relaxed or does not hold, it does not necessary imply that data is untrue. Rather, the overall validity of the model can also be observed by looking at the *R*-Squared. In the present study all regressions exhibit a high

R-Squared, very close to 1, and thereby indicates that the sample regressions give an almost '*perfect fit*'. An important property of the *R*-Squared is that, the larger the number of explanatory variables in a model, the higher the *R*-Squared will be. This is in fact evidenced in the equity fund dataset since the *R*-Squared obtained in the regression for the Single-Factor Model are smaller than those obtained for the Three- and Four-Factor Models.

Nonetheless, as stated by Gujarati (2006), '*... comparing the* R^2 *values of two models with the same dependent variables but with deferring number of explanatory variables is essentially like comparing apples and oranges*'. Therefore, it would be more appropriate to establish the analysis on a measure of '*goodness of fit*' that is adjusted for the number of explanatory variables in the model – the adjusted *R*-Squared. The adjusted *R*-Squared, for degrees of freedom, eliminates any positive bias in the *R*-Squared and hence provides an even more variability then *R*-Squared itself. Unsurprisingly, the adjusted *R*-Squared values for all portfolios are found to be slightly lower, still very close to 1, than the corresponding unadjusted *R*-Squared values.

RESULTS AND ANALYSIS

The section progresses by analysing comprehensively two issues: Firstly, how do US, European and EM fund managers perform on a risk-adjusted basis? Are they able to collectively generate alphas whilst investing in apparently less efficient markets? Secondly, how do their structures perform given the funds' specific characteristics?

Asset Pricing Model Results for Mutual Funds with an Emerging Market Exposure

Many fund managers attempt to recognise asset classes, to add to their portfolios, which are under- or over-valued and are anticipated to move in a certain direction in the future as price leans towards their actual intrinsic values. These managers often set their mind at selecting those securities which they believe will '*beat the market*' and hence outperform market benchmarks and mainstream equity indices. Undoubtedly, any edge that managers own, when it comes to employing valuation techniques to assist

them in their investment decisions and asset allocation, can be translated into considerable profits.

Nevertheless, believers of the EMH argue that, in efficient markets, no such manager is ever able to consistently produce excess profits even if he uses his best efforts, and that the only way a manager can perhaps attain higher returns is by engaging in riskier securities. There is a general consensus that EMs, by their very nature are riskier and less efficient along the world's spectrum (Fisher, 2014; Russell.com, 2013; Swedroe, 2014), and thereby have higher tendencies for the presence of arbitrage opportunities. This raises the interest to investigate whether it is practical to consider that the '*lesser*' intense competition amongst managers allocating resources to the EM regions allows them to actually '*beat the market*' over a period of time, and whether investors' tolerance for the extra risk is indeed compensated by the higher risk-adjusted returns as measured by alpha.

Table 1 represents the outcomes of the estimations of Jensen's (1968) Single-Factor Model, Fama and French's (1993) Three-Factor Model and Carhart's (1997) Four-Factor Model of the US, European and EM domiciled collective investment vehicles. The empirical results evidently do not demonstrate any nonnegative alphas, and hence no creation of value, for all three equally weighted fund portfolios. In actual fact, they deliver an alpha which is not statistically different from zero, other than for the US domiciled portfolio which exhibits statistically significant but negative alpha under all three asset-pricing models. For this reason, it is meaningless to search for mispriced securities or try to foresee trends in the '*less*' efficient markets, as overall no particular fund portfolio is generating an average return that is higher to that of the market index.

Furthermore, it can be observed that the alphas for the three equally weighted portfolios are fairly alike, which is not a surprising result given that all portfolios have an exposure to the emerging economies. In this regard, investors wishing to gain exposure to the emerging world or fund managers whose objective is the investment in other units of collective investment vehicles, should not be concerned on whether to select the services of a US, a European or an EM fund manager, but should rather take into account the regulatory aspects of their home country and the prevailing charges of the scheme prior to committing. Prospective investors ought to know that performance fees, which most often are in place to tie the fund managers' reward to their level of return, may result in amplified risk as they try to multiply incentive levels by undertaking riskier or more speculative investments than outlined in the schemes' prospectus. Investors

Table 1. Empirical Results for the Asset-Pricing Models.

Jensen's (1968) Single-Factor Model

Series	α_p	β_{p1}	Adj. R^2
Portfolio U.S.	−0.0034*	1.0037***	0.9989
Portfolio Europe	0.0015	0.9953***	0.9970
Portfolio EMs	−0.0017	1.0003***	0.9994

Fama and French's (1993) Three-Factor Model

Series	α_p	β_{p1}	β_{p2} (SMB)	β_{p3} (HML)	Adj. R^2
Portfolio U.S.	−0.0035**	1.0036***	−0.0003	0.0002	0.9989
Portfolio Europe	−0.0001	0.9954***	−0.0022**	0.0030**	0.9972
Portfolio EMs	−0.0016	0.9997***	−0.0012***	−0.0011**	0.9995

Carhart's (1997) Four-Factor Model

Series	α_p	β_{p1}	β_{p2} (SMB)	β_{p3} (HML)	β_{p4} (PR1YR)	Adj. R^2
Portfolio U.S.	−0.0041**	1.0039***	−0.0002	0.0004	0.0007	0.9989
Portfolio Europe	−0.0012	0.9960***	−0.0019*	0.0033***	0.00133*	0.9973
Portfolio EMs	−0.0018	0.9998***	−0.0012**	−0.0010*	0.0002	0.9995

The table presents the results of the estimations of Jensen's (1968) Single-Factor Model, Fama and French's (1993) Three-Factor Model and Carhart's (1997) Four-Factor Model of the U.S., European and EM domiciled collective structures with an investment concentration in emerging economies. The measures estimate equally weighted portfolios of equity funds from January 2004 to December 2014, using ordinary least squares. α_p indicates the abnormal returns of the portfolio; β_{pk} represents the sensitivity of the portfolio's excess returns to the independent variables; SMB is the size premium factor, which is the return of small stock portfolios in excess of returns of large stock portfolios; HML is the value premium factor, which is the return of stock portfolios with high B/M ratio in excess of returns of stock portfolios with low B/M ratio; PR1YR is the difference in return between a portfolio of past winners and a portfolio of past losers; Adj. R^2 is the modification of R^2 that adjusts for the number of terms in the regression. ***, **, * denote rejection of the null hypothesis at 1%, 5% and 10% level of significance, respectively.

should therefore focus on aligning their preferences regarding risk and return with the managers' motivation so as to avoid any conflicts of interest.

Evaluating betas can offer deeper insights into how fund managers perform. The empirical results show that β_{p1}, under the three asset pricing models, is found to be statistically significant, which outcome was predictable given that the relevant market portfolio is the mainstay component for explaining the equity fund portfolios' performance. Besides

the explanatory power, the beta coefficients are very close to one, thereby implying that on average the portfolios are composed of equity funds which entail similar risk structures as the MSCI Emerging Market Index. In addition, it is known that the fund portfolios do not have the same constituents as that of the market benchmark, yet their movements seem to be relatively positively correlated. This further provides an indication that, on average, the collective vehicles do not tend to deviate from the market and thereby a large fraction of the portfolios' constituents might be index replication structures and/or conservative active funds. The result is further supported by the absence of nonnegative alphas at portfolio levels, provided that at micro levels an equity fund could possibly enjoy a positive alpha, in which case this is concealed when analysing portfolios. Where an analysis on an individual fund's level is undertaken, conservative investors willing to preserve capital should focus on securities with lower betas, whilst investors willing to risk should look for high beta investments. Nevertheless, taking on higher risk gives only the *possibility* of higher returns, as such these are not guaranteed. Analysing further the betas, it can be observed that, on average, the US domiciled fund's portfolio is the least conservative, whereas the European fund portfolio exhibits the minimum fluctuations given their smaller beta coefficient.

The results are consistent with the majority of existing literature, such as that of Jensen (1968), Grinblatt and Titman (1989), Cumby and Glen (1990) and Elton and Gruber (1999) who examined the US collective vehicles, Blake and Timmermann (1998) who focused on UK funds and Białkowski and Otten's (2010) who based their analysis on the Polish fund industry, that collectively fund managers are unable to add value to their portfolios. Nonetheless, this does not necessary imply that there aren't any skilled managers around the globe, particularly since the data employed takes a portfolio approach rather than analysing mutual funds' performance individually.

There are therefore grounds to believe that emerging economies are very close to the EMH ideal and indeed market inefficiency for the latter regions might be an impression of market participants, where competition is in actual fact powerful amongst fund managers globally to profit from any new information. Any apparent opportunity to generate excess risk-adjusted returns will be exploited by fund managers until such time the arbitrage opportunity disappears. Systematically beating the market remains exceedingly hard, and seeking for mispriced securities for the average manager is a hard task which may not be worth the time. The prominent EMH saying: '*Trust market prices!*' (Clarke, Jandik, & Mandelker, 2001)

should be very well acknowledged by fund managers as well as by investors. An ordinary investor should not fall into the trap of the manager believing that his '*distinctive*' investment strategy will manifestly outshine the market.

Fund Managers' Investment Style Analysis

The study reveals that the US domiciled portfolio exhibits no significant exposure towards any of the factors, and thereby suggest a balanced orientation. Furthermore, European fund managers favour large over small cap stocks, as evidenced by the negative and significant beta coefficient for the SMB factor. This leads to the supposition that, on average, as small-cap stocks outperform the large, the equally weighted fund portfolio is affected negatively due to the existence of an inverse relationship. In addition, they are also more exposed to value firms given the positive statistically significant beta coefficient of the HML factor and to the PR1YR factor which results that they place efforts to investing in winning equity portfolios. With respect to the EM domiciled portfolio, results show that more weight is given to large and growth stocks, as illustrated by their significant negative SMB and HML beta coefficients, respectively.

This puts forward that the overall market, as based on the research data sample, is more comfortable to invest in large cap equity funds rather than small, hence taking advantage of added stability and lower volatility, whilst employing a blend in terms of value or growth, and momentum or contrarian strategies. These apparent results leave room for return opportunities for investors and fund managers, who believe that small cap funds outperform the large, value funds outperform the growth and that winner funds will continue an upward direction, as these fund managers are not taking full advantage of the market anomalies. Then again, since the data employed in the present study takes a portfolio approach rather than analysing funds at their individual level, this does not necessary imply that managers are not exposed to a single factor loading.

Influence of Mutual Fund Characteristics on Risk-Adjusted Performance

The question of how the mutual funds' attributes influence their risk-adjusted performance is principal to market participants because it can be the primary point of direction in choosing collective vehicles, besides it can

also assist fund managers to administer and select their portfolios more professionally and competently.

The approach employed in the present research stands out from the majority of existing literature, in that, rather than considering the funds' characteristics as the dependent or independent variables in the regression equation, it investigates how the different funds' characteristics, namely size, expense ratio, age and standard deviation, influence their risk-adjusted performance, and in particular whether the portfolios with such characteristics achieve superior or inferior risk-adjusted returns as measured by alpha than their peers.

Size

Table 2 shows that only the US portfolio achieved statistically significant results under all three asset pricing models. Furthermore, the researcher observes that the larger-sized portfolio has an edge over both the medium and small-sized competitors, provided that although it is not creating any value, on average, it is delivering the lowest negative alpha. The results further suggest that size and alpha generation are positively related whereby small-sized portfolio means smaller alpha and vice-versa. This recommends investors to opt for larger-sized collective structures when aiming to obtain an EM exposure.

Potential reasons for the US large-sized portfolio obtaining the lowest negative alpha may be due to the fact that large collective structures benefit from economies of scale, in that they are better able to spread their fixed expenses and have more resources for research whilst being administered by highly experienced professionals. It may also be the case that funds must reach a certain amount of TNA to realise sufficient returns to make up for their cost of acquiring and trading information. In addition, fund managers of larger structures may access investment opportunities not available to smaller market participants.

The results are consistent with those of Elton, Gruber, and Blake (1996a, 1996b) who finds that *all* large funds operate better than smaller ones when dataset is controlled for survivorship bias and Indro et al. (1999) who document that the size of non-indexed US schemes reflects implicit transaction costs and consequently diminishing marginal returns. Then again, Ferreira et al. (2011) find a negative relationship between US domiciled mutual funds' size and performance, but also reveals a positive and significant relationship between the non-US domiciled funds which they argue is due to the size difference between US and non-US fund industry.

Table 2. Size Model Statistics.

Jensen's (1968) Single-Factor Model

Series	α_p	β_{p1}	Adj. R^2
Portfolio U.S. Small	−0.0044**	1.0034***	0.9990
Portfolio U.S. Medium Sized	−0.0037*	1.0046***	0.9987
Portfolio U.S. Big	−0.0022	1.0029***	0.9989
Portfolio Europe Small	0.0010	0.9931***	0.9975
Portfolio Europe Medium Sized	−0.0004	0.9981***	0.9987
Portfolio Europe Big	0.0024	0.9952***	0.9958

Fama and French's (1993) Three-Factor Model

Series	α_p	β_{p1}	β_{p2} (SMB)	β_{p3} (HML)	Adj. R^2
Portfolio U.S. Small	−0.0043**	1.0034***	0.0000	−0.0002	0.9990
Portfolio U.S. Medium Sized	−0.0040**	1.0045***	−0.0004	0.0002	0.9987
Portfolio U.S. Big	−0.0025*	1.0029***	−0.0005	0.0006	0.9989
Portfolio Europe Small	−0.0002	0.9931***	−0.0020**	0.0021*	0.9978
Portfolio Europe Medium Sized	−0.0014	0.9981***	−0.0017**	0.0018**	0.9988
Portfolio Europe Big	0.0005	0.9954***	−0.0025**	0.0038***	0.9962

Carhart's (1997) Four-Factor Model

Series	α_p	β_{p1}	β_{p2} (SMB)	β_{p3} (HML)	β_{p4} (PR1YR)	Adj. R^2
Portfolio U.S. Small	−0.0047***	1.0036***	0.0001	0.0000	0.0005	0.9990
Portfolio U.S. Medium Sized	−0.0046**	1.0049***	−0.0003	0.0004	0.0008	0.9987
Portfolio U.S. Big	−0.0031*	1.0032***	−0.0004	0.0007	0.0006	0.9989
Portfolio Europe Small	−0.0014	0.9937***	−0.0017*	0.0025**	0.0014**	0.9977
Portfolio Europe Medium Sized	−0.0026	0.9987***	−0.0014**	0.0022***	0.0014***	0.9988
Portfolio Europe Big	−0.0006	0.9960***	−0.0022*	0.0041***	0.0013	0.9962

The table presents the results of the estimations of Jensen's (1968) Single-Factor Model, Fama and French's (1993) Three-Factor Model and Carhart's (1997) Four-Factor Model of the U.S. and European domiciled collective structures with an investment concentration in emerging economies. The measures estimate equally weighted portfolios of equity funds, specifically grouped by the lower and upper 30th percentile and the middle 40th percentile, who share the same size characteristic, from January 2004 to December 2014, using ordinary least squares. α_p indicates the abnormal returns of the portfolio; β_{pk} represents the sensitivity of the portfolio's excess returns to the independent variables; SMB is the size premium factor, which is the return of small stock portfolios in excess of returns of large stock portfolios; HML is the value premium factor, which is the return of stock portfolios with high B/M ratio in excess of returns of stock portfolios with low B/M ratio; PR1YR is the difference in return between a portfolio of past winners and a portfolio of past losers; Adj. R^2 is the modification of R^2 that adjusts for the number of terms in the regression. ***, **, * denote rejection of the null hypothesis at 1%, 5% and 10% level of significance, respectively.

Additionally, the researcher further observes that the US fund portfolio does not have a statistically significant exposure to the small-firm, book-to-market or momentum effects, whereas, although the European portfolio does not exhibit a statistically significant alpha, it has an exposure to large cap and value stocks. Also, the medium and small-sized European portfolios are exposed to the momentum effect.

Total Expense Ratio

Table 3 reports that the regression results are statistically significant for three out of the six portfolios, namely the US and European portfolios which incur an average expense ratio and the US portfolio which incurs the highest ratio. Overall, the portfolios generate an alpha which is fairly alike. Nevertheless, when observing the results with three decimal point precision, the US portfolio comprising the '*high-cost*' collective vehicles achieves an alpha, which although negative, is superior to its peers. Investors should therefore be concerned on whether as a minimum the most expensive collective structures are providing some kind of value over and above that of their peers with identical objectives. A possible explanation for this '*better*' alpha could be that fund managers are accessing more remotely EM regions which may still be in their infant stage or which do not meet the standards to be developed markets, and thereby might be providing greater growth potentials but along with higher costs.

Notwithstanding the above, fund managers and potential investors seeking to participate in emerging economies either directly or through investing in other units of CISs, should take into account the overall annual costs for an investment, including the scheme's trading activity, that is, the buying and selling of the portfolios' securities and redemption or switching fees (if applicable), which frequently are not included in the computation of the expense ratio but are to the cost of the participants.

The results are consistent with those of Bauer et al. (2006) who find a positive relationship between the risk-adjusted performance of New Zealand equity funds and expense ratio. However, several other academic studies, including those of Carhart (1997) for US funds and Dahlquist et al. (2000) and Otten and Bams (2000) for European funds, generate conflicting outcomes, thereby justifying the decision for market participants to avoid the buying of collective structures with high expenses. At the same time, Barber, Odean, and Zheng (2005) evidence that mutual funds with high expenses have the highest growth grates, leaving the decision of whether to opt for high or low-cost investment vehicles puzzling.

Table 3. Total Expense Ratio Model Statistic.

Jensen's (1968) Single-Factor Model

Series	α_p	β_{p1}	Adj. R^2
Portfolio U.S. Efficient	−0.0021	1.0023***	0.9991
Portfolio U.S. Standard	−0.0045**	1.0050***	0.9983
Portfolio U.S. Inefficient	−0.0033*	1.0034***	0.9990
Portfolio Europe Efficient	0.0023	0.9948***	0.9963
Portfolio Europe Standard	−0.0045**	1.0050***	0.9983
Portfolio Europe Inefficient	−0.0006	0.9958***	0.9973

Fama and French's (1993) Three-Factor Model

Series	α_p	β_{p1}	β_{p2} (SMB)	β_{p3} (HML)	Adj. R^2
Portfolio U.S. Efficient	−0.0023	1.0024***	−0.0002	0.0004	0.9991
Portfolio U.S. Standard	−0.0049**	1.0050***	−0.0008	0.0005	0.9983
Portfolio U.S. Inefficient	−0.0031*	1.0033***	0.0002	−0.0004	0.9990
Portfolio Europe Efficient	0.0006	0.9950***	−0.0024**	0.0032**	0.9966
Portfolio Europe Standard	−0.0049**	1.0050***	−0.0008	0.0005	0.9983
Portfolio Europe Inefficient	−0.0019	0.9961***	−0.0016	0.0027**	0.9974

Carhart's (1997) Four-Factor Model

Series	α_p	β_{p1}	β_{p2} (SMB)	β_{p3} (HML)	β_{p4} (PR1YR)	Adj. R^2
Portfolio U.S. Efficient	−0.0024	1.0025***	−0.0002	0.0005	0.0002	0.9991
Portfolio U.S. Standard	−0.0057**	1.0054***	−0.0006	0.0008	0.0001*	0.9984
Portfolio U.S. Inefficient	−0.0037**	1.0036***	0.0003	−0.0002	0.0008*	0.9990
Portfolio Europe Efficient	−0.0004	0.9955***	−0.0022*	0.0035***	0.0012	0.9966
Portfolio Europe Standard	−0.0057**	1.0054***	−0.0006	0.0008	0.0001*	0.9984
Portfolio Europe Inefficient	−0.00361	0.9969***	−0.0012	0.0032***	0.0020***	0.9976

The table presents the results of the estimations of Jensen's (1968) Single-Factor Model, Fama and French's (1993) Three-Factor Model and Carhart's (1997) Four-Factor Model of the U.S. and European domiciled collective structures with an investment concentration in emerging economies. The measures estimate equally weighted portfolios of equity funds, specifically grouped by the lower and upper 30th percentile and the middle 40th percentile, who share the same TER characteristic, from January 2004 to December 2014, using ordinary least squares. α_p indicates the abnormal returns of the portfolio; β_{pk} represents the sensitivity of the portfolio's excess returns to the independent variables; SMB is the size premium factor, which is the return of small stock portfolios in excess of returns of large stock portfolios; HML is the value premium factor, which is the return of stock portfolios with high B/M ratio in excess of returns of stock portfolios with low B/M ratio; PR1YR is the difference in return between a portfolio of past winners and a portfolio of past losers; Adj. R^2 is the modification of R^2 that adjusts for the number of terms in the regression. ***, **, * denote rejection of the null hypothesis at 1%, 5% and 10% level of significance, respectively.

The results further demonstrate that an identical factor amongst the three portfolios with a statistically significant alpha is their positive exposure to the momentum risk factor. Also, even though the European portfolios which incur the lowest and highest expenses do not display a statistically significant alpha, they show an exposure to large cap and value stocks and to value stocks whilst following the momentum effect, respectively.

Fund Longevity

The outcome from the regression analysis, as reported in Table 4, suggests that alpha is statistically significant for the three US portfolios, mainly made up of mature, middle-aged and young collective investment vehicles. More specifically, the researcher observes that the older structures' portfolio outperform its peers through generating the lowest negative alpha, owing to the fund managers' knowledgeable experience within the mutual fund industry. In addition, the middle-aged equity fund portfolio exhibits a negative alpha which is poorer to the portfolio composed of the youngest funds. This leads to the conclusion that equity funds' age has no apparent influence on risk-adjusted returns. It therefore offers grounds to believe that their risk-adjusted performance is rather dependent on current market situations.

The results are consistent with the research works as carried out by Chen et al. (2004) and Ferreira et al. (2007), Ferreira et al. (2011). Nonetheless, are in contrast to the conclusions obtained by Blake and Timmermann (1998) who reveal that CISs outperform during their first year of operation and Otten and Bams (2000) who find that newer funds perform better than mature ones, besides age to be negatively related to risk-adjusted performance in some European countries.

Furthermore, although the European portfolios as based on their age characteristic do not exhibit a statistically significant alpha their investment style has an exposure to large cap and value stocks, whilst additionally the mature and young-aged funds also perform momentum strategies.

Risk

Table 5 demonstrates the regression results for the equally weighted portfolios sharing similar risk attributes, as measured by the fund's standard deviation for one-year to last month end. In particular, it can be observed how the market betas gradually ascend from the safest to the riskiest equity fund portfolios. Additionally, the results demonstrate that only two out of six portfolios exhibit a statistically significant alpha, namely the US portfolio composed of the moderate and the highest risk collective structures.

Table 4. Age Model Statistic.

Jensen's (1968) Single-Factor Model

Series	α_p	β_{p1}	Adj. R^2
Portfolio U.S. Mature	−0.0030*	1.0039***	0.9989
Portfolio U.S. Medium	−0.0038**	1.0038***	0.9990
Portfolio U.S. Young	−0.0032*	1.0033***	0.9986
Portfolio Europe Mature	0.0014	0.9939***	0.9977
Portfolio Europe Medium	0.0021	0.9953***	0.9961
Portfolio Europe Young	−0.0007	0.9968***	0.9980

Fama and French's (1993) Three-Factor Model

Series	α_p	β_{p1}	β_{p2} (SMB)	β_{p3} (HML)	Adj. R^2
Portfolio U.S. Mature	−0.0031*	1.0039***	−0.0002	0.0002	0.9989
Portfolio U.S. Medium	−0.0040**	1.0037***	−0.0003	0.0001	0.9989
Portfolio U.S. Young	−0.0035*	1.0033***	−0.0005	0.0005	0.9986
Portfolio Europe Mature	0.0002	0.9939***	−0.0021**	0.0020*	0.9979
Portfolio Europe Medium	0.0003	0.9956***	−0.0023*	0.0035**	0.9964
Portfolio Europe Young	−0.0022	0.9969***	−0.0022**	0.0026***	0.9982

Carhart's (1997) Four-Factor Model

Series	α_p	β_{p1}	β_{p2} (SMB)	β_{p3} (HML)	β_{p4} (PR1YR)	Adj. R^2
Portfolio U.S. Mature	−0.0034*	1.0041***	−0.0001	0.0003	0.0004	0.9989
Portfolio U.S. Medium	−0.0044**	1.0040***	−0.0002	0.0002	0.0006	0.9990
Portfolio U.S. Young	−0.0044**	1.0038***	−0.0002	0.0008	0.0010*	0.9987
Portfolio Europe Mature	−0.0009	0.9944***	−0.0018**	0.0023**	0.0013**	0.9979
Portfolio Europe Medium	−0.0008	0.9962***	−0.0020*	0.0038***	0.0013	0.9964
Portfolio Europe Young	−0.00323	0.9974***	−0.0019**	0.0029***	0.0013**	0.9983

The table presents the results of the estimations of Jensen's (1968) Single-Factor Model, Fama and French's (1993) Three-Factor Model and Carhart's (1997) Four-Factor Model of the U.S. and European domiciled collective structures with an investment concentration in emerging economies. The measures estimate equally weighted portfolios of equity funds, specifically grouped by the lower and upper 30th percentile and the middle 40th percentile, who share the same age characteristic, from January 2004 to December 2014, using ordinary least squares. α_p indicates the abnormal returns of the portfolio; β_{pk} represents the sensitivity of the portfolio's excess returns to the independent variables; SMB is the size premium factor, which is the return of small stock portfolios in excess of returns of large stock portfolios; HML is the value premium factor, which is the return of stock portfolios with high B/M ratio in excess of returns of stock portfolios with low B/M ratio; PR1YR is the difference in return between a portfolio of past winners and a portfolio of past losers; Adj. R^2 is the modification of R^2 that adjusts for the number of terms in the regression. ***, **, * denote rejection of the null hypothesis at 1%, 5% and 10% level of significance, respectively.

Table 5. Risk Model Statistic.

Jensen's (1968) Single-Factor Model

Series	α_p	β_{p1}	Adj. R^2
Portfolio U.S. Lowest	−0.0028	1.0022***	0.9975
Portfolio U.S. Moderate	−0.0033**	1.0037***	0.9991
Portfolio U.S. Highest	−0.0042**	1.0054***	0.9987
Portfolio Europe Lowest	0.0000	0.9938***	0.9971
Portfolio Europe Moderate	0.0021	0.9950***	0.9964
Portfolio Europe Highest	−0.0009	0.9963***	0.9964

Fama and French's (1993) Three-Factor Model

Series	α_p	β_{p1}	β_{p2} (SMB)	β_{p3} (HML)	Adj. R^2
Portfolio U.S. Lowest	−0.0037	1.0022***	−0.0013	0.0016	0.9976
Portfolio U.S. Moderate	−0.0032**	1.0036***	0.0000	−0.0003	0.9991
Portfolio U.S. Highest	−0.0041**	1.0054***	7.49E−05	−0.0003	0.9987
Portfolio Europe Lowest	−0.0014	0.9941***	−0.0016	0.0028**	0.9972
Portfolio Europe Moderate	0.0004	0.9952***	−0.0023**	0.0033**	0.9967
Portfolio Europe Highest	−0.0027	0.9963***	−0.0029**	0.0032**	0.9967

Carhart's (1997) Four-Factor Model

Series	α_p	β_{p1}	β_{p2} (SMB)	β_{p3} (HML)	β_{p4} (PR1YR)	Adj. R^2
Portfolio U.S. Lowest	−0.0045	1.0026***	−0.0011	0.0019*	0.0009	0.9976
Portfolio U.S. Moderate	−0.0038**	1.0039***	0.0001	−0.0002	0.0007	0.9991
Portfolio U.S. Highest	−0.0044**	1.0055***	0.0001	−0.0002	0.0003	0.9987
Portfolio Europe Lowest	−0.0031	0.9949***	−0.0012	0.0034***	0.0021***	0.9974
Portfolio Europe Moderate	−0.0007	0.9957***	−0.0021*	0.0036***	0.0013	0.9967
Portfolio Europe Highest	−0.00379	0.9969***	−0.0027**	0.0035***	0.0013	0.9968

The table presents the results of the estimations of Jensen's (1968) Single-Factor Model, Fama and French's (1993) Three-Factor Model and Carhart's (1997) Four-Factor Model of the U.S. and European domiciled collective structures with an investment concentration in emerging economies. The measures estimate equally weighted portfolios of equity funds, specifically grouped by the lower and upper 30th percentile and the middle 40th percentile, who share the same risk characteristic, from January 2004 to December 2014, using ordinary least squares. α_p indicates the abnormal returns of the portfolio; β_{pk} represents the sensitivity of the portfolio's excess returns to the independent variables; SMB is the size premium factor, which is the return of small stock portfolios in excess of returns of large stock portfolios; HML is the value premium factor, which is the return of stock portfolios with high B/M ratio in excess of returns of stock portfolios with low B/M ratio; PR1YR is the difference in return between a portfolio of past winners and a portfolio of past losers; Adj. R^2 is the modification of R^2 that adjusts for the number of terms in the regression. ***, **, * denote rejection of the null hypothesis at 1%, 5% and 10% level of significance, respectively.

Unanticipated by the researcher the latter portfolio generated the largest negative alpha, and thereby fund managers who encountered the highest volatility and thereby have placed their capital into the riskier regions have not generated an exceptional gain but rather a deteriorated value. In other words, the highest risk US equity funds not only did they wipe away any benefits available, which would have been the case if alpha was negligible, but rather have generated an even negative alpha, leading to inferior risk-adjusted returns. This *'high risk/lower alpha generation or inferior risk-adjusted return'* occurrence clearly creates doubt as to whether market participants should engage themselves into risky asset classes with the hope of earning exceptional returns, when having an exposure to the emerging world.

This finding is in conflict with the theoretical asset pricing models which support the notion that bearing relative risk in securities markets yields a positive reward. It is therefore on this basis as to why the researcher anticipated results to show a negligible alpha and thereby no abnormal returns or losses. A possible explanation for this negative relationship is that investments in emerging regions may shed new light on the different hypothesis which has been proposed in literature to rationalise the apparently anomalous empirical relation between risk and return. Put simple, the asset pricing models assume a linear relationship between risk and return, despite results illustrating that actual return and compensation for added risk is increasing at a decreasing rate, rather than uniformly where alpha would have been equal to zero across all portfolios.

Nevertheless, the results are consistent with the conclusions observed by prominent researchers such as Jensen et al. (1972), and more recently Baker and Haugen (2012) and Blitz et al. (2012), who evidence that this relation is negative. In this regard, it is recommended that investors should opt for schemes having an average standard deviation when compared to that of their peers when considering mutual funds which concentrate on emerging markets.

In addition, the researcher further observes that although the US portfolio composed of the lowest risk collective structure and the European portfolios composed of the lowest, moderate and highest risk structures do not exhibit a statistically significant alpha, they all have an exposure to large cap and value stocks. Also, the European low risk fund portfolio exhibits the momentum effect.

CONCLUSION

Performance of the equally weighted equity fund portfolios, estimated by means of Jensen's (1968) model is consistent with the Fama and French's

(1993) Three-Factor model and Carhart's (1997) Four-Factor model showing that, on average, fund managers administering collective structures whose investment objective is geographically limited to the emerging regions, do not generate an average return that is higher to that of the market index. Additionally, the single factor model produces an alpha which, although negative, is superior to that obtained by the multifactor models, thereby resulting in an alpha which gradually deteriorates with the inclusion of the risk factor loadings alongside the systematic risk. Notwithstanding that the same conclusions have been obtained, CISs' performance is susceptible to the asset pricing model employed.

The use of the multifactor models also provides a highly constructive tool for understanding the strategies utilised by fund managers. The asset pricing models homogeneously suggest that, as a whole, the market is more at ease investing in large cap value equity funds whilst placing efforts in winning portfolios, thereby leaving space for return opportunities for market participants who believe that small cap funds outperform the large, as these fund managers are not taking full advantage of the market anomalies.

In addition to the ample research works as carried out on collective structures' performance, their development and popularity have led to investigate issues such as: How do mutual funds perform given their characteristics? How can one differentiate a superior performing fund from another as based on its characteristics? The present study explores four fund attributes, namely size as measured by TNA, expense ratio, age and risk, and particularly reveals that large-sized portfolios have an edge over both the medium and small-sized competitors, expensive and older collective vehicles achieve an alpha which is superior to their peers whilst age has no apparent influence on the risk-adjusted returns. The high risk/lower risk-adjusted return also creates doubts as to whether market participants should engage themselves into risky assets with the hope of earning higher returns, at least when aiming to gain an exposure into the emerging world.

Unquestionably, diversification effects remain the basis for investing in collective investment vehicles, and thereby the researcher encourages market participants to incorporate EM exposed securities into their portfolios. EMs can offer new investment opportunities to prospective investors, especially if careful consideration is given to the mutual funds' characteristics analysed through the current research. Outstandingly, this work has shown that investors should not allow cost to be the deciding factor in selecting equity mutual funds, but rather to rationally elect the cheapest fund from a list of funds with an identical objective.

Finally, the study shows both similarities and inconsistencies to the existing literature as carried out on developed economies. Evidently, such inconsistencies call for further research so as to discover the grounds behind what exactly causes them.

LIMITATIONS AND RECOMMENDATIONS FOR FUTURE RESEARCH

Whilst the present empirical work takes a 10-year observation period which allows for the researcher to capture diverse economic scenarios, data cannot be traced further back more than the past decade, and perhaps overlooks market downturns which principally impacted the emerging economies, such as Black Monday, the 1997 Asian financial crises and the Argentine economic crisis of 2000. In addition, the evaluation of mutual fund performance through a portfolio approach makes it unable to distinguish the top-performing funds from the rest, even though such a drawback has been somehow limited when funds are segmented according to their characteristics. Nevertheless, the absence of concrete date on the characteristics of EM domiciled funds limits the present work to only evaluate the effect of US and European domiciled equity funds' characteristics on risk-adjusted performance, leaving the emerging region rather opaque in this aspect.

On the basis of the preceding review of the existing literature concerning to collective investment vehicles in emerging economies and through the process of this empirical work, a handful of new research ideas have cropped up. Primarily, the distinguishable characteristics of the less developed regions, including the infrequent trading, non-normality, structural breaks, high volatility and absence of liquidity, call for the need to develop performance models which take such aspects into account, and thereby have richer models in the fund literature. This further highlights the importance to examine how these characteristics affect shareholders' return as well as the existing performance measures. Secondly, the research encourages investigation on mutual funds at their individual level so as to present more precise understanding on whether fund managers can indeed offer some kind of value added to their investors, besides opportunities to diversify. Thirdly, an evaluation into how the various categories of mutual funds, mainly equity funds, alternative assets, fixed income, commodities, mixed assets, money-market securities and real estate fund, perform against each other across the world is also recommended. In addition, an interesting subject matter

would also be that of appraising country characteristics as potential determinants of collective investment vehicles' performance, including quality of legal institutions, economic and financial development.

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RECENT ANNUAL REPORT WEAKNESSES BY A SUPREME AUDIT INSTITUTION: AN ANALYSIS

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ABSTRACT

This chapter is based on the Annual Report on Public Accounts prepared by the Maltese National Audit Office (NAO), Malta's Supreme Audit Institution. Its objectives are to analyse and classify the reported issues, evaluate their significance and how the findings are reflected in the Public Sector, and assess the adequacy of the communication of these findings through the Annual Report. The research consisted of a qualitative analysis of the Annual Reports for the three years 2007, 2009 and 2011. This analysis was supplemented by unstructured interviews conducted with both NAO and Government officials. Findings report a significant number of issues emerging from different factors. The highest incidence of weaknesses was related to record-keeping and compliance with policies and procedures. Moreover, the interviews with NAO officials showed that the departments were not always taking on board

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the recommendations made through the Annual Reports, thus indicating a passive attitude towards the reported findings. The results also show that while the Government has its own structures of checks-and-balances to prevent and detect errors, and no internal control system is completely effective, there is still much room for improvement within the Public Sector to ensure that public funds are appropriately utilised. The detection of various issues by the NAO is therefore inevitable, particularly given the complexity and size of the Public Sector. In conclusion, the NAO findings should be more thoroughly examined to reduce the incidence of issues. Furthermore, the way forward should be directed at enhancing the current systems and promoting a more positive relationship between the NAO and auditees.

Keywords: National audit office; Public Sector; annual report; Malta

INTRODUCTION

Public Sector Auditing has a pivotal role with respect to the Public Accounts which are published by Government on an annual basis. In fact, through the evaluation of the use of public resources, Public Sector auditors enable Government to establish its accountability and integrity in the eyes of those it means to govern.

The National Audit Office (NAO), headed by the Auditor General (AG), is the main organ responsible for Public Sector Auditing in Malta. As per the Auditor General and National Audit Office Act 1997 and the Constitution of Malta 1964, the NAO's primary duty is to perform the financial and regulatory audit of Government accounts and of all those entities making use of public resources. In simpler terms, it is the 'Guardian of the Public purse' (National Audit Office, 2010). Acting as a watchdog, it carries out an unbiased investigative role to obtain an independent and objective opinion as to the truth and fairness of the Public Accounts, ensuring that these are of a sufficient quality and have been prepared in accordance with the relevant accounting framework.

The NAO's mandate also enables it to examine whether the audited entity '*has used the funds and resources available to it effectively, efficiently, and economically without incurring expenditure which is unnecessary*' (Auditor General and National Audit Office Act, 1997). It also plays a consulting role by flagging areas of potential improvements through the Annual Report.

The output of the NAO's Financial and Compliance Audit is the Annual Audit Report on Public Accounts. This is the main vehicle providing assurance as to the validity and fairness of the representations claimed in the Public Accounts. The Annual Report should be structured in the best possible way to demonstrate the results of the audit procedures in a clear, holistic and understandable manner. This report should instil credibility in the Government's operations, reduce the risk of corruption and protect the interests of the general public.

The aim of this study is to identify the major issues raised by the NAO in the 2007, 2009 and 2011 Annual Reports, and to assess their significance and implications. The study also seeks to assess how these issues were reflected within the Government system and whether there was adequate communication of the issues to the users.

This study focuses exclusively on Financial and Compliance Audits within the statutory Annual Report (excluding Arrears of Revenue Reports and Local Councils sections) and was limited to three out of the six published Annual Reports covering the period 2006–2011. In order to study the trend in weaknesses, Annual Reports were selected for review on an alternating year basis (2007, 2009 and 2011).

The reports (Auditor General of Malta, 2008, 2010, 2012) were analysed to assess the adequacy of the communication to the users and to classify the reported weaknesses into six categories. This was supplemented by a qualitative research approach whereby interviews were held with both NAO and Government officers to gain a better insight from both the preparers of the Annual Report and its users.

The rest of this chapter is divided into five main sections. The following section presents an evaluation of relevant literature. This is followed by a description of the research methodology adopted in the study. The findings of the study are presented and discussed in subsequent sections. The final section concludes the study and forwards some recommendations.

LITERATURE REVIEW

The Public Sector presents us with a classic case of the Principal–Agent Problem, where a conflict exists between the elected Government representatives (Agent), who have been entrusted with the stewardship of public funds, and the general public (Principal), whose main concern is to ensure that the elected representatives and Government officials are not using these resources to further their own personal interests.

Therefore, in line with the professional guidelines issued by the IIA (2006), in order to instil confidence in the Public Accounts prepared by Government, there is the need for an independent oversight body having the responsibility to assess whether the real measurement of Government's performance coincides with the reported results. This role is fulfilled by the Supreme Audit Institution (SAI), which is defined by the International Organization of Supreme Audit Institutions (INTOSAI, 2010b) in ISSAI 1003 as '*The public body of a State which … exercises by virtue of law, the highest public auditing function of that State*'.

Corporate Governance

'*Corporate governance generally refers to the processes by which organizations are directed, controlled, and held to account*' (Australian National Audit Office, 1999). Although this definition is predominantly directed towards entities in the Private Sector, the same principles can and should be applied in the Public Sector. The primary difference between entities in the Private and Public Sector is embodied in the identity of their stakeholders. Whilst the directors of the former dedicate their efforts to the maximisation of shareholder value, Public Sector entities face a wide spectrum of stakeholders, whose diverse interests must be taken into account when formulating strategies in line with broader government policy (Australian National Audit Office, 1999).

The three fundamental principles underlying Good Governance are Transparency, Integrity and Accountability. This instils confidence in the Government's operations, reduces the risks of corruption and ensures that appointed officials behave with integrity and responsibility. Ultimately, this results in better service being provided to the people. The SAI is a significant part of the Governance process, helping to strike a '*balance between freedom to manage, accountability and the legitimate interests of the different stakeholders*' (IFAC Public Sector Committee, 2001).

Accountability refers to the '*obligation to answer for a responsibility that has been conferred*' (IFAC Public Sector Committee, 2001). According to Bovens (2006), public accountability implies an obligation for the Agent to report on his conduct; a possibility for the Principal to review the Agent's performance, providing room for the Agent's explanations; and the sanctioning of good or bad behaviour. Locally, the accountability chain flows upwards from Civil Servants to Ministers to Parliament. Ultimately,

the elected representatives are answerable to the citizens and '*render account to the voters at election time*' (Bovens, 2006; Cachia & Baldacchino, 2012a, 2012b).

In most Parliamentary democracies, of which Malta is an example, there is the separation between the Executive and the Legislative branches of Government. The Executive branch is held accountable for the use of public money. Through Cabinet, it implements financial plans in line with its selected policies and has the duty to set up proper governance structures and to provide reports explaining its performance as the steward of public money.

The Legislative branch, through Parliament, provides the Executive with the authority to carry out its financial plan for the subsequent period (the Budget). More importantly, the Legislative is responsible for overseeing the Executive's performance. In Malta, the Public Accounts Committee (PAC) is entrusted by law with the powers to scrutinise public financial administration. It is empowered to examine the accounts of public bodies, review the Audit Reports issued by the AG and report to the House of Representatives (HoR) about any issues or recommendations that may result from the Annual Report (HoR Standing Orders: Art. 120E). Moreover, it can summon public officials for hearings to provide explanations in the course of inquiries into the Public Accounts.

The third entity that completes the Accountability Process within the Public Sector is the Legislative Auditor. Accountability requires the entities receiving public funds to properly disclose all information regarding their annual performance in the form of understandable financial statements. The Legislative Auditor audits these financial statements in order to obtain an objective and independent opinion as to whether these financial statements are fairly stated.

The NAO holds the Maltese Executive to account as to the utilisation of public assets and the economy, efficiency and effectiveness in its performance. This tri-party structure subjects the Executive to external scrutiny to reduce the possibility of misuse of public funds or corrupt practices.

The Functions of Public Sector Auditing

Public Sector Auditing has three main functions, as outlined by the IIA (2006):

Oversight: Government Auditing examines whether public funds are being properly used for the purposes for which they were raised. It also

compares the actual performance with the stated objectives and ensures that cases concerning fraud or corruption are detected.

Insight: SAIs also perform a consulting role by assessing the adequacy of Government programs to achieve the intended results and help to evaluate alternative practices in response to discovered problems.

Foresight: Finally, SAIs may act as eye-openers with regards to upcoming challenges in the future through the risk assessment exercise conducted during the audit itself. For instance, assessing the adequacy of the internal control structure can deter fraudulent activity. An important thing to keep in mind is self-review threat. When making recommendations, one could end up auditing these same proposals in successive years. Therefore, one needs to guard against such threats by ensuring objectivity and impartiality.

> Ultimately, government auditing strengthens public governance by providing for accountability and protecting the core values of government — ensuring managers and officials conduct the public's business transparently, fairly, and honestly, and with equity and probity. (IIA, 2006)

The Annual Report

SAIs review the Public Accounts and report to the general public in the form of an Annual Report. The Annual Report must be submitted to the Speaker of the HoR within 12 months from the financial year-end, who then presents the report to the HoR. The Annual Report serves as a counter balance to the powers entrusted to all civil servants directing and managing Government operations. Its main function is to try and instil confidence in Public Administration. '*The philosophy … is that in a democracy the citizen is entitled to have a fair and independent appraisal as to whether all public funds are being expended appropriately and judiciously*' (National Audit Office, 2010).

In the last decade, there have been pressures to adjust the approach taken by the NAO in its work, as represented in the Annual Report. The most important leap was from the audit being a post-mortem activity that analyses the past to become a future-oriented activity by supplementing the findings in the Annual Report with recommendations to make Public Service more effective (Sciberras, 2004). The SAI is in a strategic position, where through its legal mandate, it has the opportunity to use the myriad of information available both for an oversight function and as a proponent of change (Lord Sharman of Redlynch, 2001, p. 42).

The structure of each audit report is described in Fig. 1:

Fig. 1. The Structure of Audit Reports.

Of particular importance is the special relationship that exists between the NAO and the PAC in respect of the Annual Report. The NAO scrutinises public finances and publishes its findings through the Annual Report, whilst the PAC uses this report to ensure that the issues identified are given their due attention and that the recommendations do not fall on deaf ears.

The Preparation Process of the Annual Report

The preparation process of the Annual Report is quite lengthy. Sciberras (2004) splits this process into three main stages:

The Planning Stage: Since the NAO's mandate is very extensive, a plan to allocate the available resources amongst specific jobs is needed. The NAO prepares a three-year plan, which ensures that each department will be reviewed at least once within this period. Apart from this, an annual audit plan is drawn up, outlining the audits to be performed. The resources needed, in terms of required staffing and time frames, are also determined. This plan may be flexed during the year according to circumstances.

A significant part of the Planning Process consists of understanding the entity being audited in order to analyse the level of risk accompanying that audit. As explained by Camilleri (2004, pp. 17–18), factors such as the nature of the entity, regulatory factors, the entity's objectives and the internal control environment are studied.

The Execution Stage: Once the Audit Program is approved, different audit teams (averaging 2–3 members) are assigned audit tasks. In order to ensure that a proper audit is conducted, the audit team is empowered by law to visit/station itself at the auditee's site and to collect all information deemed relevant to the audit, whilst applying care and due diligence in the handling of sensitive data. Upon completion, the Principal Auditor reviews the work and discusses it with the Audit Manager to ensure that the audit objectives were achieved.

The Reporting Stage: A draft Audit Report is prepared by the Principal Auditor including all the necessary documentation to support the conclusions and is reviewed by the Unit Manager. This Report is then forwarded to the Assistant AG for approval, who assesses the audit based on the documentation provided. The finalised report is sent to the auditee in the form of a management letter. The auditee, in turn, reviews this report and comments on the recommendations put forward by the NAO. This should be supplemented by describing the remedies being proposed to mitigate the identified weaknesses. The auditee's response is included in the Final Audit Report.

Any pending issues are discussed with the auditee in an exit conference, where the auditee is allowed to provide any relevant explanations. In some cases, previous conclusions may be modified. Finally, the Audit Reports are combined together and sent to the AG for final review. Upon approval by the AG, the Annual Report is published and tabled in front of Parliament for public scrutiny.

RESEARCH METHODOLOGY

The NAO Annual Reports, which were provided by the NAO, formed the basis for the research. The contents of these reports were read and analysed carefully to classify the reported weaknesses into categories and assess the adequacy of the communication to the users. The analysis was complemented by interviews held to gain a better insight into the findings that emerged from the analysis of the Annual Reports.

In addition, a review of past dissertations examining the role of the NAO was invaluable in gaining a thorough understanding of the subject (Brincat, 2007; Sciberras, 2004). Information was also sought through the internet to build a solid literature review and also to keep abreast with current developments. This enabled the search for additional background information from a myriad of sources, such as newspaper articles, journals and websites. The latter included the use of the Maltese Government's e-portal to obtain access to relevant pieces of legislation and Public Sector guidelines.

Classification of Reported Weaknesses in the Annual Reports

The reported weaknesses were classified into six broad categories, which have been chosen to provide a logical continuity with the methodology used by Brincat (2007). The categories of weaknesses are:

1. Lack of Authorisations
2. Inadequate Segregation of Duties
3. Inadequate Record-keeping
4. Lack of Reconciliations
5. Inadequate Safeguarding of Assets
6. Non-compliance with Policies and Procedures

The data collected was then analysed to extract relevant information, enabling representation of reported weaknesses by category and also by auditee. A small number of reported issues could not be categorised under a specific heading and were grouped under the heading 'Other Weaknesses', which falls outside the scope of the study.

Unstructured Interviews

Following the analysis of weaknesses, a number of unstructured interviews were carried out to corroborate the findings. These interviews were held in February 2013 with three NAO officials and three Directors General (DGs) working within Government. These are experts in their fields and the interviews were aimed at gathering insights and opinions from both the preparers of the Annual Report and its users, enabling more meaningful conclusions to be reached.

This process provided a solid and comprehensive basis for the qualitative analysis and the unstructured interviews opened the doors to gather invaluable information, which could only be obtained from such experts.

RESEARCH FINDINGS

The results obtained from the classification of weaknesses are presented in Table 1.

The highest number of issues lies within 'Inadequate Record-Keeping' (39.93% of Total Weaknesses) followed by 'Non-Compliance with Policies and Procedures' tallying at 360 (29.34%). Together, these two categories incorporate 69% of reported issues. 'Lack of Authorisations' and 'Inadequate Safeguarding of Assets' comprise 15.89% and 10.59% of Total Weaknesses, respectively. Therefore, although not as widespread as the first two categories, these are still significant. The last two categories make up a mere 4.23% of Total Weaknesses (Table 1).

When comparing the two sets of results (Table 2), one can note that, although the ranking of categories shifted across studies, their relative importance has remained somewhat constant. In fact, 'Non-Compliance with Policies and Procedures' and 'Inadequate Record-keeping' still make up a significant majority of Total Weaknesses (Table 2).

The reported weaknesses were also categorised by auditee (Table 3). The Ministry having the most weaknesses under its name is the Ministry for Health, Elderly and Community Care, with a total of 169 weaknesses. Amongst the other auditees exceeding the 10% mark, there are the Ministry of Finance, the Economy and Investment (12.55%), and the

Table 1. Weaknesses by Category.

	Number of Weaknesses	Percentage of Total	Rank
Inadequate Record-Keeping	490	39.93	1
Non-compliance with Policies and Procedures	360	29.34	2
Lack of Authorisations	195	15.89	3
Inadequate Safeguarding of Assets	130	10.59	4
Lack of Reconciliations	30	2.44	5
Inadequate Segregation of Duties	22	1.79	6
Total	1,227	100.00	

Table 2. Weaknesses by Category in Comparison with Brincat (2007).

	Annual Reports 2007, 2009 and 2011		Annual Reports 2001–2005	
	Percentage of Total	Rank	Percentage of Total	Rank
Inadequate Record-Keeping	39.93	1	28.17	2
Non-compliance with Policies and Procedures	29.34	2	31.72	1
Lack of Authorisations	15.89	3	12.01	4
Inadequate Safeguarding of Assets	10.59	4	14.08	3
Lack of Reconciliations	2.44	5	3.42	6
Inadequate Segregation of Duties	1.79	6	10.60	5
Total	100.00		100.00	

Ministry of Foreign Affairs (12.47%). At the other end of the table, the Ministry for Urban Development and Roads recorded a modest 0.49% of Total Weaknesses.

As with every other audit, the NAO does not obtain absolute assurance but uses materiality and sampling to address high-risk areas. Furthermore, the NAO does not audit every aspect of Government every year. Hence, these figures should not be taken as an absolute measure of strength of each Government body but as an indication of weaknesses found in audited areas.

Inadequate Record-Keeping

With a little less than 40% of weaknesses, this category was the most frequently reported one. This category encompasses both purely financial record-keeping activities and also those that are administrative in nature. This is an important aspect of any business entity, let alone for a sector that is as delicate and widespread as the Public Sector.

With 23% of record-keeping weaknesses, the most frequent issue is the lack of supporting documentation for payments made. Mistakes of an accounting nature were the second most frequent weakness. Amongst the reported cases, there were accounting standards being misapplied, expenditure being allocated to wrong line items, inconsistencies and inaccuracies in the financial statements and lack of detail in the Departmental Accounting System (DAS). Similar weaknesses involved incomplete accounting records and incorrect calculations (e.g. incorrect salary calculations).

Table 3. Weaknesses Categorised by Ministry/Department.

Ministry/ Department	No. of Weaknesses												Total Weaknesses	%
	Lack of Authorisations	%	Inadequate Segregation of Duties	%	Inadequate Record-keeping	%	Lack or Reconciliations	%	Inadequate Safeguarding of Assets	%	Non-compliance with Policies & Procedures	%		
MHECC	25	12.82	2	9.09	65	13.27	3	10.00	11	8.46	63	17.50	169	13.77
MFIN/MFEI	38	19.49	2	9.09	56	11.43	3	10.00	12	9.23	43	11.94	154	12.55
MFA	15	7.69	7	31.82	58	11.84	3	10.00	19	14.62	51	14.17	153	12.47
MEEF	24	12.31	1	4.55	41	8.37	1	3.33	8	6.15	39	10.83	114	9.29
MGOZ	31	15.90	1	4.55	41	8.37	5	16.67	1	0.77	23	6.39	102	8.31
OPM	12	6.15	1	4.55	21	4.29	1	3.33	29	22.31	29	8.06	93	7.58
MEYE	10	5.13	1	4.55	38	7.76	0	0.00	8	6.15	30	8.33	87	7.09
MJHA	10	5.13	5	22.73	40	8.16	0	0.00	13	10.00	12	3.33	80	6.52
MRRA	15	7.69	0	0.00	28	5.71	0	0.00	7	5.38	29	8.06	79	6.44
MITC	2	1.03	0	0.00	15	3.06	4	13.33	5	3.85	11	3.06	37	3.02
MIIIT	7	3.59	0	0.00	13	2.65	2	6.67	0	3.85	7	1.94	29	2.36
MSP	0	0.00	1	4.55	9	1.84	0	0.00	13	10.00	4	1.11	27	2.20
CVB	0	0.00	0	0.00	22	4.49	0	0.00	1	0.77	4	1.11	27	2.20
MFSS	2	1.03	0	0.00	17	3.47	0	0.00	1	0.77	2	0.56	22	1.79
VAT	1	0.51	0	0.00	11	2.24	7	23.33	1	0.77	1	0.28	21	1.71
CONSULTANTS	1	0.51	0	0.00	4	0.82	0	0.00	0	0.00	9	2.50	14	1.14
POLICE	0	0.00	0	0.00	9	1.84	1	3.33	0	0.00	3	0.83	13	1.06
MUDR	2	1.03	1	4.55	2	0.41	0	0.00	1	0.77	0	0.00	6	0.49
	195		22		490		30		130		360		1,227	

MF Circular 14/99 (Government of Malta, 1999) requires that '*All inventory items assigned to a Department are to be shown in the inventory records of that Department*'. Nevertheless, the NAO still reported numerous instances where stock records were not being kept in the prescribed format, they were not being updated, incomplete information was being shown or assets included under the wrong category. The Public Sector Management Code (PSMC) requires the recording of trips made by public officers using Government vehicles in logbooks to ensure that Government vehicles are being used for allowable purposes only and to keep an eye on fuel consumption. Yet, NAO audits discovered cases where logbooks were not being kept, records were incomplete or incorrect details were being provided.

The view that Record-Keeping is one of the most crucial aspects and challenges within the Public Sector administration and management structures was also shared by the interviewees. '*Without proper record-keeping, one cannot verify whether the decisions made are adequate*'. This reinforces the concept of accountability. The interviewees complained that supporting documentation was not always found during audits. Some departments were still making use of manual recording systems, including conventional Attendance Sheets, which '*can lead to abuse*'.

All these deficiencies culminated in an inevitable number of over and underpayments being made, mostly the former. This does not fit in well with for the objective of reducing unnecessary expenditures, since inadequate records facilitate erroneous disbursements of public funds.

Non-compliance with Policies and Procedures

The NAO is entrusted to ensure that the policies and procedures designed for the Public Sector are being followed, hence the name 'Financial and Compliance Audit'.

The behaviour of officials within the Public Sector is governed through a number of codes, manuals, directives, Ministry of Finance, the Economy and Investment (MFEI)/Treasury circulars and legislation. The PSMC is one such code, which governs HR Management within the Public Sector. Non-compliance with the PSMC (20%) was the most frequent type of issue within this category. This ranged from Government-owned vehicles not being used as prescribed to vehicles not being equipped with milometers and GVN number plates. Moreover, there were instances where payments

to employees were not made in accordance with the prescribed rules for overtime, fringe benefits and other allowances.

The NAO reports a significant number of breaches in Public Procurement Regulations 2010. Amongst the reported cases, there were occasions where tender conditions were not followed, calls for tenders or quotations were not issued or where Direct Orders were issued instead of applying the competitive bidding process. A particular report indicated that the issue of tenders was being avoided through repetitive calls for quotations, thus spreading the value of one job amongst several calls of a smaller nature.

The provision of services to the Public Sector, including employment, was not always covered by a valid contract, or else, the expired contract was not renewed. The provisions of such contracts were not always being followed to the letter, such as payments not being made using the agreed rates.

Within the Public Sector expenditure limits are used in an attempt to control the disbursement of funds. Each Ministry and Department is allocated an annual sum in the Government Budget. Expenditure limits are also set on personal allowances (e.g. fuel, telephony) granted to civil servants. Yet, the NAO indicates a number of cases where these limits were exceeded.

Lack of Authorisations

The General Financial Regulations 1966 and the Financial Administration and Audit Act 1962 (FAAA) require that payments from public funds be backed by proper authority. Article 29 of the latter prescribes that '*No accounting officer shall pay any account unless he has ascertained … that the payment of the account is in accordance with proper authority*'. Yet, in a number of circumstances, the NAO reported that proper approvals by the appropriate level of management were not being sought prior to incurring expenditure. Similarly, there were times where the approval was sought after the expenditure was already incurred, resulting in retroactive approvals. There were instances where the authorisation for payment was being issued without a proper check, for example, approval of subsidies without ensuring that claims are backed by appropriate documentation.

Moreover, as also required by the General Financial Regulations 1966, the accounting officer has to certify the payment voucher. This involves

crosschecking vouchers with the related invoice and ensuring that details are correct, they are backed by proper authority and the service in question has been received. The results of audits show that this procedure was not always being performed as rigorously as it should.

Although good practice requires that a Purchase Order be filed to obtain the necessary approval, in a few cases it was found that an invoice was dated prior to the Goods/Services Purchase Order (GSPO). Contrary to the provisions of the PSMC, logbooks were not always being certified by the responsible officer to ensure that payments for fuel consumption are correct. Finally, the NAO encountered instances where although the approval may have been granted, no evidence of said approval was present in the files.

Inadequate Safeguarding of Assets

The Public Sector has a myriad of assets under its control, ranging from fixed assets and inventory items to cash. In order to exercise control on assets, there have to be policies in place to account for and reduce the risks of misappropriation of assets. According to the interviewees, cases of misappropriation of assets are very rare.

MF Circular 14/99 spells out the Inventory Control Regulations. Forty-four percent of reported issues falling within this category are linked to the misapplication of procedures designed for inventory control. These can be classified into two groups: Lack of Physical Control and Omission of assets from databases. The former mainly relates to the physical marking and the storage of assets within safe locations. As per circular, each inventory item should be physically marked with a unique Asset Identification Number. In a particular instance, the procurement method and the conditions of storage locations led to the obsolescence of certain items.

The second type of Inventory Control is record-keeping. Room Inventory Lists and stock records were not always being kept. Similarly, there were discrepancies between lists and physical locations, with some items not being traced to the list and other items included in the list not being found in their recorded location. The interviewees indicated that the most encountered deficiencies involved inventory records and vehicle log-books not being properly kept.

The rest of the weaknesses dealt with controls over cash. A particularly pressing issue is Debtors Control, since adequate follow-ups to recover

amounts due were not always being made. On the expenditure side, the NAO sometimes noted that not enough effort was being made to use the most economic and cost-efficient services. Also, cases where funds were being expended for services that were not required were also noted.

Lack of Reconciliations

Reconciliations enable users to compare two or more figures to ensure that there are no discrepancies between the recorded data and underlying transactions. This increases the reliability of reported data and is most effective if done by someone who was not directly involved in the underlying activity.

According to interviewees, bank reconciliations are mostly carried out by the Treasury since most payments are handled by that department. At a departmental level, reconciliations are only effected where a subvention from central funds is made. With regards to reconciliations between manual records and the DAS, the official system is the DAS and the records kept by the officers only serve audit trail purposes. The main problem is that '*wherever there are procedures, there are always ways how to circumvent them*'. Therefore, it is more of a cultural issue.

The following are some of the encountered issues in the annual reports:

- Reported figures for subsidy payments were not reconciled with the supporting documentation, resulting in unexplained discrepancies between invoices and records.
- Bank Reconciliations were not always being carried out.
- Closing balances were not reconciled with the subsequent opening balance in Arrears of Revenue Returns.
- Discrepancies between the amounts entered in the DAS and the supporting manual records kept by clerks.

Inadequate Segregation of Duties

There were a small number of cases where the concept of Segregation of Duties was not being applied. For instance, there were cases where Government employees were processing their own salaries for payment. Similarly, in a number of instances, staffing levels fell short of the capacity needed to cope with the workload, resulting in high amounts of overtime.

A particular case involved a number of Payment Vouchers being endorsed by the same officer who had approved the corresponding GSPOs.

DISCUSSION

The Issues and Their Significance: Beyond the Figures

The maintenance of proper records is vital for both auditee and auditor. A structure that is properly designed to capture, process, store and report information is commendable to keep track of activities. It enables management to analyse past events; take remedial action; and extract relevant information that will form a basis for future budgeting processes. It is also a question of accountability and good governance. If DGs are to be held truly accountable, there should be a proper account of their stewardship of entrusted assets. Proper records are also needed by the NAO to be able to obtain sufficient and appropriate audit evidence to support its conclusions.

Furthermore, the use of conventional Attendance Sheets poses the risk of human error and manipulation of data. The system requires a number of adjustments to be made to basic wages, such as unpaid leave, overtime, allowances and other deductions, which makes it very bureaucratic and prone to error. This problem is greater for medical staff, particularly because of the complexity and delicacy of these jobs and negotiations with trade unions. Electronic Attendance Recording systems should be extended to all departments.

Inventory Control has been improving through guidelines issued by the MFEI. The area that seems to be lacking is that of inventory records. Some officers are struggling with the proper upkeep of these records. However, the Treasury offers support and organises training seminars to help officers overcome any difficulties. One also has to acknowledge that some departments are enormous and it may be difficult to keep track of inventory.

Debtors Control is a significant problem within the Public Sector. There have been efforts to reduce the Arrears of Revenue, including the issue of MFEI Circular 09/2010 (Government of Malta, 2010), requesting every department and entity to reduce the arrears by 10% during 2011. This has not been achieved, possibly due to a lack of enforcement, formal programmes and targets to recoup amounts due. The age distribution of the arrears shows that a significant portion has been outstanding for a very long time. The way forward is to draw a line by implementing a formal

follow-up policy to ensure that future arrears and overpayments are avoided. Secondly, departments should make an effort to chase debtors, as long as this is time and cost efficient.

Instances of over expenditure may be a result of inadequate planning. Proper budgeting procedures and studies could aid in ensuring that everything is taken into account prior to project approval. Continuous use of budgets deters 'management by crisis'. This would avoid time delays; budget allocations being overshot and the need to obtain additional allocations and approvals.

Authorisations and Segregation of Duties are interrelated. The requirement to submit Purchase Orders and Payment Vouchers to the appropriate levels of authority is the embodiment of the 'four eyes principle'. This system of checks-and-balances reduces the risk of abuse and potential fraud. Unfortunately, this risk can only be reduced and not eliminated since management override and collusion between parties may go undetected. There might also be cases of lack of staff in small departments, resulting in one or two persons having control of the whole department.

Appointing signatories also enhances the degree of accountability, since a specific person is assuming responsibility for the underlying transaction. Unfortunately, these lines of authority are sometimes surpassed or are informally carried out without being properly documented.

The Bigger Picture: Reflections on the Government System

Whilst going through the issues in the Annual Report, one may form a misguided perception that the structures within the Public Sector are simply not effective. However, one should not rush to such conclusions.

An Internal Control structure can never be 100% effective due to two factors. First, there is the risk that controls can be overridden. Secondly, as long as there are people involved, any system will be prone to human errors. This is already a significant limitation in the Private Sector, where management has the means, albeit limited, to maintain direct control on the structures. When projecting this concept to the Public Sector, it becomes overwhelming, since this sector is so vast and complex that it is impossible to harness all the risks. Therefore, it is inevitable that the Annual Report will reveal a number of issues.

Moreover, one needs to separately consider issues arising due to genuine error and those that are intentional. Whilst the former can be mitigated through building more robust structures, it is much more difficult to

control intentional errors as people can always find ways to circumvent the regulations.

Another important consideration is that one has to differentiate between error prevention and error detection. Within the Public Sector, there is a rather solid administrative and legal framework that is geared to perform as a web of checks-and-balances. Apart from the various regulations and manuals, there are also a number of structures that are constantly overseeing the Public Sector:

- Within the MFEI, there are the Financial Management and Monitoring Unit (FMMU) and the Financial Policy and Management Division. The former monitors the financial performance of departments and entities, whilst the latter works to enhance specific aspects of the control structure through revision and formulation of policies.
- The National Statistics Office (NSO) assesses the reliability of the data that is fed by Government. Moreover, the European Union, through Eurostat, has its own structures to scrutinise the quality of the Government accounts.
- The Budget is a control in itself since there are imposed expenditure limits on departments and entities.
- The Internal Audit and Investigations Department (IAID) carries out audits of the effectiveness of control systems, compliance with laws and regulations and assessing whether public funds are being used legally.

Therefore, there is already an elaborate system employed by Government to keep itself in check. The other side of the coin is error detection. This is where the Annual Report comes into play – it is a tool to enhance the confidence of the general public in Government operations. The NAO is complemented by the IAID, which also investigates into cases of wrongdoing and may report serious findings to the Attorney General.

The MFEI keeps itself abreast of developments and maintains a proactive mind-set. First of all, it scrutinises the Annual Report in detail in order to identify weaker areas. In this spirit, it follows up on the recommendations made through the Annual Report and takes corrective action. Secondly, the MFEI has recently been organising Information Seminars that are aimed at imparting policy information to officers within departments and entities. More importantly, these seminars provide a forum where these officers are given the chance to voice their opinions and concerns.

Therefore, the Annual Report is not the sole source of control since there are additional structures of checks-and-balances within Government. The legal and administrative framework and the related control processes

are there. The challenge is to make these processes more efficient over time. One such area, which has been flagged for improvement, is the IT structure.

The main system processing transactions for Ministries and Departments is the DAS. This system has a number of effective controls over payments. It enables departments to remain within budget, as the allocated budget cannot be exceeded without further approval. However, this system has been in force since the mid-1990s and is considered to be rather archaic. The Government is pursuing a move towards accruals-based accounting. Accounting information is currently compiled on a cash basis, through the DAS. However, the data published by NSO are accruals based. The Treasury collects quarterly returns from Ministries and Departments containing accruals data (National Statistics Office, 2010). The data from the DAS are then adjusted with this information in order to get accruals-based reporting in accordance with ESA 95, which is the prescribed accounting methodology in the EU.

The Government is committed to the introduction of this new system, which will provide more reliable accounting information and help address some of the issues reported in the Annual Report. Having said that, due to the size and complexity of the Public Sector, this is not an easy endeavour. The Government is a vast entity and an overhaul of this calibre requires a macroscopic investment in terms of money, time and effort. Moreover, there will be problems of migration between systems and resistance to change.

Presently, the DAS is at the centre of the IT platform, surrounded by dedicated packages such as the Financial Data Reporting System (FDRS), the Inland Revenue Department (IRD) systems and the Payroll package. An issue with this structure is centralisation: the DAS enables the MFEI to exercise direct control on expenditure by Ministries and Departments, but not entities. Entities receive subventions and their managements are responsible for the use of those funds. Entities submit financial reports through the FDRS, meaning that MFEI only identifies issues on a post facto basis. A step in the right direction would be the setting up of a fully integrated IT system. However, would this lead to more bureaucracy and stifle efficiency and effectiveness?

One cannot make sweeping statements about structures within the Public Sector. Enhancing the IT structure should reduce both genuine and intentional errors. A lot depends on the attitudes of people and the 'tone at the top'. One of the criticisms that may be directed at public officials is a certain lack of ownership. Motivation may not be as high as in the Private Sector, since managers are not risking their personal capital. Heads of

departments should increase enforcement efforts to create a strong control environment, mainly through training employees and rotating personnel responsibilities to guard against complacency.

Communication and Its Adequacy

In the interviews, NAO officials felt that the recommendations made were sometimes brushed aside. The issues in the Annual Report were not being given sufficient attention, especially during PAC meetings. Indeed, the interviewees generally agreed that PAC members were not always adequately prepared to discuss the reports. One interviewee said that sometimes, nothing is done until a serious issue crops up. Nevertheless, the users remarked that it is not always possible to implement recommendations.

Had it not been for the annual publication of this report, the public would have little, if any, control on Government performance. Its usefulness can be seen in two ways: it keeps the auditees alert and it also aids by pointing out areas of weaknesses and providing timely recommendations.

The users of the Annual Report receive a detailed Management Letter containing the identified issues prior to publication. This provides users with the chance to provide explanations and feedback to recommendations. These are included in the Annual Report and if action has been initiated before publication, it is mentioned accordingly. Most departments and entities appreciate these contributions and try to rectify the situation to prevent issues from resurfacing. The repetition of issues in successive Annual Reports may indicate that recommendations are falling on deaf ears. Obviously, one cannot generalise since a lot of recommendations are adopted and it is not always possible to implement the recommendations immediately, due to lack of staff or financial resources. However, it all boils down to the person's attitude.

The NAO should follow up on the recommendations put forward. Follow-up audits would crystallise the progress, if any, made by auditees. This would also make the Annual Report more effective by placing more pressure on auditees to take action. By law, the NAO's powers are limited to reporting. It does not possess any executive or judicial powers to enforce its decisions on departments. The power to investigate and follow up the Annual Reports is assigned to the PAC, meaning that the effectiveness of the Annual Report rests on the proper functioning of the PAC. The PAC frequently summons both Government and NAO officials in order to discuss the reported issues. An inevitable consequence of having such

a Parliamentary committee is the presence of political agendas. As a result, the NAO may sometimes see its work go unnoticed and therefore, it might be reasonable to create a solid administrative structure supporting the PAC.

The structure of the Annual Report has remained largely untouched. However, more detail is being included in the Background section of audit reports and a new section has been introduced that defines the Audit Scope and Methodology. This offers the readers a snapshot of the audit context, rendering the findings more relevant and understandable. The report is adequately structured and the findings are clearly communicated in simple English, apart from the occasional use of pure accounting terminology which is justifiable given that is a technical report. The NAO publishes a simplified version of the Management Letter in the Annual Report in order to make the contents lighter.

A possible criticism of the Annual Report is that it is predominantly rules-based, meaning that there is an excessive focus on detecting specific instances of non-compliance and reporting detailed findings. Interviewees indicated that a possible improvement of the Annual Report would be to focus more on material areas and findings. In order to be more effective and useful, the Annual Report may be complemented with a brief report that is more principles based. This report would discuss the structural faults within the system and how these can be improved, rather than delving into the dynamics of particular events. This would extract the essence of the Annual Report and would more clearly pinpoint high-level issues to the administrative heads.

There is room for more collaboration between the NAO and users. Unfortunately, the NAO is sometimes seen as a policeman rather than a helping hand. This may make the NAO seem intimidating, as no department wants to be publicly shamed through the Annual Report. To counter this, both sides have to make efforts. Departments and entities should value the NAO's contributions more, which will increase their effectiveness. The NAO can adopt a more 'friendly' one-to-one relationship, without compromising its independence, in order to impart the idea that ultimately, it is there to help.

CONCLUSION

The NAO carries out an invaluable job on a yearly basis in assessing the financial aspect of Public Administration. It adds value to the Public Sector

by pointing out areas of potential improvements. The Annual Report adequately communicates the findings and is also a proponent of change.

There has been considerable improvement within departments and entities in recent years, but there is room for more. Reported issues are not always taken seriously and those with the authority to do so sometimes do not implement the proposed recommendations. In a number of instances, a lack of enforcement was noted. This is more significant in view of the introduction of the Balanced Budget rule.

An unfortunate consequence of the nature of the Annual Report being inherently focused on reporting issues is that the general public may develop a perception that mismanagement is the order of the day within the Public Sector and that there is a widespread misuse of funds. However, not all is gloom and doom. A closer examination shows a very elaborate structure of checks-and-balances within the Public Sector directed at keeping control. The internal control structure can never be 100% effective and therefore, it is expected that the NAO captures instances of non-compliance in an organisation as vast as Government.

The answer does not lie in introducing additional rules since this would simply increase instances of non-compliance and make the system more bureaucratic. The way forward should be directed at making the existing processes more efficient, mainly through IT, and developing a more collaborative attitude between the NAO and the users.

Having sound financial management practices is imperative for Public Administration. The NAO is in a strategic position to provide the general public with reasonable assurance that public funds are being properly used. Ultimately, it is all a question of trust: unless there is an independent reviewer who is reporting to the Principal about the activities of the Agent, a People can never have confidence in its Government.

> The only sure bulwark of continuing liberty is a government strong enough to protect the interests of the people, and a people strong enough and well enough informed to maintain its sovereign control over the government. (Franklin D. Roosevelt)

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ANALYSIS OF RISK PARITY APPROACH FOR SOVEREIGN FIXED-INCOME PORTFOLIOS IN EUROZONE COUNTRIES

Noel Cassar and Simon Grima

ABSTRACT

Introduction – *The recent development of the European debt sovereign crisis showed that sovereign debt is not "risk free." The traditional index bond management used during the last two decades such as the market-capitalization weighting scheme has been severely called into question. In order to overcome these drawbacks, alternative weighting schemes have recently prompted attention, both from academic researchers and from market practitioners. One of the key developments was the introduction of passive funds using economic fundamental indicators.*

Purpose – *In this chapter, the authors introduced models with economic drivers with an aim of investigating whether the fundamental approaches outperformed the other models on risk-adjusted returns and on other terms.*

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Methodology – *The authors did this by constructing five portfolios composed of the Eurozone sovereigns bonds. The models are the Market-Capitalization RP, GDP model RP, Ratings RP model, Fundamental-Ranking RP, and Fundamental-Weighted RP models. These models were created exclusively for this chapter. Both Fundamental models are using a range of 10 country fundamentals. A variation from other studies is that this dissertation applied the risk parity concept which is an allocation technique that aims to equalize risk across different assets. This concept has been applied by assuming the credit default swap as proxy for sovereign credit risk. The models were run using the Generalized Reduced Gradient (GRG) method as the optimization model, together with the Lagrange Multipliers as techniques and the Karush–Kuhn–Tucker conditions. This led to the comparison of all the models mentioned above in terms of performance, risk-adjusted returns, concentration, and weighted average ratings.*

Findings – *By analyzing the whole period between 2006 and 2014, it was found that both the fundamental models gave very appealing results in terms of risk-adjusted returns. The best results were returned by the Fundamental-Ranking RP model followed by the Fundamental-Weighting RP model. However, better results for the mixed performance and risk-adjusted returns were achieved on a yearly basis and when sub-dividing the whole period in three equal periods. Moreover, the authors concluded that over the long term, the fundamental bond indexing triumphed over the other approaches by offering superior return and risk characteristics. Thus, one can use the fundamental indexation as an alternative to other traditional models.*

Keywords: Risk-adjusted returns; risk parity; portfolio management; risk-free rate; Eurozone sovereign debt; European financial crisis

INTRODUCTION

Markowitz, the founder of the mean-variance portfolio theory in 1952, seems to be the earliest and perhaps the most recognized piece of modern portfolio theory (MPT). He explained how risk can be minimized through proper diversification of investment. However, the mean-variance optimization has come under great criticism especially during the global

financial crisis of 2008−2009, because of the poor performance generated by asset managers. In the wake up of this financial crisis, improving risk management tools became among the top priorities for each and every investor. Risk taking is now at the core of active asset management, especially when it enables active managers to pursue above-benchmark performance. The European Sovereign Debt crisis, which started in Greece and spilled into other countries such as Ireland, Portugal, Italy, and Spain, has alerted the investors of the dangers of instability and turmoil in bond markets. The impact of the Sovereign Debt crisis subjected the area to serious political and financial tensions, triggering a serious recession and causing a steep deterioration in government finances. This led to the aforementioned and other Eurozone countries to impose several austerity measures to try and strengthen their economies. An indirect consequence of the European Sovereign Debt crisis and the rising debt levels was the impact on portfolio management especially the bonds portfolios.

Before the beginning of the Sovereign Debt crisis, the global capital market had considered the Eurozone debt as a safe investment and that no Eurozone government would default on its debt. This encouraged the investors to diversify their portfolios by looking at nondomestic bonds. However, the crisis, country bailouts, and the possibility of a country's exit from the Eurozone, led to the reconsideration of sovereign credit risk and has shaken the investors' faith in sovereign debt. It changed the idea completely by showing that sovereign debt is not "risk free." This led to the rethinking of how bond portfolios are created and managed, by including the concept of credit risk management as one of the main pillars.

BOND PORTFOLIOS CREATION THROUGHOUT THE YEARS

Traditionally, a common approach applied for determining sovereign limits was by using market capitalization as the underlying basis. This method owes its existence to the fact that most bond indexes are given weights in accordance with the level of outstanding debt. According to Goltz and Campani (2011), this method was popular because it has to do with the passive investing strategy. That is once an investor has bought the securities at market-value proportions, the weights will evolve over time,

adjusting automatically. This approach serves well in theory but during the European debt crisis it has raised several questions since it gives higher weightings to the most indebted countries, regardless of their capacity to service their debt. It gives the highest allocation to issuers with the greatest amount of outstanding debt.

However, during the last decade, different approaches have emerged to counterbalance the disadvantages of Debt bond indices. One of these approaches applied the fundamental data. Toloui (2010) proposed to weigh country exposures in global bond indices by GDP instead of outstanding debt. Contrary to the market-capitalization weighting, GDP weighting index does not reward countries with high levels of debt issuance. This model can enhance the index portfolio performance by reweighting the exposures over the economic cycle. Toloui explained that a country's GDP-determined weight would tend to peak at the same time that the bond market is positioned to rally, and vice versa when the market is positioned to sell off. Relative to Debt-Weighted approach, the GDP-Weighted approach entails a more complex set of index rules and also raises questions about market liquidity.

Although, multiple options are available to structure a portfolio (i.e., Passive, hybrid, and active), the structure of the models created in this chapter follows a passive strategy, since the authors carefully sharpened the criteria or formulas without making portfolio decisions on each security. These types of bond portfolios do not track a traditional index.

Some studies such as Behr, Güttler, and Miebs (2008), Choueifaty and Coignard (2008), Clarke, de Silva, and Thorley (2006), Martellini (2008), and DeMiguel, Garlappi, and Uppal (2009) showed that better diversification leads to superior performance of the risk-based asset allocation.

During the past decades, a number of weighting schemes were created such as Capitalization-Weighting, Price-Weighting, Equal-Weighting, and GDP-Weighting. This chapter has moved further by introducing Credit Ratings-Weighting and the Fundamental-Weighting where the sovereign indicators were used for the latter index. The performance of the Fundamental-Weighting index represents the performance of a portfolio that invests according to various country's metrics. Moreover, the authors applied the risk parity concept which is explained in further detail below. The introduction of these indexes led the portfolios to consider the credit or default risk of the country rather than the outstanding debt, showing the countries' *true values*. This chapter is establishing whether

the Fundamental-Weighting models together with the risk parity concept outperform the other indexes.

Equity Research

In the last two decades, there has been renewed interest in stock selection motivated by fundamental factors which enriched the competence of using fundamental approaches. Arnott, Hsu, and Moore (2004) have carried out a 42-year study using equity-indices based on fundamental metrics of size and compared them to other indices which were weighted by market capitalization. The study indicated that these fundamental indices delivered consistent and significant benefits relative to standard capitalization-weighted market indices by outperforming the latter by an average of 213 basis points. Arnott, Hsu, Li, and Shepherd (2008) showed that the best of the fundamental indices outpaced the Reference Capitalization index by 2.50% per annum. The annual results favor all of the fundamental indices over the Reference Capitalization index.

Similarly, Clare, Motson, and Thomas (2013) made use of an alternative approach by using 1,000 largest US stocks every year for the period of 1968−2011. Empirically, in each case, they noted that the fundamentally weighted indices outperformed the Market-cap benchmark.

According to Basu and Forbes (2013), they have investigated the claims of superiority of fundamental indexation strategy by using data for Australian's Stock Exchange (ASX) listed stocks between 1985 and 2010. They found that the fundamental indexation could offer potential outperformance over traditional indexation based on market capitalization for the 25-year period. The outperformance over rolling five-year periods is between 2% and 5%.

A study constructed by fundamental indices for 23 countries for a 20-year period (1984 through 2004) done by Hsu and Campollo (2006) illustrated that the fundamental indices outperformed valued indices because the latter were based on capitalization and discarded many growth companies that were growing their fundamentals equally rapidly.

Clarke et al. (2006) have built two portfolios, that is, a capitalization-weighted portfolio and long-only minimum-variance portfolios, composed of 1,000 large-cap US equities for the period of 1968−2009. They showed that the minimum-variance portfolio has registered higher Sharpe Ratio relative to the market portfolio.

From an accounting point of view, Abarbanell and Bushee (1998) demonstrated that an investment strategy based on the fundamental signals extracted from financial statements like change in inventories, accounts receivables and gross margin among others, would generate abnormal returns.

Fixed-Income Research

The aforementioned equity research and analyses were created at the expense of few studies on fixed-income portfolios. Toloui analyzed and compared the historical performance of bond portfolios consisting of industrial countries based on two approaches being the market-capitalization-weighted and GDP-weighted bond indices. For the 20-year period (1989−2009), the GDP-weighted index outperformed the standard market-cap-weighted index while displayed less volatility than the market-cap-weighted index as a result to the countercyclical rebalancing property in the GDP-weighted version. The standard deviation of annual returns for the market-cap-weighted index was higher at 7.65%, when compared to only 7% for the GDP-weighted basket. The latter displays a high degree of consistency of outperformance relative to the former version.

In 2011, BlackRock Investment Institute introduced a model that goes beyond the standard "debt-to-GDP" metric. They introduced a model which consists of various economic indicators shown hereunder (Table 1).

The top position in the BlackRock Sovereign Risk Index was composed of Norway, which benefits from extremely low absolute levels of debt, a strong institutional context and very limited risks from external and financial shocks. On the other side of the index lie Greece and Portugal whose debt levels appeared to be unsustainable at those levels of growth and expenditure behavior. Thus, an investor looking to maintain exposure to global debt markets can perform this analysis to arrive at a fair weighting.

Additionally, Bruder, Hereil, and Roncalli (2011) moved a step further beyond Toloui's analysis by including the credit default swap (CDS) as a sovereign risk measure. They proposed two weighting methods being the fundamental indexation and the risk-based indexation. The fundamental indexation was based on GDP indexation, whereas risk-based indexation used a risk budgeting approach based on the sovereign credit risk measure. They demonstrated that the risk budgeting approach was the most appropriate scheme to manage sovereign credit risk in bond portfolios. They noticed that alternative index approaches post better returns than the

Table 1. Weighting in the BlackRock Sovereign Risk Index (Introducing the BlackRock Sovereign Risk Index – A More Comprehensive View of Credit Quality – June 2011).

Categories and Weights	Drivers of Each Category
Fiscal Space	Debt/GDP
40%	Per capita GDP
	Proportional of domestically held debt
	Term structure of debt
	Demographic profile
	Growth and inflation volatility
	Debt/revenue
	Depth of funding capacity
	Default history
	Reserve currency status
	Interest rate on debt
External Finance Position	External debt/GDP
20%	Current account position
Willingness to Pay	Political/institutional factors
30%	
Financial Sector Health	Bank credit quality and size
10%	

capitalization weighting, but at the expense of higher tracking errors. On a risk-adjusted return, the fundamental indexation generated the highest Sharpe Ratio and Information Ratio. With regards to the Gini index, the GDP risk-based index approaches in terms of weightings lead to more concentrated portfolios. Conversely, its concentration in terms of risk is decreased when compared to debt-based (capitalization) weighting.

Arnott in another study has constructed fundamental weighted bond indexes in six distinct areas for the time period of January 1997–June 2011. The portfolios were focused mainly on developed markets sovereign debt; emerging markets sovereign debt; emerging markets sovereign debt; global developed markets investment-grade corporate debt; global developed markets high-yield corporate debt; and emerging markets corporate debt. He used various variables for each type of portfolio. These portfolios were rebalanced yearly. Each of the six fundamentally weighted portfolios outperformed both the cap-weighted portfolio benchmark and the relevant published index. Moreover, they showed that the annual reweighting of fundamentally weighted index contributed a substantial proportion of the outperformance.

RISK-PARITY CONCEPT

Every investment portfolio is managed with the ultimate aim of delivering positive returns in most financial scenarios. Despite the challenge to maximize risk-adjusted returns while minimizing the risk of large investment losses, it is quite difficult to achieve in a world characterized by fat tails, unstable asset correlations, and stricter regulation. Part of the solution has been the Risk Parity concept which derives its name from its stated objective of creating a portfolio where each asset class contributes evenly to the overall risk of the portfolio. The risk parity is an allocation technique that aims at equalizes risk across asset classes. Thus, in a simple equity-bond portfolio, applying risk parity would give the high-risk asset class like equities a lower capital allocation than a low-risk asset class like bonds. Risk Parity Portfolios are based purely on risk diversification. In this chapter, despite having only one asset class which is the sovereign debt, the authors still can apply this approach by equalizing the risks of high-risk countries and low-risk countries. It ignores return forecasts in favor of risk forecasts. The only input that needs to be supplied is assets covariance, which usually can be estimated more accurately than expected returns based on historical data.

More studies are focusing on various versions of risk-based approaches applied to a global universe of assets, especially in cases of pension and endowment management. Anderson, Bianchi, and Goldberg (2012) compared the return of four investment strategies: value weighted, 60/40 fixed mix, unlevered and levered risk parity based on two asset classes being US Equity and US Treasury Bonds. They found that in 85-year sample, 1926−2010, assuming borrowing at the risk-free rate and there were no trading costs, the levered risk parity strategy had the highest cumulative return. However, after adjusting for transaction costs, both the 60/40 and the value-weighted strategies had higher cumulative returns than the levered risk parity strategy did. Over the whole period, unlevered risk parity had the highest Sharpe Ratio and the lowest expected return.

Another research was contributed by Chaves, Hsu, Li, and Shakernia (2011) by comparing the Risk Parity strategy against other asset allocation strategies such as Equal weighting, 60/40 equity/bond portfolio structure, minimum-variance and mean-variance efficient portfolios. The Risk Parity strategy favors most of the lower risk asset classes, resulting in one of the lowest portfolio volatilities with only the minimum-variance portfolio has a lower volatility. The Sharpe Ratio for the equal weighting and Risk Parity portfolios has been comparably more stable over the three

decades than the other strategies, showing that both strategies were better predictors of strategy performance than mean variance and minimum variance.

Furthermore, Clarke, de Silva, and Thorley (2013) compared and contrasted risk-based portfolio construction techniques using long-only analytic solutions for risk-based portfolios for large-cap US stocks from 1968 to 2012. They have used three risk-based portfolios being an equal weighted portfolio, risk parity portfolio, minimum-variance portfolio, and the market (value-weighted) portfolio. All three risk-based portfolios outperformed the excess market return of 5.3%. The risk parity portfolio had an excess return of 7.4%, closely matching the return on the market-wide equal-weighted portfolio. Comparing the three risk-based portfolios, the minimum-variance portfolio has the lowest risk and the highest Sharpe Ratio.

RESEARCH QUESTION AND HYPOTHESIS

As noted above, notwithstanding the authors have examined the construction of optimal bond portfolios from various sides, they have not addressed the risk parity approach in bond portfolios.

After the Sovereign Debt crisis, the investor has realized that the Eurozone debt is not risk-free anymore and arriving at an optimal portfolio allocation thus entails a lot more knowledge and skills. By this chapter, the authors set up five Eurozone sovereign fixed-income portfolios and checked which one yields the best historical performance and highest risk-adjusted return. The authors emphasized more on the risk-adjusted return so as to look at both the return registered and the risk.

This chapter wanted to answer several questions such as:

- Does it make sense to use rating measures or a matrix of fundamental indicators to manage a portfolio when there might be easier options by using the Debt RP or the GDP RP model which might give you higher return for each unit of risk?
- Is it suitable to try to build an indexing portfolio while there are several benchmarks which an investor can mimic?
- Does the outperformance in the equity and corporate bond benchmarks computed by the fundamental indicators indices cited in the Literature Review exist also in the sovereign bond indices?

To answer these questions, five models based on the risk parity (RP) approach are built and analyzed simultaneously with the objective of investigating how the risk contributions and actual weights differ during the period under review:

- Evaluating the concentration of the portfolios weights and risk contributions;
- Analyzing the whole-period risk-adjusted return performance of each model by using various risk measures;
- Comparing the results between the five portfolios, on a yearly basis between 2006 and 2014;
- Analyzing the sub-periods, that is, Pre-crisis Period, Crisis Period and Austerity Periods; and
- Presenting recommendations for further research on how to improve the setting up of a sovereign bond portfolio.

Moody's as the Unique Sole Provider of Credit Rating

The authors have used Moody's ratings as the unique provider of credit rating because as Morgan and Van Roy found in 2002 and 2005, this credit rating is more likely to assign the conservative (lower) rating than S&P, when these two differ. Consistent with Baker and Mansi's (2002) survey results, Güttler and Wahrenburg (2007) found that Moody's updates its ratings to reflect changing default risk in a more suitable manner than S&P. In line with this, Güttler (2005) found that Moody's ratings are slightly better at predicting default than S&P ratings.

CDS as a Measure of Country Risk

One of the difficulties of risk-based indexation is to define the appropriate risk measure for sovereign risk. One of the common measures is the assessment of rating agencies. However, reliance on ratings is not without its disadvantages such as the lag in time to publish the change in rating and also some internal politics to provide ratings to the company. Another market-based indicators of sovereign risk is Bond yield spreads – but it has several shortcomings such as which reference rate and maturity should be chosen. According to Baek, Bandopadhyaya, and Du (2005) bond yield spreads are more responsive then ratings but are nonetheless less sensitive than CDS

spreads to changing market conditions. Moreover, they supported the idea that yield spreads suffer from the contagion effect and that the impact of risk attitudes has a negative effect on the accuracy of bond yield spreads as a sovereign credit risk indicator.

Since the onset of the Sovereign Debt crisis, CDS spreads have become an alternative data source for the study of sovereign credit risk in developed countries given their increasing liquidity. They have gained in importance as a tool for approximating credit risk. The CDS spread can be a potential substitute to the use of credit ratings and bond yields as the leading indicator for sovereign risk. Zhu (2006) confirmed that CDS spreads work better than bond yields in assessing credit risk. Some advantages for CDS spreads are that they are collected at a daily frequency and are better in adapting more frequently to credit risk changes than bond yield spreads.

Using this rationale, the authors have chosen the CDSs of each country to work out the correlation between the Eurozone countries in the study.

METHODOLOGY – THE CREATION OF BOND PORTFOLIOS IN THIS STUDY

After the turmoil the financial faced during the last decade, it is not surprising that fund portfolios are evaluating alternatives on how to build their portfolios. To test the hypothesis posed in this chapter, the authors use the Gross Debt and GDP indicators, respectively, for the Market-Capitalization RP model and GDP RP model, the credit rating by Moody's rating is used for the Ratings RP model, and the Fundamental-Ranking risk parity model and the Fundamental-Weighted RP model, composed of 10 fundamental factors as sovereign risk indicators. The method of construction is the following:

- In the Fundamental-Ranking model, the authors have sorted the data by the ordinal scale without allowing for relative degree of difference between them.
- In the Fundamental-Weighted model, the data were organized by allowing for relative degree of difference between them, despite that some statistics are negative integers.

One should note that all the models were exclusively designed for this chapter.

Table 2. Indicators Used for the Fundamental Models.

Fundamental Indicators
Fiscal space
Forecasted GDP Growth
Total investment to GDP
Unemployment rate
General government gross debt to GDP
Banking sector health
Bank non-performing loans to total gross loans
Bank capital to assets
External finance
External debt to GDP
Surplus (deficit) to GDP
Political and institutional
Competitiveness index
Business confidence

The 10 proposed sovereign indicators which are used exclusively for this chapter are listed in Table 2.

All the proposed models consider economic indicators or the ratings to determine relative country risk, interacted with the correlation between the CDS of the selected Eurozone countries with a view to maximize the level of exposure for each country (i.e., weights).

The authors considered a period of a nine-year study covering the period from 2006 to 2014 because this period covers both pre-crisis and post-crisis times. Moreover, in the end of the analysis, the authors wanted to study the performance and risk-adjusted returns of three equal periods being mainly pre-crisis term (2006–2008), the crisis period (2009–2011), and the austerity period (2012–2014). Here, it makes more intuitive sense to compare the same number of years in each sub-period. Nonetheless before this, the authors analyze the whole period and yearly statistics. The researchers had to remove some countries from this analysis due to data limitations such as lack of CDSs pricings and historical 5YR yield's data for certain countries. The countries analyzed are listed in Table 3.

The portfolio weights for January 1 of any year are generated by using only annual data available on the last trading day of the prior year. In most cases, this means using data lagged by one year. One should note that the authors rebalanced the portfolio once a year thus the authors had to sell and buy new bonds. This is in line with the investigation made by Arnott et al. (2004), where they found no return advantage of using

Table 3. Eurozone Countries for the Sample.

2006	2007	2008	2009	2010	2011	2012	2013	2014
Italy	Italy	Italy	Italy	Italy	Italy	Italy	Italy	Italy
Spain	Spain	Spain	Spain	Spain	Spain	Spain	Spain	Spain
Portugal	Portugal	Portugal	Portugal	Portugal	Portugal	Portugal	Portugal	Portugal
Greece	Greece	Greece	Greece	Greece	Greece	Greece	Greece	Greece
Austria	Austria	Austria	Austria	Austria	Austria	Austria	Austria	Austria
Germany	Germany	Germany	Germany	Germany	Germany	Germany	Germany	Germany
France	France	France	France	France	France	France	France	France
Ireland	Ireland	Ireland	Ireland	Ireland	Ireland	Ireland	Ireland	Ireland
Netherlands	Netherlands	Netherlands	Netherlands	Netherlands	Netherlands	Netherlands	Netherlands	Netherlands
Belgium	Belgium	Belgium	Belgium	Belgium	Belgium	Belgium	Belgium	Belgium
Finland	Finland	Finland	Finland	Finland	Finland	Finland	Finland	Finland
		Malta	Malta	Malta	Malta	Malta	Malta	Malta
			Slovakia	Slovakia	Slovakia	Slovakia	Slovakia	Slovakia
								Latvia

monthly, quarterly, and semiannual rebalancing over annual rebalancing. As aforementioned, the authors opted to use the daily volatility in the five year CDSs denominated in dollar (5Y USD CDS) for all the five approaches because as explained by Dominic and Bankers (2015), the standard and hence the most liquid CDS contracts on Eurozone sovereign credits are denominated in US dollars.

The credit risk of a portfolio of "n" sovereign bonds is then defined as the volatility of the CDS basket, which would perfectly hedge the sovereign risk of the portfolio. Thus, the credit risk is estimated by computing the empirical correlation matrix of the relative variations of historical spreads

$$R(x) = \sqrt{x^T \sum x} \tag{1}$$

Hereunder is a summary of all five models

DEBT-RISK PARITY

A Debt weighting approach consists in fixing the risk contributions of the ith country in the portfolio every year by the country's outstanding gross debt in absolute terms which was extracted by the IMF.

$$\mathrm{RC}_i = \frac{\mathrm{DEBT}_i}{\sum_{j=1} \mathrm{DEBT}_J} \tag{2}$$

Thus, the country with the largest level of outstanding debt is given the highest risk contribution, while the highly credit quality country (lowest level of debt) is given the lowest risk contribution. Then the actual allocation will be determined by these risk contributions, together with the CDS.

GDP-RISK PARITY

The methodology used in Debt-RP Weighted may be applied to other metrics such as GDP-RP. In this case, the weights are computed such that

the risk contribution of each country is proportional to its GDP in absolute terms. Particularly, GDP weighting implies that all countries in the study present the same risk levels and correlations.

$$\mathrm{RC}_i = \frac{\mathrm{GDP}_i}{\sum_{j=1} \mathrm{GDP}_J} \tag{3}$$

In other words, the country with the highest level of GDP is given the highest risk contribution and vice versa.

Both aforementioned ratios are in line with Bruder and Roncalli (2012) in "Managing Risk Exposures using the Risk Budgeting Approach".

RATING-RISK PARITY

In order to arrive at the risk-contribution of each country by sovereign credit rating, the authors used Moody's rating as the sole contributor for this analysis. The main reason is that Moody's ratings are slightly better at predicting default than S&P ratings. In order to get appropriate data to implement empirical estimations, it is necessary to perform a numerical transformation of the rating notches into numbers. Since an update of sovereign rating and outlook is provided instantaneously, the portfolio weights at the start of any year are generated using rating and outlook as at end of November of each previous year. The formula for this model is the following:

$$\mathrm{RC}_i = \frac{\mathrm{RATING}_i}{\sum_{j=1} \mathrm{RATING}_J} \tag{4}$$

FUNDAMENTAL-RISK PARITY

The last two approaches that highlight the main drivers of the economy are the Fundamental-Ranking RP and the Fundamental-Weighting RP. Looking at the fundamentals cited above, it is noted that these are split into four sections, being Fiscal Space, Banking Sector Health, External Finance and Political and Institutional factors.

Fundamental-Ranking Risk Parity

In the first fundamental method, that is, Fundamental-Ranking RP, it is important to note that since the fundamental drivers are all in percentage terms and some of them are negative figures, it was difficult to use the formula used in the Debt-Weighted RP model or GDP-Weighted RP model. In fact the Researchers used the ordinal scale to rank the countries according to the health of the indicator. He ranked each measure by giving "1" to the worst figure and the highest result to the best figure for each indicator. With ordinal data, the interval between rank 1 and rank 2 is equal to rank 3 and rank 4, since it does not allow for a relative degree of difference between them.

Fundamental-Weighting Risk Parity

On the other hand, by the second fundamental method, that is, Fundamental-RB Weighting, the authors wanted to allow for a relative degree of difference between the figures attained. Thus, the weight of the *i*th country in the portfolio was achieved by using the data gathered and works out as follows:

- Divide each indicator's figure of each country by the sum of the absolute value of each fundamental. Then multiply each result found, by the weight of the indicator, that is, 10% since the fundamentals are equally weighted;
- Add the results;
- Then calculate the maximum value and the minimum value, whereby the country with the maximum value will hold the maximum weight, while the minimum value will end up holding "0" percentage in that particular year;
- Calculate the difference between the maximum and the minimum value;
- Then convert the results to a percentage to become risk contributions;
- A vital observation is that in each year there is a country with null weightings in the portfolio.

RISK CONTRIBUTIONS

One of the claims by Risk Parity proponents is that the strategy provides true diversification by equally allocating across assets. To compute

the Marginal Risk, first one needs to run the covariance of the CDS of each Eurozone countries and then divide them by the standard deviation.

As the authors cited above, the covariance matrix for a number of Eurozone Countries has been determined using 5YR CDSs. The Euler decomposition of risk measure for the risk of the portfolio, that is, Absolute Risk, is used. This is calculated by adding the sum of the weights, and multiplying the result by the marginal risk. Hereunder is the formula used to find the Absolute risk:

$$\mathrm{RC}_i = x_1 . \frac{9R(x_1, \ldots, x_n)}{9x_{1,}} \tag{5}$$

Then the absolute risk is converted to a percentage of standard deviation to obtain the relative risk. Then the authors set a constraint that Relative Risk of each sovereign should be equal to Risk Contribution. The use of a coherent convex risk measure is central to the portfolio management world whereby it becomes "R" if it satisfies this mathematical property:

$$R(x_1, \ldots, x_n) = \sum_{i=1}^{n} x_i \frac{9R(x_1, \ldots, x_n)}{9x_{i,}} \tag{6}$$

Considering the collection of possible future outcomes that can be generated using the resources available to an investor. That is, one investment strategy leads to outcome X, while the second strategy leads to outcome Y. By diversification, one can invest a fraction λ of the resources on the first possibility, and using the remaining part of the second alternative, one can obtain it. Therefore, the axiom of convexity gives a precise meaning to the notion that diversification should not increase the risk.

The optimization used for these models is the Generalized Reduced Gradient (GRG) method which can be assessed through the standard Excel Solver. At best, the GRG Solving method alone – like virtually all "classical" nonlinear optimization algorithms – can find a *locally optimal* solution to a reasonably "*well-scaled*," non-convex model. This means that there is no other set of values for the decision variables close to the current values that yields a better value for the objective function.

Portfolio managers may use an array of constraints when employing mean-variance optimization for portfolio construction. Here in the optimizer, the authors imposed several constraints. Thus, the constrained portfolios consist of positions that are aligned with the manager's alphas and mandates. The constraints set in the portfolio optimizer are:

- All stock weights must sum to 1 ("Budget Constraint").
- Each stock's weight must lie between 0 and 1 ("Long-Only Constraint"), thus removing the chance of having to short an asset.
- The Relative Risk must be equal to the Risk Contributions. This is the Risk Parity Approach.

In order to apply these constraints, the Lagrange Multipliers has been used.

The Karush–Kuhn–Tucker (KKT)

The method of Lagrange Multipliers is used to find the solution for optimization problems constrained to one or more equalities. When the models' constraints also have inequalities such as in our case where the weights have to be non-negative, there is the need to extend the method to the KKT conditions.

The inequality conditions are added to the method of Lagrange Multipliers in a similar way to the equalities.

Trading or Turnover Costs

Note that the authors did not adjust for trading costs in the indices construction, notwithstanding they require some sort of annual rebalancing. As explained in Arnott et al. (2004) this is consistent with the practice used by the commercial capitalization-weighted indices and in most academic research. Moreover, it would be difficult to know the actual trading cost with any precision. Since the authors compare the performance of the indices with the Merrill Lynch index, given the latter do not incur turnover costs, it makes intuitive sense to compare apples with apples.

LIMITATIONS AND ASSUMPTIONS OF THE METHODS

There are some limitations to the findings that must be noted. First, it was assumed that the most suitable sovereign risk measure is the CDS. As explained by Antonio Di Cesare (2006) and Zhu (2006), CDSs are the leading indicator for sovereign risk. During the period, there were some countries which have suffered from lack of pricing of CDS in certain periods such as Malta, Finland, Netherlands, Greece, and Ireland. Kidwell showed that Moody's ratings are a proxy for default risk, thus it makes intuitive sense to use the ratings when pricing of CDS is missing. As explained, only in these circumstances, the authors had to use the CDSs pricing of other Eurozone countries of the same rating as a proxy for these countries' CDSs.

One of the difficulties to work out several risk-adjusted return ratios such as the Sharpe, Sortino, and the Omega ratios was to find the adequate risk-free rate and the benchmark return. With regards to the former, the authors choose the 5YR German Bund as a safe haven investment. On the other hand, recently, indices have also been used as performance benchmarks, where considered as a neutral indicator of the returns an investor could have generated when investing in these types of portfolios. However, in this case the authors have tried to find a benchmark or index which invests in Eurozone sovereigns and have a weighted average year to maturity of five. However, there is a lack of Eurozone sovereign indices to be used as benchmarks with the same characteristics. Thus, the authors computed the averages of two indices − BofA Merill Lynch 3−5 Year All Euro Govt Index and the BofA Merill Lynch 5−7 Year All Euro Govt Index as a proxy of Merill Lynch 5 Year All Euro Govt Index. In line with this, the authors have computed the Omega Ratio and Sortino Ratio by using the aforementioned two target returns, being the risk-free by the German Bund 5YR Yield and the other being the index return, one at a time as shown in Appendix C.

RESULTS AND ANALYSIS

Here, the authors have run the five indexing approaches: Debt RP, GDP RP, Ratings RP, Fundamental-Weight RP, and Fundamental-Ranking model. Hereunder, the authors gave a detailed-explanation of the variation between the Risk Contribution and the actual weightings, and also to

explain the concentration of these models. Moreover, the authors compare the risk contribution and the actual allocation of all the five models and their performances. To conclude, the authors sub-divided the period under review into three equal periods being the *Pre-crisis period, Crisis period*, and *Austerity period.*

CDS for Eurozone Countries

The authors sub-divided the period into two sub-samples being the "Pre-sovereign Crisis" and Post-start of the Crisis. Before the Sovereign Debt crisis, there was a high degree of correlation between sovereigns. Prior to the European Sovereign Debt crisis, there were no clear differences between peripheral and non-peripheral sovereigns, from end of 2004 till mid-2007 there is a straight line for all of them (Fig. 1).

In the aftermath of the crisis, this correlation dropped significantly. Clearly, after the start of the debt crisis, the highest increases in CDS were attributable to Greece, followed by those of Portugal and Ireland, which also received financial assistance by the "Troika." The moment when the Greek CDS spread skipped the other 13 CDS, it never returned back to pre-crisis levels. The CDS spreads of other European peripheral countries like Spain and Italy, whose credit ratings were also downgraded on different occasions, overcame 500 bp. The Netherlands, Germany, and Finland moved in a narrow range and never surpassed 150 bp.

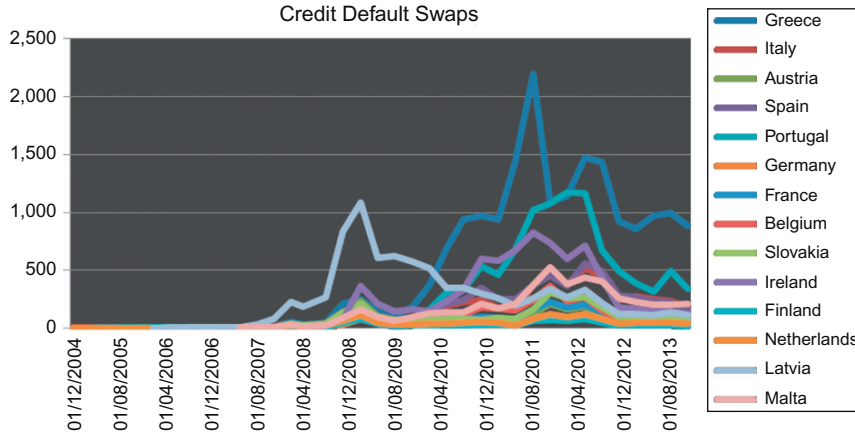

Fig. 1. CDS of the Eurozone Countries.

In a nutshell, there were many variances comparing the CDS prices before the crisis to those after the crisis. One can realize that in general the Greek CDS is more correlated with the peripherals CDS spread rather than with the "core" countries. Moreover, the German CDS spread is correlated more with the non-PIIGS countries, especially with the French and Finnish CDSs.

By considering the whole period correlation matrix from 2005 till 2013, one can see clearly that the "core" countries' CDS have very high correlations with each other.

Risk Contribution Weights versus Actual Allocation

First and foremost, risk contributions are the weights that resulted from the calculations of the five models without the addition of the risk-metric. Thus, these are the weightings without the CDSs. On the other hand, the actual allocation is the weightings after the risk-metric is included.

Importantly, one can notice how the risk contribution weights differed from the actual allocation during the period under study. One should notice a phenomenon in the first two years of this study (2006−2007), where (Appendix B) the risk contributions of Germany in all five models are larger than the actual allocations. One plausible reason is that in that particular period and especially before, Germany was not seen as the flagship of Europe as we know it today. As time passed by, the trend for Germany has reversed and it became the main driver of the Eurozone and a dominant economy of the currency block. In relation to this, its risk contributions became lesser than the actual weights. Conversely on the onset of the Sovereign Debt crisis and after, the indebted countries have registered higher risk contributions than the actual allocations, meaning that they should have lower allocations in the portfolio. Thus, one should conclude that when risk aversion in particular country is high such as the PIIGS, the risk contributions of that particular country would be higher than the actual weights. Conversely, when sovereign risk concerns are low, the risk contribution of that country would be lower than the actual allocation.

Examining the concentration of the model using the Gini coefficient for the whole period firstly by using the Risk Contributions Weights, the authors found that the Fundamental-Ranking model is the least concentration model. Explaining this on a yearly basis, the authors discovered that

in eight years out of nine years, the Fundamental-Ranking model exhibited the lowest concentration. Looking at the actual allocation, the results were similar to those of using Risk Contributions Weights. On the basis of the whole period, the Fundamental-Ranking RP (0.44) is the lowest concentration model, followed by the Fundamental-Weight RP model (0.49). Explaining on a yearly basis, the authors discovered that in seven years out of nine years under review, the Fundamental Ranking was lowest concentration among the models. Moreover, the Gini coefficient can be exhibited diagrammatically by looking at the cumulative probabilities every year using the Lorenz Curve. In the majority of the years, the Lorenz Curve unveiled that the Fundamental-Ranking RP has the lowest concentration (Tables 4 and 5).

Another variation between the Risk Contribution and the Actual Weighting is found in the Weighted Average Rating (WAR). This means

Table 4. Models Concentration Using the Risk Contributions.

RC	Fundamental-Ranking	GDP	Debt	Ratings	Fundamental-Weight
2006	0.09	0.58	0.59	0.68	0.41
2007	0.16	0.57	0.59	0.68	0.26
2008	0.23	0.60	0.63	0.63	0.21
2009	0.12	0.62	0.65	0.65	0.17
2010	0.15	0.62	0.33	0.53	0.43
2011	0.20	0.61	0.33	0.53	0.32
2012	0.19	0.62	0.63	0.48	0.24
2013	0.22	0.62	0.62	0.38	0.33
2014	0.15	0.57	0.57	0.25	0.26
Average	0.17	0.60	0.55	0.53	0.29

Table 5. Models Concentration Using the Actual Weighting.

Weight	Fundamental-Ranking	GDP	Debt	Ratings	Fundamental-Weight
2006	0.39	0.51	0.53	0.35	0.57
2007	0.48	0.59	0.59	0.51	0.52
2008	0.40	0.69	0.71	0.48	0.42
2009	0.32	0.73	0.74	0.44	0.39
2010	0.29	0.71	0.44	0.41	0.49
2011	0.69	0.75	0.62	0.70	0.54
2012	0.50	0.50	0.76	0.56	0.52
2013	0.48	0.74	0.74	0.59	0.54
2014	0.44	0.63	0.62	0.51	0.45
Average	0.44	0.65	0.64	0.51	0.49

that using the weightings after considering the CDS, that is, Risk Parity Concept, the Actual weightings provide the authors with higher credit ratings compared to the Risk Contribution. One can remark that the lowest rating by Risk Contribution models is in the range of A3, while by using the actual weightings, the lowest rating is Aa3. Considering only the Actual Weightings calculations as the unique weighting used in this study for performance, the difference between the highest ranking model, that is, Ratings and GDP model and then the lowest ranking throughout the years, that is, Fundamental-Weighted model was only of two notches. The main reason is that since all the models are based on risk parity concept, the difference must be modest (Tables 6–10).

Table 6. WAR of Debt RP.

Weighted Average Ratings		
Debt	Risk Contribution	Actual Weighting
2006	Aa1/Positive	Aaa/Negative
2007	Aa1/Positive	Aaa/Negative
2008	Aa1/Positive	Aaa/Negative
2009	Aa1/Stable	Aaa/Negative
2010	Aa2/Stable	Aa1/Negative
2011	A1/Negative	Aa1/Negative
2012	A2/Positive	Aa2/Stable
2013	A2/Positive	Aa2/Negative
2014	Aa3/Negative	Aa2/Negative
Average	Aa2/Negative	Aa1/Negative

Table 7. WAR of GDP RP.

Weighted Average Ratings		
GDP	Risk Contribution	Actual Weighting
2006	Aaa/Negative	Aaa/Negative
2007	Aaa/Negative	Aaa/Negative
2008	Aaa/Negative	Aaa/Negative
2009	Aa1/Positive	Aaa/Negative
2010	Aa1/Stable	Aa1/Positive
2011	Aa2/Negative	Aaa/Negative
2012	A1/Positive	Aa2/Positive
2013	A1/Stable	Aa2/Stable
2014	Aa3/Negative	Aa2/Negative
Average	Aa2/Positive	Aa1/Stable

Table 8. WAR of Ratings RP.

Weighted Average Ratings		
Ratings	Risk Contribution	Actual Weighting
2006	Aaa/Negative	Aaa/Negative
2007	Aaa/Negative	Aaa/Negative
2008	Aaa/Negative	Aaa/Negative
2009	Aa1/Positive	Aa1/Positive
2010	Aa1/Negative	Aa1/Stable
2011	Aa2/Negative	Aa1/Positive
2012	Aa3/Negative	Aa2/Positive
2013	Aa3/Stable	Aa2/Positive
2014	Aa3/Stable	Aa3/Positive
Average	Aa2/Positive	Aa1/Stable

Table 9. WAR of Fundamental-Ranking RP.

Weighted Average Ratings		
Fundamental-Ranking	Risk Contribution	Actual Weighting
2006	Aa1/Positive	Aa1/Positive
2007	Aa1/Positive	Aaa/Negative
2008	Aa1/Stable	Aaa/Negative
2009	Aa1/Negative	Aa1/Stable
2010	Aa2/Negative	Aa2/Positive
2011	A1/Negative	Aa1/Positive
2012	A2/Positive	Aa2/Negative
2013	A2/Stable	Aa3/Positive
2014	A2/Negative	Aa3/Negative
Average	Aa3/Stable	Aa1/Negative

Table 10. WAR of Fundamental-Weighted RP.

Weighted Average Ratings		
Fundamental-Weighted	Risk Contribution	Actual Weighting
2006	Aa1/Positive	Aa1/Positive
2007	Aaa/Negative	Aaa/Negative
2008	Aa1/Positive	Aaa/Negative
2009	Aa1/Stable	Aa1/Positive
2010	Aa2/Negative	Aa2/Stable
2011	A1/Negative	Aa2/Stable
2012	A3/Negative	Aa2/Negative
2013	A3/Stable	Aa3/Positive
2014	A3/Negative	Aa3/Negative
Average	Aa3/Stable	Aa2/Positive

PERFORMANCE ANALYSIS

This study shows that on annual average return basis, the Fundamental-Ranking RP model has averaged a annual return of 5.32% which is 0.2% higher than the 2nd best model, that is, Fundamental-Weighted RP model and 0.451% higher than the worst-performing model, that is, Debt RP model. The standard deviation of all the five approaches is in the range of 1% difference, with the lowest risky model being the GDP RP model (3.213%). In terms of "alpha," all of the approaches have earned a return that has compensated for the risk taken, with the highest one being the Fundamental-Ranking RP model. The "*beta*" which is a historical measure of volatility of each portfolio versus the Merrill Lynch index, were similar to each other with the highest volatility of 82.566% is registered by the Fundamental-Weighted RP and the smallest volatility is recorded by the GDP RP (65.112%). However, all the models implied a positive correlation with volatility. By using solely the "Skewness" measure, the best model is the Debt RP approach followed by the GDP RP approach (Table 11).

In order to compare the models, the authors ran various risk-adjusted return metrics to adjust for the risk of the underlying holdings. The metrics used are Sharpe Ratios, Sortino Ratio, Omega Ratio, and Information Ratio.

Starting with the Sharpe ratio, it shows that the Fundamental-Ranking RP registered the highest result at 15.076%, followed by the Fundamental-Weighted RP at 8.965%. In the case of the Sortino ratio and the Omega ratio, both ratios are calculated using two benchmarks, one being the index return and the other one being the German 5YR yield. The Fundamental-Ranking RP is preferred to other models over this investment period since it produced the best results. One should note that by using all the aforementioned four metrics, the Debt RP model produced the lowest positive

Table 11. Statistics of the Models.

	Debt RP	GDP RP	Ratings RP	Fundamental-Ranking RP	Fundamental-Weighted RP
Whole period Avg return (%)	4.871	5.028	5.036	5.322	5.126
St. Dev. (%)	3.335	3.213	3.347	3.493	3.686
Alpha (%)	0.067	8.143	8.554	9.155	9.060
Beta (%)	73.926	65.112	73.803	80.470	82.566
Kurtosis	−0.832	−0.394	−1.312	−0.955	−1.037
Skewness	0.053	0.025	0.013	−0.035	−0.368

Table 12. Risk-Adjusted Returns of the Models.

Risk Metrics	Debt RP (%)	GDP RP (%)	Ratings RP (%)	Fundamental-Ranking RP (%)	Fundamental-Weighted RP (%)
Sharpe ratio	2.279	7.248	7.190	15.076	8.965
Sortino ratio-rf	3.526	11.750	11.020	24.967	13.074
Sortino ratio-index	3.537	12.412	11.651	25.648	13.619
Omega ratio-rf	105.925	120.002	117.888	146.171	123.944
Omega ratio-index	106.917	121.177	118.925	147.452	124.975
Information ratio	4.609	10.347	12.518	32.435	17.972

Table 13. Average Ratings of the Models.

Average	Debt-RP	GDP-RP	Ratings-RP	Fundamental-Ranking RP	Fundamental-Weighted RP
	Aa1/Negative	Aa1/Stable	Aa1/Stable	Aa1/Negative	Aa2/Positive

ratios. The Information ratio's calculation shows that still the Fundamental-Ranking RP provides the highest result at 32.435%, followed by the Fundamental-Weighted RP at 17.972% (Table 12).

Other important consideration is the weighted Credit Rating of the portfolio. From the below table, one should realized that the models with the highest credit ratings are the GDP RP and the Ratings RP models recording an Aa1 rating with a Stable outlook (Table 13).

Yearly Performance

The authors continued by demonstrating the performance on a yearly basis. Fig. 2 shows the year-on-year variation for the five models, the benchmark (Merrill Lynch Index) and the risk-free rate (5YR German Bund). It depicts that as time passed by, the gap between the models, benchmark, and the risk-free rate started to widen. In 2006 and 2007, the gaps between the major

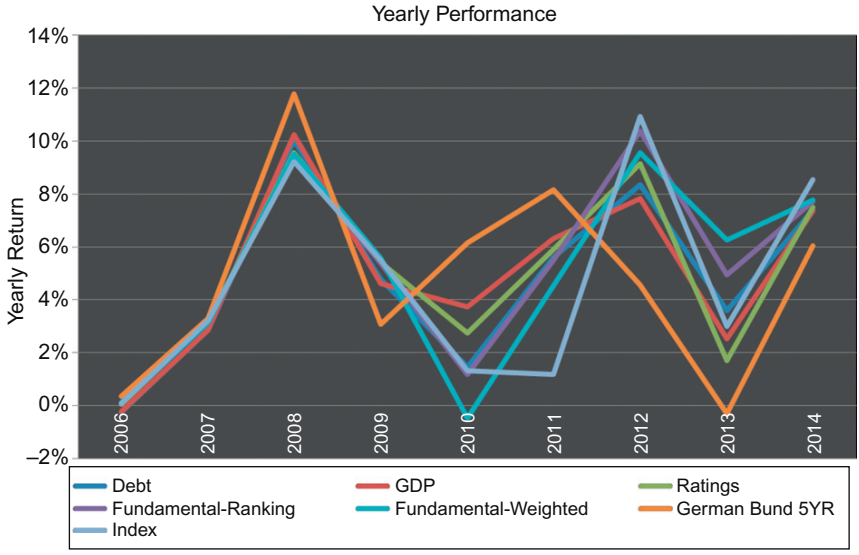

Fig. 2. Performance of the Models.

performing instrument (German Bund) and the least performing instrument (GDP RP and Debt RP) stand at the lowest, 0.58% and 0.43%, respectively. After 2007, the variation widened – reaching almost 7% in 2011. The main reason for this was that in that particular period, the Eurozone was going through the Debt Sovereign turmoil and there was a high demand for the safe haven investments. In this case, the demand for the German Bund surged, leading to yielding very high capital gains. Afterwards, the gap started to tighten again until 2014, when it had a difference of 2.51%. In that period, the troubled water in the Eurozone area started to calm down, shifting a lot of funds to equities. Thus, the yields of the so-called "quality" bonds started to increase again at the expense of lowering bond prices. In 2012 and 2014, the Merrill Lynch index has superseded the other models. On a cumulative monthly returns basis, GDP RP yielded better performance than the other models. This model is followed by the Fundamental-Ranking RP model. The Merrill Lynch Index performed the worst.

In terms of risk-adjusted returns, one can notice that on a year-by-year basis the results vary according to the particular year. Thus, it lacks consistency over results. The GDP RP model has outperformed the other models in three years, while the Fundamental-weighted RP outpaced the others in two years.

Table 14. Correlation Matrix of Monthly Returns.

	Debt-RP	GDP-RP	Ratings-RP	Fundamental-Ranking RP	Fundamental-Weighted RP
Debt-RP	1				
GDP-RP	0.9776075	1			
Ratings-RP	0.969132	0.9831038	1		
Fundamental-Ranking RP	0.9791232	0.9557537	0.97359435	1	
Fundamental-Weight RP	0.9153251	0.8678213	0.89832117	0.955325853	1

The authors looked also at the tracking error measure which gives investors a sense of how "tight" the portfolio in question is around its benchmark, that is, Merrill Lynch. The largest tracking error was registered by the Fundamental-Weight RP model. This result showed that the latter fund has generated returns which differs from the benchmark returns by the most, meaning that it is the most actively managed portfolio from all the five. On the other hand, the Debt RP model gives the highest sense of "tightness" to the benchmark when compared to the others, meaning that it is passively managed to the index.

Another measure which is important to discuss is the standard correlation between the monthly returns. The highest correlated figure was registered between GDP RP and Ratings RP returns, while the lowest correlation was registered between Fundamental-Weight RP and GDP RP model. It was noted that all series track each other on a monthly basis. This makes intuitive sense since all models are based on risk parity concept, thus a lot of differences are unexpected (Table 14).

Sub-periods Performance

In the nine-year period, one can note that the Fundamental-Ranking RP model had the highest returns and risk-adjusted return ratios. However, the outperformance was not uniform across the relative sub-periods. Thus, the authors split the nine-year period into three particular three-year periods, being:

- *"Pre-crisis period"* – 2006–2008
- *"Crisis period"* – 2009–2011
- *"Austerity period"* – 2012–2014

During the Pre-crisis Period, the GDP RP outperformed the other models by the highest average annual return of 0.36% with the largest risk of 1.076% and the least negative kurtosis of −0.294. All of the Sharpe ratio and the Sortino-rf are negative, however, the higher ratio was registered by the GDP RP model.

In the Crisis period, the GDP RP still surpassed the other models by registering the highest average return of 0.407% and was the lowest risky portfolio (0.981%). All the Sharpe Ratios are negative, thus the respective portfolio return is lower than the risk-free rate (German Bund). On the other hand, both Omega and the Information ratios supported the GDP-RP model.

As a result of the European Debt crisis, some Eurozone governments had to introduce austerity measures to lower deficits and debts and improve their economies in the long term by restoring confidence. In this period, one can notice that both fundamental RP models superseded the other models. However, the Fundamental-Weight RP superseded its counterparty. Fundamental-Weight RP produced the highest average return of 0.50%, while registering the highest risky portfolio with a standard deviation of 1.283%. This model also registered the highest kurtosis and the lowest skewness.

The findings are in line with Arnott, Hsu, Li, and Shepherd (2010), Bruder et al. (2011), Clare et al. (2013), Tamura and Shimizu (2005), Toloui (2010), where they concluded that by indexing the portfolios by fundamental indicators, they yield better results.

Tests of Significance

There are two different types of significance tests, being the parametric tests and the other being non-parametric tests. Parametric tests require that certain assumptions are satisfied such as the sample is normally distributed. These tests are generally more powerful and can test a wider range of alternative hypotheses. On the other hand, when there are situations in which assumptions for a parametric test are violated, a non-parametric test is more appropriate. These tests are based on fewer assumptions such as no assumption is required that the observations, outcome is approximately normally distributed. This chapter is using non-parametric tests in line with the thoughts by Morgan (1995) where reported that government bond return exhibit fatter tails and peaked at a point greater than that predicted by the normal distribution.

In order to compare the outcomes between two independent groups, the authors had to choose which test suits these data well. Since there are only nine observations and the distribution is non-normal, the Mann–Whitney test was found to be more appropriate.

For any Mann–Whitney U test, the theoretical range of U is from 0 (complete separation between groups), where H_1 is most likely true to $n_1 \times n_2$, (n_1 refers to the population size of set 1 and n_2 refers to the population size of set 2) where there is little evidence in support of H_1.

H_0: The two populations are equal.

H_1: The two populations are not equal.

The decision rule here is to reject H_0 if $U < 9$.

Thus, smaller values of U support the research hypothesis, and larger values of U support the null hypothesis. If the observed z value does not equal or exceed the critical z value of 1.96 ($p \leq .05$ critical z value for a two-tailed test), then you can assume that the null hypothesis is correct and that there is no difference between groups. Since the authors took the yearly returns, it means that the sample size was composed of only nine observations. Table 15 posits that the authors found no significance between each portfolio and the index at 5% confidence, thus showing that the portfolio's returns are equal. However, in this example, the failure to reach statistical significance might be due to low power. Notwithstanding, the sample data suggest a difference in performance for each population compared to the index, when using the Mann–Whitney U test, the sample size is too small to conclude that there is a statistically significant difference.

In this case, there might be Type II error which occurs when a test fails to reject H_0 when it is false. Therefore, it is important to consider the possibility of a Type II error when a non-parametric test fails to reject H_0.

Here, the Debt versus Index exhibited the highest Probability of a Type II error of 99.7%, meaning that there is a high probability that the authors are failing to reject the incorrect null hypothesis. On the other hand, the lowest

Table 15. Mann–Whitney U Test.

Mann–Whitney U Test at 0.05%	*U*-Value	*Z*-Value	*p*-Value
Debt versus Index	40.50	0.0442	0.9681
GDP versus Index	40.50	0.0442	0.9681
Ratings versus Index	40.50	0.0442	0.9681
Fundamental-Ranking versus Index	40.50	0.0442	0.9681
Fundamental-Weighting versus Index	40.50	0.0442	0.9681

probability of a Type II error is 53.6%. In this case, one should interpret this that there is a 47.4% chance that the authors are correctly rejecting the null hypothesis. One can notice that here the authors did not used the *t*-test since the distribution is non-normal and the sample size is small.

In the case of monthly performance, since the size of the sample is large with 108 observations, the parametric tests work well. However, the results became non-significant and with a possibility of Type II error.

CONCLUSION

Using five models with the Risk Parity approach, the authors show that indexation based on risk-based techniques may be an efficient alternative to the traditional models. Therefore, the results generated from this chapter confirm and support the researchers' hypothesis that portfolios using fundamental indicators perform better than the traditional approaches. Here, the authors focused on portfolios of sovereign bonds and taking into consideration only credit risk. With limited research carried out in the fixed-income area, this study may be seen as a stepping stone to further investigation. This approach can be extended to specific economic and capital market outcomes, such as high or rapidly rising inflation, flight to quality, liquidity events, and rapidly changing interest rates or deflation. Since this study emphasized the need to take Moody's as the solely credit rating, further analysis may take into account the second best rating of the three main credit ratings, that is, Moody's, S&P, and Fitch. Extending the risk parity concept to other asset classes could further contribute to the current debate and improve our understanding on weighting strategies. Moreover, investors need to recognize the dynamic nature of markets and make asset allocation decisions on a cyclical and secular basis, rather than a calendar-year basis. The findings in this chapter contribute to the on-going debate concerning the use of risk parity concept together with fundamental indicators and could possibly encourage more research studies to be conducted to generate more information.

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APPENDIX A: DEFINITIONS AND ABBREVIATIONS

In this chapter, the following groupings were employed:

Eurozone	It refers to all the countries in the Eurozone countries. These are Germany, France, Italy, Ireland, Greece, Spain, Portugal, Finland, Austria, Belgium, Netherlands, Malta, Slovakia, Luxembourg, Cyprus, Finland, Slovenia, and Latvia
Troika	It refers to European Central Bank, European Commission, and International Monetary Fund
PIIGS	It refers to Portugal, Italy, Ireland, Greece, and Spain.

In the rest of this chapter, the terms "Market-Capitalization" and "Debt" models are used interchangeably to refer to such weighting scheme.

The following abbreviations are used:

Table A1. List of Abbreviations.

σ_p	Standard deviation of portfolio
σ_{pd}	Standard deviation of negative returns of portfolio
$\sigma_{\Delta_{(p-i)}}$	Tracking error (standard deviation of the difference between returns of the portfolio and the returns of the index)
BofA	Bank of America
CAGR	Compound annual growth rate
CDS	Credit default swap
CWI	Capitalization-weighted index
DWI	Dividend-weighted index
DWMI	Datastream world market index
DYWI	Dividend-yields weighted index
ECB	European Central Bank
ERC	Equal risk contribution portfolio
EW	Equally weighted portfolio
GDP	Gross domestic product
GRG	Generalized reduced gradient
IMF	International Monetary Fund
KKT	Karush–Kuhn–Tucker
MDP	Most diversified portfolio
MPT	Modern portfolio theory
MVP	Minimum-variance portfolio

Table A1. (*Continued*)

NPL	Nonperforming loans
Omega-rf	Omega ratio-risk free
r_f	Risk-free rate
r_i	Index return/benchmark return
r_p	Portfolio return
RB	Risk based (Table 1)
RP	Risk parity
RC	Risk contributions
S&P	Standards & Poor Rating Agency
Sortino-rf	Sortino ratio-risk free

APPENDIX B: MOODY'S RATING METHODOLOGY

Moody's Investors Service in September 2013 has published a revised global rating methodology for sovereign issuers, which includes refinements aimed at further increasing the transparency and forward-looking nature of Moody's current approach. This rating methodology provides guidance on Moody's approach to assigning credit ratings to sovereigns globally.

Table B1. Moody's Rating Factors.

Broad Rating Factors	Rating Sub-factor	Sub-factor Weighting	Sub-factor Indicators
Economic strength	Growth Dynamics	50%	Average Real GDP Volatility in Real GDP Growth WEF Global Competitiveness Index
	Scale of the Economy	25%	Nominal GDP
	National Income	25%	GDP per Capita
	Adjustment Factors	1–6 scores	Diversification Credit Boom
Institutional strength	Institutional Framework and Effectiveness	75%	World Bank Government Effectiveness Index World Bank Rule of Law Index World Bank Control of Corruption Index
	Policy Credibility and Effectiveness	25%	Inflation Level Inflation Volatility
	Adjustment Factor	1–6 scores	Track Record of Default

Table B1. (*Continued*)

Broad Rating Factors	Rating Sub-factor	Sub-factor Weighting	Sub-factor Indicators
Fiscal strength	Debt Burden	50%	General Government Debt/GDP General Government Debt/ Revenues
	Debt Affordability	50%	General Government Interest Payments/Revenues General Government Interest Payments/GDP
	Adjustment Factors	1−6 scores	Debt Trend General Government Foreign Currency Debt/General Government Debt Other Public Sector Debt/GDP Public Sector Financial Assets or Sovereign Wealth Funds/GDP
Susceptibility to event risk	Political Risk	Max. Function	Domestic Political Risk Geopolitical Risk
	Government Liquidity Risk	Max. Function	Fundamental Metrics Market Funding Stress
	Banking Sector Risk	Max. Function	Strength of Banking System Size of Banking System Funding Vulnerabilities
	External Vulnerability Risk	Max. Function	(Current Account Balance + FDI)/GDP External Vulnerability Indicator (EVI) Net International Investment Position/GDP

APPENDIX C: RISK CONTRIBUTIONS VERSUS ACTUAL WEIGHTINGS

Table C1. Debt RP Risk Contributions versus Actual Weightings.

Debt RP	RC	2006	RC	2007	RC	2008	RC	2009	RC	2010	RC	2011	RC	2012	RC	2013	RC	2014
Malta (%)	0.0	0.00	0.00	0.00	0.06	0.03	0.06	0.04	1.10	1.03	1.10	0.60	0.05	0.02	0.06	0.03	0.06	0.05
Italy (%)	26.7	9.72	26.66	5.46	27.14	16.43	26.86	12.66	14.29	10.66	13.19	3.95	23.67	7.21	23.09	11.51	15.49	3.64
Spain (%)	6.9	16.79	6.91	19.93	6.70	3.00	6.40	4.25	10.99	12.23	10.99	2.28	8.24	5.04	8.93	5.55	11.44	1.86
Portugal (%)	1.7	1.00	1.70	0.48	1.76	0.89	1.94	1.37	5.49	5.79	5.49	0.64	2.08	0.39	2.24	0.46	1.73	0.43
Greece (%)	3.4	2.67	3.44	0.80	3.84	1.89	4.00	1.43	7.69	5.02	7.69	0.39	4.21	0.85	4.30	1.29	1.86	0.42
Austria (%)	2.8	2.47	2.77	2.44	2.77	6.34	2.76	1.37	6.59	3.62	6.59	10.91	2.64	2.64	2.64	2.18	3.02	3.85
Germany (%)	26.8	20.77	26.83	18.04	26.93	42.86	26.50	42.04	13.19	19.79	14.29	29.30	26.30	51.82	25.27	45.83	27.49	31.57
France (%)	20.2	20.54	20.16	25.56	19.74	19.34	20.28	24.31	12.09	16.79	12.09	7.99	20.39	17.50	20.79	19.38	22.79	14.46
Ireland (%)	0.8	1.12	0.78	1.37	0.75	0.46	0.79	0.67	4.40	1.94	4.40	0.56	1.84	1.12	2.05	0.53	1.92	0.57
Slovakia (%)	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.10	2.20	1.27	2.20	4.14	0.35	0.24	0.36	0.27	0.72	1.11
Netherlands (%)	4.7	5.50	4.68	5.11	4.38	3.07	4.33	6.01	9.89	9.53	9.89	17.23	4.76	7.68	4.77	7.66	7.03	10.28
Belgium (%)	4.9	18.40	4.91	19.79	4.80	4.33	4.72	4.31	8.79	7.33	8.79	3.32	4.35	2.94	4.38	2.67	4.10	2.70
Latvia (%)	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.22	24.84
Finland (%)	1.2	1.02	1.16	1.02	1.13	1.36	1.06	1.43	3.30	4.99	3.30	18.70	1.11	2.56	1.12	2.63	2.11	4.22

Table C2. GDP RP Risk Contributions versus Actual Weightings.

GDP RP	RC	2006	RC	2007	RC	2008	RC	2009	RC	2010	RC	2011	RC	2012	RC	2013	RC	2014
Malta (%)	0.00	0.00	0.00	0.00	0.06	0.03	0.06	0.04	0.06	0.05	0.06	0.03	0.06	0.02	0.06	0.04	0.06	0.05
Italy (%)	15.35	7.28	17.18	3.81	17.08	10.29	16.89	7.40	16.63	10.71	16.27	4.54	15.47	4.21	16.50	7.65	16.15	3.82
Spain (%)	10.37	21.21	10.29	26.02	9.07	4.00	9.09	5.60	9.09	8.80	9.05	1.76	8.50	4.65	12.13	7.01	11.96	1.96
Portugal (%)	1.45	1.05	1.76	0.52	1.75	0.88	1.73	1.14	1.72	1.57	2.15	0.23	2.05	0.35	1.84	0.34	1.79	0.45
Greece (%)	1.63	3.13	1.64	0.41	2.75	1.35	2.40	0.80	2.44	1.39	2.45	0.12	2.18	0.47	2.11	0.59	1.98	0.44
Austria (%)	3.24	2.58	3.16	2.32	3.18	7.20	3.16	1.46	3.20	1.50	3.46	5.68	3.33	2.93	3.12	2.37	3.16	4.05
Germany (%)	30.90	21.32	29.73	16.53	29.67	44.03	29.47	43.22	29.62	38.06	29.22	50.73	29.95	52.06	28.33	47.36	28.65	33.11
France (%)	22.39	20.45	21.67	23.48	21.67	20.47	21.48	23.87	21.40	25.52	21.54	12.97	22.48	17.13	20.85	17.87	20.91	13.38
Ireland (%)	2.12	2.68	2.18	3.30	2.32	1.40	2.47	1.96	2.40	0.91	2.24	0.29	2.03	1.17	1.84	0.43	1.85	0.55
Slovakia (%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.19	0.66	0.33	0.65	1.15	0.63	0.38	0.74	0.51	0.76	1.18
Netherlands (%)	6.64	6.85	6.50	5.93	6.22	4.23	6.27	8.07	6.35	5.26	6.32	10.09	6.98	9.91	6.43	9.47	6.41	9.48
Belgium (%)	3.82	11.78	3.79	16.15	4.11	3.66	4.20	3.56	4.30	3.09	4.51	1.63	4.34	2.60	4.19	2.35	4.20	2.79
Latvia (%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.23	24.97
Finland (%)	2.09	1.64	2.09	1.54	2.14	2.47	2.16	2.70	2.15	2.79	2.07	10.78	2.01	4.14	1.87	4.01	1.87	3.78

Table C3. Ratings RP Risk Contributions versus Actual Weightings.

Ratings RP	RC	2006	RC	2007	RC	2008	RC	2009	RC	2010	RC	2011	RC	2012	RC	2013	RC	2014
Malta (%)	0.00	0.00	0.00	0.00	1.79	1.04	1.47	1.14	2.67	2.48	3.90	1.52	5.00	1.55	6.82	3.75	6.86	3.36
Italy (%)	4.55	2.16	4.55	1.02	5.36	3.11	5.88	2.90	6.67	4.91	7.79	1.69	5.00	1.39	5.68	2.68	4.90	0.82
Spain (%)	11.36	18.23	11.36	21.35	10.71	4.36	10.29	7.11	10.67	11.77	9.09	1.37	7.50	4.19	4.55	2.95	3.92	0.46
Portugal (%)	4.55	2.95	4.55	1.17	5.36	2.50	5.88	4.33	5.33	5.56	3.90	0.34	2.50	0.43	2.27	0.37	1.96	0.32
Greece (%)	2.27	5.45	2.27	0.39	3.57	1.59	2.94	1.09	1.33	0.87	1.30	0.05	1.25	0.29	1.14	0.35	0.98	0.20
Austria (%)	11.36	7.52	11.36	6.81	10.71	22.30	10.29	5.36	10.67	5.71	11.69	11.62	11.25	10.01	11.36	7.92	10.78	10.41
Germany (%)	11.36	6.64	11.36	5.37	10.71	21.82	10.29	17.19	10.67	15.67	11.69	16.72	11.25	19.96	11.36	18.03	10.78	9.72
France (%)	11.36	8.48	11.36	9.33	10.71	9.43	10.29	12.94	10.67	14.55	11.69	5.52	11.25	8.72	10.23	8.22	9.80	4.74
Ireland (%)	11.36	11.58	11.36	12.98	10.71	5.97	10.29	9.18	8.00	3.45	2.60	0.25	3.75	2.21	3.41	0.75	2.94	0.64
Slovakia (%)	0.00	0.00	0.00	0.00	0.00	0.00	2.94	1.02	2.67	1.52	3.90	4.42	8.75	5.33	7.95	4.94	7.84	8.19
Netherlands (%)	11.36	9.73	11.36	8.58	10.71	7.27	10.29	14.79	10.67	10.08	11.69	14.49	11.25	16.24	11.36	15.58	10.78	11.28
Belgium (%)	9.09	19.79	9.09	26.18	8.93	7.44	8.82	8.39	9.33	7.65	9.09	2.49	10.00	6.08	9.09	4.66	8.82	4.27
Latvia (%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.88	25.80
Finland (%)	11.36	7.45	11.36	6.81	10.71	13.17	10.29	14.56	10.67	15.77	11.69	39.52	11.25	23.60	14.77	29.80	13.73	19.79

Table C4. Fundamental-Ranking RP Risk Contributions versus Actual Weightings.

Fundamental-Ranking RP	RC	2006	RC	2007	RC	2008	RC	2009	RC	2010	RC	2011	RC	2012	RC	2013	RC	2014
Malta (%)	0.00	0.00	0.00	0.00	8.40	5.00	8.22	7.00	4.47	4.39	5.46	2.24	5.62	1.97	14.35	9.42	6.62	4.56
Italy (%)	6.76	2.38	6.26	1.30	5.30	3.29	5.56	3.01	6.34	4.96	9.04	2.08	7.44	2.32	5.20	2.84	6.27	1.42
Spain (%)	11.21	19.39	10.69	21.22	9.01	3.96	8.56	6.50	8.60	10.02	8.05	1.28	5.40	3.40	9.15	6.44	3.68	0.57
Portugal (%)	8.76	4.25	8.40	2.07	6.66	3.34	6.67	5.40	10.09	11.13	4.74	0.43	5.90	1.07	4.16	0.85	6.12	0.99
Greece (%)	7.22	5.42	6.41	1.02	6.43	3.06	6.33	2.59	5.57	3.82	9.04	0.36	2.48	0.49	6.44	2.16	8.86	1.09
Austria (%)	8.14	5.74	9.62	6.84	9.03	20.11	8.11	4.67	9.59	5.50	10.64	11.25	9.09	9.40	7.90	6.81	6.72	9.34
Germany (%)	6.91	4.33	7.18	4.13	8.02	17.79	7.33	13.55	10.97	17.20	9.32	14.54	9.75	19.86	13.37	25.77	9.61	11.99
France (%)	7.83	6.15	7.79	7.26	6.41	6.05	6.78	9.42	5.84	8.49	6.50	3.29	9.97	8.82	8.52	8.38	10.00	6.18
Ireland (%)	12.60	13.61	12.98	16.47	10.86	6.50	8.56	8.41	9.10	4.18	3.47	0.35	9.42	5.31	4.71	1.27	8.46	2.38
Slovakia (%)	0.00	0.00	0.00	0.00	0.00	0.00	8.67	3.29	6.06	3.66	6.39	7.70	11.24	7.78	6.86	5.28	4.43	5.93
Netherlands (%)	8.91	8.19	9.16	8.17	8.74	6.40	7.89	12.53	8.54	8.61	7.88	10.46	9.48	15.93	6.24	10.51	6.57	9.59
Belgium (%)	8.14	21.14	7.94	21.86	7.94	7.05	6.78	7.11	7.61	6.63	7.44	2.15	5.95	4.18	6.58	4.18	7.87	5.07
Latvia (%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.00	30.48
Finland (%)	13.52	9.42	13.59	9.67	13.19	17.45	10.56	16.51	7.22	11.41	12.02	43.86	8.26	19.45	6.51	16.10	4.78	10.42

Tabel C5. Fundamental-Weighted RP Risk Contributions versus Actual Weightings.

Fundamental-Weighted RP	RC 2006	RC 2007	RC 2008	RC 2009	RC 2010	RC 2011	RC 2012	RC 2013	RC 2014
Malta (%)	0.00	0.00	11.11	6.26	8.44	6.70	0.00	0.00	12.62	7.49	13.86	5.32	13.32	9.02	5.11	4.20
Italy (%)	0.00	0.00	7.39	4.61	7.30	3.69	6.73	5.33	4.51	1.58	6.94	2.38	2.64	1.46	7.62	2.48
Spain (%)	22.00	32.29	8.38	3.74	7.86	5.57	12.35	14.51	6.29	1.50	6.96	4.79	10.59	7.28	3.35	0.71
Portugal (%)	3.29	1.50	5.37	2.76	5.98	4.51	16.86	18.80	11.66	1.53	5.50	1.10	3.50	0.75	9.30	2.27
Greece (%)	14.99	8.37	0.00	0.00	0.00	0.00	4.45	3.08	0.00	0.00	10.69	1.81	9.69	3.17	14.38	2.00
Austria (%)	9.19	5.99	7.49	4.65	7.10	16.03	7.01	3.77	11.25	6.52	5.42	10.21	8.05	9.23	4.43	3.96	4.24	7.06
Germany (%)	9.78	5.66	9.47	4.71	10.26	20.70	9.54	16.38	14.66	23.27	7.23	18.81	8.43	19.05	11.54	22.90	11.06	16.45
France (%)	8.30	6.06	10.03	8.25	8.72	8.25	8.68	11.23	3.37	4.96	9.91	7.69	6.70	6.51	7.09	7.19	12.74	9.87
Ireland (%)	13.93	13.59	17.25	19.57	10.65	6.46	10.03	9.19	13.48	6.25	13.48	1.82	0.00	0.00	14.17	3.92	11.88	4.21
Slovakia (%)	0.00	0.00	0.00	0.00	0.00	0.00	7.70	2.73	1.12	0.69	10.80	22.67	5.87	4.57	0.00	0.00	2.53	4.82
Netherlands (%)	0.11	0.09	9.38	7.33	8.76	6.41	8.25	12.26	7.87	8.04	8.11	16.58	6.53	12.14	7.96	13.79	5.92	12.22
Belgium (%)	9.24	20.53	8.77	25.06	9.97	8.94	8.38	8.19	5.62	4.96	9.01	3.85	10.83	8.36	6.20	4.09	10.19	8.40
Latvia (%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	20.74
Finland (%)	9.15	5.91	13.53	8.39	12.29	15.83	10.84	15.78	2.25	3.60	0.95	6.28	9.65	24.73	8.86	22.48	1.68	4.56

APPENDIX D: RISK METRICS

Sharpe ratio

$$= \frac{r_p - r_f}{\sigma_p} \tag{D.1}$$

Sortino ratio
Using risk-free rate

$$= \frac{r_p - r_f}{\sigma_{pd}} \tag{D.2}$$

Using benchmark return

$$= \frac{r_p - r_i}{\sigma_{pd}} \tag{D.3}$$

Omega ratio

$$\Omega(r) = \frac{\int_r^{\infty} (1 - F(x))\, \mathrm{d}x}{\int_{-\infty}^{r} F(x)\, \mathrm{d}x} \tag{D.4}$$

where F is the cumulative distribution function and r the threshold and partition defining the gain versus the loss.
Information ratio

$$= \frac{r_p - r_i}{\sigma_{\Delta_{(p-i)}}} \tag{D.5}$$

Tracking error

$$= \sqrt{\frac{\sum_{i-1}^{n} (R_P - R_B)^2}{N - 1}} \tag{D.6}$$

THE EVOLUTION OF THE RETAIL PAYMENT MARKET – A FOCUS ON MALTA

Sharon Marya Cilia Tortell

ABSTRACT

Purpose – *The purpose of this chapter is to determine the future trends in the retail payment market in Malta, and the manner in which the major stakeholders are set to respond to the potential that innovative technology within this area is unlocking. Stakeholders strive to keep abreast with developments within this ambit, in pursuit of implementing a proactive approach within their respective roles.*

Methodology/approach – *The objective of this study is achieved through a series of semi-structured interviews with the major stakeholders in the local retail payment market, mainly Financial Services Regulators, Supervisors and overseers as well as the Maltese Financial Services licence holders.*

Findings – *The evolution in the retail payment landscape witnessed in recent years exposes immeasurable challenges to Malta's financial services sector and the economy at large. The conclusions derived from*

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this research dovetail with the thorough literature review conducted, in exploring the manner in which such trends are envisaged to unfold within this sector. This study explores the legislative framework and regulatory regime, both current and proposed, which lay the foundations for the interplay between the respective stakeholders.

Originality/value – *This study reveals the approach taken by the various stakeholders, as they each respond to such developments in the retail payment sphere. These are predominately driven by market forces endowed with a mix of opportunities, as each stakeholder strives to remain resilient towards future industry challenges. This research is conducive towards enhancing the much needed clarity and awareness in the local retail payment market, and promotes the use of innovative, secure and cost-efficient retail payment methods.*

Keywords: Electronic money; financial institution; retail payments; risk management; security; technology

INTRODUCTION

Over the years, developed and emerging economies have experienced changes in peoples' payment methods driven by growth and innovation within the retail payments market, enhanced technology and an evolving regulatory landscape. Such an environment creates both opportunities and challenges within the retail payments sector (Bolt, Foote, & Schmiedel, 2011).

The Oxford Dictionary does not provide an all-embracing definition for 'retail payments', however if the term had to be segregated by defining 'retail' and 'payment', the former would refer to '*the sale of goods to the public in relatively small quantities for use or consumption rather than for resale*', whereas the latter would be defined as '*the action or process of paying someone or something or of being paid*' (Oxford University Press, 2014).

The Central Bank of Malta (CBM) (2002) defines retail payments as '*payments that include consumer and corporate payments, constituting the bulk of payment transactions within the economy, but exclude high-value payments generated within the interbank space*'. Although not all are deemed to be 'systemically' relevant, they nonetheless contribute towards the efficiency and stability of the financial system.

The timing of this research is in itself noteworthy, given that the current financial services legislative landscape affecting the retail payments market is undergoing a significant overhaul to address, both the ongoing improvements to the laws and regulations currently in force, as well as to cater for the developments mainly brought about through disruptive innovation.

The European Commission and national competent Authorities significantly contribute towards the endorsement of beneficial changes in the payments industry, particularly in the manner in which they exercise their regulatory oversight. Although such Authorities believe that the promotion of innovation will stimulate economic growth, nonetheless, conservatism reins particularly in realm related to virtual and crypto currencies, that if not adequately managed, may become detrimental to the stability of the financial sector (Rolfe, 2013).

In 2012, the European Central Bank (ECB) carried out a study in relation to the private and social costs of the various payment instruments. The *private costs* relate to all the individual parties' costs incurred in the payment chain, whereas the *social costs* refer to costs borne by society in using the resources required in the production of payment services, such as fees and tariffs made to other participants in the payment chain (Schmiedel, Kostova, & Ruttenberg, 2012). This study brought to light a number of interesting facts that prompt for further investigation into the types of policy measures; particularly in dovetailing payment instruments that are suitable for enhancing social welfare with potential cost savings along the transaction value chain. Hence, Schmiedel et al. (2012) affirm that there may seem to be potential for achieving economies of scale in the provision of retail payment services for relatively all payment instruments.

Thereby, this research shall seek to gain insight into the legislative framework paving the way for future trends in the retail payment market with a focus on the local scenario, coupled with the manner in which the major stakeholders are envisaged to react to the evolutionary innovation.

The global economic crisis and the collapse of the financial markets brought about a drastic change in society's 'traditional' ways of operating. However, despite all the doom and gloom, humanity has evolved and continues to do so at such an accelerated rate, that it has come to terms with the fact that such turbulent times tend to create havoc and possibly raise questions as to what the future might hold in store. Nonetheless, there lies a window of opportunity yet to be discovered, and potentially exploited, as witnessed over the years in the payments industry.

Regulators are continuously seeking effective ways of re-stabilising their respective country's position with the intention to bring about cost-effective

measures to stimulate the economy. Thus, eradicating the ambivalence formed by the absence of definite legislative and regulatory direction.

Most financial institutions and retailers have realigned their strategies and business operations, mainly due to competitive forces coupled with consumers' shift in demand, resulting from a mismatch in their potentially transformed standard of living.

It has become clear particularly in Europe that efficient and safe payment methods are a priority for each citizen and for every business in order to free up time and resources through innovation. Moreover, any failure or malfunction in the payment industry is to be avoided at all costs given that it would impinge on day-to-day commerce and life in general for the whole of society and is therefore of public interest (Russo, 2012).

AIM OF STUDY

The study aims to test the hypothesis that Malta, with particular emphasis on the various retail payment stakeholders, is geared towards embracing the incredible potential that innovative technology is unlocking in the many aspects of the retail payment market. The extent of such proactiveness however depends on a number of factors, including legislation and regulation as well as cost-efficiency and security.

It has been observed that in the EU, retail payment technology has picked up a certain momentum through the proliferation ranging from ATMs and POS terminals to more innovative devices such as smartphones, which to an extent are replacing the more traditional methods of conducting business transactions (Hasan, Schmiedel, & Song, 2009).

Alfing (2013) sustains that over time, it has become more evident that the point-of-sale needs to provide the customers with the necessary services and value added; whereby the actual value adding benefit has become more evident in mobile payment solutions, by rewarding customers with loyalty offers, for instance.

From a local perspective, studies were undertaken and analysed by the Ministry for the Economy, Investment and Small Business, following the outcome of a survey conducted amongst the members of the General Retailers and Traders Union Malta Chamber of Small and Medium Sized Enterprises. Such study assessed whether to extend shops' opening hours, and from the results obtained, it was evident that such course of action will not solve the physical world's problem, due to the fact that consumers

seem to be heading in another direction, and retailers need to take stock of such developments in order to remain competitive and ultimately survive.

To this effect, the government has taken the initiative towards attempting to stimulate the economic market by pioneering various programmes, also through the support of EU partly/fully funded projects. This is clearly substantiated in the recent Global Competiveness Report 2013–2014, whereby out of a total of 148 countries worldwide, Malta ranked 35th in '*Government procurement of advanced technological products*' and 47th in terms of '*capacity for innovation*' (Annoni et al., 2013). These statistics bode well for Malta's pro-activeness towards innovation and technology.

Hence, this study shall also contribute towards creating further awareness regarding the current retail payments industry coupled with emerging trends that are transforming the payments landscape through innovative-driven solutions currently available as well as forthcoming.

The objective, outcome and results obtained from this study shall be conducive towards enhancing the much needed clarity in the local retail payment market. This proves to be significant to the numerous stakeholders, particularly at this juncture given the transformation the payment landscape is undergoing; thus a proactive approach is a prerequisite towards adequately addressing the outcomes brought about by such disruptive innovation.

Therefore, in the light of the limited Maltese literature available on this topic, the research undertaken by this study shall hopefully contribute towards creating awareness of the retail payment market in Malta. The findings are discussed and the study provides practical recommendations to assist policy makers, as well as financial services licence holders and industry at large, in taking into account the current trends that shall act as a basis for them to map out an action plan and remain resilient towards industry challenges. Such a concerted strategy shall provide the necessary guidance in taking a proactive approach towards the future of the retail payments market in Malta. This market is expected to continue to evolve in the coming years, in tandem with regulation that is one of the leading factors that makes Malta a successful financial centre and a model for other jurisdictions.

LITERATURE REVIEW

This section provides the theoretical background to the current study. Primarily the developments in the Legislative and Regulatory sphere, both

at EU-Level as well as locally; the subsequent impact and challenges faced by the stakeholders, followed by an overview of the various regulated payment products and channels, together with the approach adopted towards unregulated subject-matters; thereafter cost-efficient, innovative and secure retail payments shall be identified and concluding with an insight into the future.

Developments in the Current Legislative and Regulatory Regime

As developments within the retail payments sphere continue to unfold, and given the relative importance to the payments market, contemporary and recent literature is deemed rather sparse (Hasan, Tania, & Schmiedel, 2013); this being even more evident in relation to literature pertaining to the Maltese scenario which is still considered to be relatively limited, hence the legislative and regulatory aspects remain the backbone of the retail payments industry, that seeks to keep up to speed with the constant developments within this ambit.

EU Directives and Regulations Binding Retail Payments

The European Single Market's scope is essentially to promote harmonisation in terms of regulation, whilst removing barriers for European citizens and business for them to take advantage of the benefits in all Member States. To this effect, Directives and Regulations promote a pan-European approach of addressing specific areas once these are adopted on a national level by all the respective European jurisdictions. Over the last decade, due to the evolving landscape brought about by the dynamic advancements and innovations in this field, payments regulation has undergone a major overhaul with a view to improve and cater for such developments.

From its accession in the EU, Malta has always sought to transpose European Legislation into local Laws and Regulations (including local Directives and Rules) by adopting, implementing and enforcing them in a timely and efficient manner. Consequently, every Member State is monitored by the European Commission that controls and ensures that such process is carried out within acceptable timeframes for the ultimate benefit of European citizens (European Commission, 2014). From a Maltese perspective, the Major pieces of legislation that have directly been affected by the EU's Directives and Regulations pertaining to retail payments are the *Financial Institutions Act (Cap. 376) of the Laws of Malta (1994)* and the *Central Bank of Malta Act (Cap. 204) of the Laws of Malta (1968)*.

Other Local Laws and Regulations relevant within this area include the *Prevention of Money Laundering Act (Cap. 373) of the Laws of Malta (1994)*; *Prevention of Money Laundering and Funding of Terrorism Regulations (S.L.373.01, 2008)*; *Electronic Commerce Act (Cap. 426) of the Laws of Malta (2002)*; and *Data Protection Act (Cap. 440) of the Laws of Malta (2001)*.

The major legal texts undergoing proposed amendments pertaining to the retail payments field include the Payment Service Directive, Multilateral Interchange Fees Regulation as well as the Anti-Money Laundering Directive.

The European Commission published a Proposal on 24 July 2013 for a Directive on payment services in the internal market, referred to as the 'PSD2', which when coming into force will repeal Directive 2007/64/EC – the current PSD. During a Press Conference, Commissioner Michel Barnier, responsible for Internal Market and Services, expressed his full support towards this revised proposed Directive.

In addition to the PSD2 Proposal, the European Commission (2013) also adopted a Regulation on Multilateral Interchange Fees (MIFs) with the intention to promote a level playing field and enhanced legislative clarity to develop further the payments market for card payment instruments, card-based payment transactions for online, offline and mobile transactions, in tandem with Europe 2020 as well as the Digital Agenda, with the ultimate intention that fees pertaining to payment transactions are transparent for both consumers and retailers alike. The ultimate intention is to relieve both the cash and card paying consumers of inherent additional costs they are charged by retailers when setting retail prices, to compensate for the fees they in turn are charged by way of interchange fees by their banks and consumer banks, respectively, when processing card payments. Pace O'Shea (2012) had identified that in Malta, a bank commission can range from anything between 1.7% and 2.0% on local debit cards whereas higher percentages would apply on credit cards, hence such amounts are included in the retail price charged to customers who are further taxed through the Value Added Tax (VAT).

The scope for the proposed 4th Anti-Money Laundering Directive is to prevent money laundering and terrorist financing through the financial system, as well as the Regulation, to promote 'due traceability' in the transfer of secure funds, arise as further enhancements to the Commission's action plan against crime, tax evasion and corruption. In addition, taking into account the Financial Action Task Force's (FATF) latest Recommendations (FATF, 2012), as well as Guidance (FATF, 2013a, 2013b) specifically

relating to novel payment products and services, financial inclusion, and also the inclusion of the Simplified Due Diligence (FATF, 2013a, 2013b), that allows for a practical risk-based approach whilst still acting as an enabler for consumers at large (Sabri, 2013). Moreover, the two proposals shall grant the respective competent authorities further administrative sanctioning powers through the adoption of principle-based rules.

The Current Impact and Challenges Faced by Stakeholders

A study carried out by Abdul-Muhmin (2010), who developed and tested a hypothesis based on analytical and empirical literature, conducted a survey to test whether the preferred method at the point-of-sale for consumers, for certain specific products whose list price varies systematically, was set to be cash for low-value payments, debit card for medium-value transactions and credit card for high-value transactions. To this effect, the findings actually mirror this hypothesis whereby debit and credit cards are less preferred for low-value payments, whereas cash and debit cards are least preferred for high-value transactions. Moreover, it transpired that collective electronic payment methods are a substitute for cash for low-value transactions, whereas credit cards are a substitute for cash and debit cards for high-value transactions.

During Spring 2013, van de Sande analysed the results of a Global Survey conducted by CardNotPresent.com in collaboration with Payvision, which obtained feedback on around 50 questions posed to global acquirers, online merchants, merchant service providers, and payment services providers. From the responses gathered it emerged that research analysts had predicted that by 2015, global ecommerce would generate a sales volume of US$1.4 trillion, whereby in 2012 such figures had already reached US$1 trillion. Thus, with an estimated growth of 21%, which for Europe alone ecommerce turnover reached US$412.6 billion, a 35.1% share of the global B2C ecommerce market was noted.

Processing costs can be reduced and social welfare enhance simply by implementing innovative methods; however, there lie greater challenges for central banks in terms of policy issues, and the potential implications for a sound and effective retail payment system (Working Group on Innovations in Retail Payments, 2012).

Developments in Retail Payment Methods

Whereas a decade ago, when one questioned a typical consumer: 'What is in your wallet?' many would generally identify cash, cheques, various debit

and credit cards, and potentially stored value cards (Schreft, 2005); Nowadays the medium used for a physical wallet has been transformed to also include a device such as smartphones and other portable devices.

As the term 'innovative' generally suggests, innovation relates to novel advanced ways and means of carrying out processes and procedures in a more efficient and effective manner, thus resulting in better and attractive products and services. This is generally brought about by either adapting existing or adopting new technologies along with the '*development of new business models and mechanisms for handling the underlying payment processes and activities*' (Natarajan, Cirasino, & Garcia, 2012). Consequently, this is resulting in new payment products and methods such as electronic money, new channels for using existing payment products to the likes of a mobile phone, and the manner in which the product is availed of by way of biometric authentication, as an example.

Innovation in retail payments can happen for either or both of the two parties to a transaction, being the 'Payer' and 'Payee'; involving any of the following processes: initiation, ID and authentication, authorisation, clearing, settlement, post-transaction inquiries, and dispute resolution.

The trends and processes in retail payments indicate that such payment methods shall become all the more efficient reaching optimum real-time. This includes enhancing the ease of use and security features to counteract criminal action, whilst lowering the costs involved in such process. As a result, Natarajan et al. (2012) outline that smart cards, including Europay, MasterCard, and Visa shall be adopted on a worldwide basis leading to other embedded devices such as smartphones, that have in turn facilitated the advent of mobile applications commonly referred to as 'Apps' and mobile (electronic) money. Consequently, mobile money products shall become more integrated with traditional payment infrastructures to the likes of Automated Clearing House(s) and payment card networks. Encryption and multi-factor authentication methods are the major contributors in ensuring the necessary security measures, all of which put more pressure and demands on the regulatory and oversight importance of such innovative payment process mechanisms.

The Approach towards Unregulated Virtual/Crypto Currencies

Back in October 2012, the European Central Bank issued a paper with the intention of providing further insight into emerging 'Virtual Currency Schemes' and the manner in which these functioned, especially when compared to traditional regulated currencies and their interaction with the 'real' economy particularly in exchange for goods and services.

The European Central Bank (ECB) outlined three types of virtual currency schemes, the first being a '*closed*' virtual currency scheme similar to online games; the second type having '*unidirectional flows*' whereby fiat currency is used to buy virtual currency to purchase virtual (and potentially real) goods and services; and the third type having '*bidirectional flows*' hence the virtual currency has a buy and sell exchange rate with a fiat currency to purchase virtual as well as real goods and services. The chapter clearly outlined that at the time, the ECB was assessing the manner in which such virtual currency schemes were to be regulated and whether it would most likely fall under the Electronic Money Directive given the similarity to electronic money. Yet, many notable differences distinguish and exclude it from such definition of electronic money, particularly due to the following main reasons (European Central Bank, 2012):

- The unit of account has no physical counterpart which has a legal tender status or legal framework;
- The issuer of the scheme/currency is likely to be an unregulated and unsupervised non-financial private entity which has complete control over the virtual currency's denomination, as opposed to traditional financial institutions and central banks.

Since the publication of the ECB's paper, such virtual/crypto currencies remain unregulated. Hence, given the fact that virtual currencies do not form part of the current Electronic Money Directive raises queries as to the category and type of regulatory regime such currency would fall under. Moreover, in view of the various virtual currencies currently in circulation, Bitcoin happens to be the most popular having attracted substantial attention globally as well as locally. To this effect, the Bitcoin Community has publically expressed its desire towards international authorities to assess the merits of such virtual currency and regulate it accordingly – however, neither regulatory authority (including at International, European and local level) took a firm position to regulate.

On 12 December 2013, the European Banking Authority (EBA) issued a '*Warning to consumers on virtual currencies*', stating that currencies such as Bitcoin pose certain possible risks which also include potential money laundering and financing of terrorism, lack protection to customers when they hold or trade in such virtual currencies, whilst exposure to the currency's high volatility and potential tax charges may have diverse implication (European Banking Authority, 2013).

Moreover, on 4 July 2014, EBA issued an opinion on virtual currencies by proposing a potential regulatory regime, whilst it recommends that

financial institutions are not to '*buy, hold or sell them whilst no such regime is in place*'. In addition, EBA issued a list of around 70 risks posed by such virtual currencies, and noted that a process has to be undertaken in order to assess the manner in which regulation should best address such currencies (European Banking Authority, 2014a, 2014b).

Henceforth, back in April 2014, Jeremy Allaire, CEO at the Circle noted that Bitcoin will become a global payment platform only when governments and regulators will find the synergy between the traditional banking sector and the digital currencies (The Paypers, 2014); the challenges and opportunities brought about by the virtual (online) world are extraordinary. Various complexities have to be factored into the traditional business model in order to cater for virtual goods and currencies.

Given that the market for virtual goods is set to grow to around US$5 billion by 2016, one must consider that once such projections come to fruition, the generation of such a substantial amount in the payments industry should not be overlooked (de Lange, Longoni, & Screpnic, 2012).

Cost-Efficient, Innovative and Secure Retail Payments

In a recent study carried out by WorldPay Zinc in 2013, based on the responses of over 5,000 individuals, it transpired that UK citizens are shying away from using cash as a means of payments due to cash withdrawal inconvenience and the inherent security risks, resorting to debit and credit cards as the next better alternative. Consequently, it emerged that, unless merchants get up to speed with such shift in retail payment preferences, they might stand to lose out (Payments Cards and Mobile, 2013).

Considering the security aspect in retail payments, the Lexis-Nexis 2012 'True Cost of Fraud Report' outlined the fact that in absolute numbers, merchants were less proactive towards fraud prevention in 2012 when compared to 2011. Consequently, given that less fraudulent transactions were detected, a greater margin was lost to such fraudsters. Thus, unless merchants augment their fraud detection techniques and carry out adequate risk assessments, to determine their fraud risk profile by implementing analytics, as well as gauge their current state of controls, they stand the chance of being subject to the mercy of their adversaries – the implications of which may be deemed significant (James, Fowlie, Hicks, & MacDonald, 2013).

Following a consultation process, the European Central Bank (2013) issued 'Recommendations' for the industry to follow in order to better improve the security of internet payments as well as to combat and prevent

payment fraud. These were developed by the European Forum on the Security of Retail Payments – SecuRe Pay.

This Forum was purposely set up in 2011 with the intention to facilitate the knowledge and information sharing between Authorities, and to provide a platform for Payment Service Provider Supervisors and overseers, allowing them to disseminate information on the security of electronic retail payment services and instruments available within the European Union.

Subsequently, the European Central Bank (2014) issued an 'Assessment Guide for the Security of Internet Payments' to assist stakeholders in comprehending the 14 recommendations, 56 considerations and 12 best practice addressing three key elements, mainly related to: (a) risk management; (b) strong authentication; and (c) consumer education; which should be implemented by February 2015.

Looking Ahead into the Future

The retail payment market in Malta is currently undergoing substantial developments, particularly due to rapid technological growth. The major stakeholders in this industry, predominately the retailers and merchants have the option to either shape the future, adopt a fast follower approach, or alternatively defend their position or simply put off change – each bearing the respective consequences which more often than not are unknown (PricewaterhouseCoopers, 2014). Moreover, consumers' behaviour provides evidence that shows individuals want choice and varied options to suit their profile which, more often than not, also depends on their age bracket.

Hence, it is pertinent and of utmost importance for all the stakeholders in the payments process, particularly Regulators and Supervisors, merchants and retailers, as well as service providers to collaborate in moving towards a clear objective; to ultimately provide consumers with secure, cost-efficient and effective innovative retail payment products ensuring that fraud and criminal abuse risks are adequately contained.

The manner in which the future trends in the retail payment market in Malta will develop is yet to be discovered given the current developments being discussed and proposed at EU-level. These proposals intend to create a stronger Legislative and Regulatory framework in order to stimulate further growth within a secure retail payment environment. What is certain, however, is that given Malta has continuously strived towards becoming an 'innovation-driven' economy, it is envisaged that over the next few years,

further innovative opportunities shall come to fruition. Hence, it is ultimately in each and every stakeholder's interest to keep abreast with such an evolving landscape and embrace the challenges as these unfold.

METHOD

According to Ghauri and Grønhaug (2005) systematic research, which is based on logical relationships and not just beliefs, is rigorously employed to discover current unknowns and thus enhance one's knowledge on the subject matter. Hence, the researcher is compelled to focus on the empirical realities and engage in inductive reasons to produce analyses relevant to today's reality. This process was accomplished by keeping abreast with the manner in which legislation and regulation pertaining to the retail payment market affects the main stakeholders, holding discussions with subject-matter experts as well as gathering substantial data from varied sources.

Measures

An effective manner in evaluating the research topic and of obtaining the necessary information is by carrying out interviews – a popular strategy for collecting qualitative data. The interview schedule consisted of a mixture of predefined closed-/open-ended questions, with additional questions emerging from the course of the interview. The semi-structured interviews provided the researcher with the opportunity to discuss any areas which required further probing dependent on the interviewees' background, organisation and operation; moreover, in conjunction to supplement further comments particularly to add and amend if responses appeared to be false or insufficient.

All interviewees were first invited to answer general questions on demographics relating to their role and organisation, followed by questions being legislative and regulatory in nature, others that targeted the organisations' operations and the ways in which they approach retail payments and concluding with questions on the developments, willingness to adopt new methodologies and any proposed changes they would like to see within the retail payment market in Malta. Ultimately concluding on the manner in which they envisage the retail payment market to unfold in the coming years.

Participants and Criteria for Selection

The main participants contributing towards this study were the local Regulators, Supervisors and overseers of retail payments, as well as locally licensed core-domestic Credit Institutions also commonly referred to as Banks, Payment Service Providers and Electronic Money Institutions.

All prospective interviewees were first contacted by email and telephonically, to enable the author to give a verbal explanation of the purpose of the study at hand, explain the objective of the interview, provide reassurance of confidentiality, and establish an appointment for the interview. The pool of respondents was mainly derived from the authors' personal contacts, the Malta Financial Services Authority's (MFSA) website, as well as the Professionals social media websites. The interviews were mainly carried out face-to-face, whilst some interviewees opted to provide feedback telephonically finding it more convenient and time-efficient given their busy schedule. The population of 30 organisations were contacted over a period of a month, out of which 22 actively participated in the interview, thus resulting in a total participation rate of 73.33%.

The Thematic Approach

Qualitative research encompassing data obtained whilst posing open-ended questions during the interview, was analysed by employing the 'Thematic' approach. Holloway and Todres (2003) note that qualitative approaches are incredibly diverse, complex and nuanced whereby thematic analysis should therefore be seen as a foundational method. Hence, through its theoretical freedom, thematic analysis provides the necessary flexibility and acts as a useful research tool that can potentially provide an account of data that is rich and detailed (Braun & Clarke, 2006). Hence, the authors' background in the financial services sector assisted in the research process of judging and identifying the themes to address and research on.

Braun and Clarke (2006) outline a phased approach to thematic analysis which required the familarisation with the data by immersing onself through repeated reading and subseqent transcribing of the verbal data which will lead to the generation of initial codes and the subsequent search for themes and visually illustrating them by way of a 'thematic map'. Themes however require sufficient review, definition and nomenclature to ultimately produce

the report whilst ensuring that the results blend in with the original research questions and the literature reviewed.

A pilot test set the scene for the subsequent actual interviews in order to ensure that the correct level of probing was adopted. This was tested with a financial services industry expert who is substantially conversant with the topic being addressed.

Sample Size and Selection

The two major payment stakeholders were selected: the first stakeholder group consisting of Regulators, Supervisors and overseers of retail payments in Malta; the second stakeholder group was composed of credit institutions and financial institutions. Although such organisations were in scope, during the information gathering phase, it was clear that only those entities dealing directly with retail payments in Malta would essentially add value to this study.

To this effect, given that this study is focused on the future trends in the retail payment market in Malta, the CBM, MFSA and Financial Intelligence Analysis Unit (FIAU) were selected to represent the Supervisor, Regulator and overseer, together with credit and financial institutions licensed to carry out payment services activities. In relation to this, from a total of 27 local credit institutions, the 5-core domestic banks, as categorised by the CBM, were selected to form part of the sample. Additionally, from the 33 local financial institutions, 16 Payment Service Providers and six Electronic Money Institutions were selected to form part of the sample on the basis that they were licensed to carry out 'Payment Services' – Activity 4 of the First Schedule to the Financial Institutions Act (Cap. 376) of the Laws of Malta (1994). Thus, following purposive sampling, the researchers focused on 30 entities. Out of the 30 organisations, 22 were willing to cooperate and provide their feedback to the researchers; two organisations informed the researcher that they are still in their 'start-up' phase and subsequently do not feel they could actively contribute towards the study; whilst six provided no substantial feedback, of which three opted out of the study mainly due to confidentiality reasons notwithstanding sufficient assurance was given in this respect, and the remaining three organisations were unreachable also due to the foreign senior management not being present in Malta, as well as the compliance function responsible for regulatory and compliance issues is being outsourced to third parties.

RESULTS AND DISCUSSION

As previously outlined, the interview schedule consisted of a mixture of predefined closed-/open-ended questions, with additional questions emerging from the course of the interview.

Legislation and Regulation Pertaining to Retail Payments

The researcher sought to obtain an indication as to how each stakeholder interviewed approached the legislation and regulation pertaining to retail payments. The majority of respondents, including Regulators and Supervisors as well as licence holders, emphasised the importance of keeping abreast with current Laws and Regulations relevant to their line of business.

In contrast, one respondent felt rather neutral given the fact that the financial institution concerned operates mainly in terms of activities licensed solely under the First Schedule to the Financial Institutions Act (Cap. 376) of the Laws of Malta (1994), and thus retail payments do not form part of the main line of business.

In another question, the interviewees were asked to indicate the level of awareness and knowledge they perceived to possess with regards to upcoming EU Directives and Regulations pertaining to retail payments. At this stage, the researcher prompted certain legislation by citing and making reference to the PSD 2, the 4th AML Directive and the MIF Regulation. The majority of respondents were prompt in stating that they are aware of such legislative and regulatory processes currently being undertaken especially at EU-level. Moreover, they feel committed towards keeping abreast with discussions and proposals being put forward, and assess the potential impact such legislation and regulations might have on their organisation and business process. Some also noted that specific employees within their organisation, mainly Compliance Officers, have been designated with the responsibility to ensure that the organisation is kept duly informed and notified of upcoming amendments, whilst assessing and where possible simulating the potential impact and outcomes of such amendments.

On the other hand, a handful of licence holders took their time in answering this question, showing that they struggled to keep up to speed with such a dynamic environment. Thus, emphasising the fact that significant reliance is placed on local regulatory notifications and updates issued mainly by the MFSA. For the most part due to their size, in terms of head

count and business operations, they often find themselves taking a reactive rather than a proactive approach towards such amendments.

Approach to Retail Payments in Malta

In order to adequately gauge and perceive the future trends expected within the local retail payment market, the interviewed stakeholders were asked to provide their opinion on the direction the Maltese population and consequently Malta as a country are taking towards this subject matter.

- The Major Retail Players, Payment Channels and Payment Methods: The researcher posed three questions to delve further and obtain an indication as to who the major retail players in Malta are, which payment channels are frequently availed of and the habitual payment methods used, providing examples in all cases for each theme, without influencing the interviewees' opinion.
  i) Retail Players: Both literature and statistics provide an overload of information as to which stakeholders and institutions are the forefront market leaders of such sector. So as to stimulate and engage the respondents in a discussion, the researchers prompted whether in the respective respondents' view, banks/credit institutions are the major players for retail payments in Malta, as opposed to the more recent entrants being Payment Service Providers (PSPs) and Electronic Money Institutions (EMIs). The 22 respondents provided diverse feedback whereby, 14 respondents agreed, six disagreed, whereas two respondents were neutral to such statement.
  ii) Payment Channels: Prior to querying on the use of payment channels, the researcher provided a brief overview of the various channels currently available, such as the traditional ATMs and branches provided by credit and financial institutions, as well as the more innovative smartphone applications and the internet. The researchers queried whether the former two traditional models were more commonly availed of as opposed to the more innovative options.

     The feedback provided by the 22 respondents varied considerably ranging from 55% total agreement to the statement, whilst 27% expressed neutrality and 18% conveyed their divergences towards the implications of such query.
  iii) Payment Methods: In the light of the ECB's Payments Statistics Report issued in 2013, and following the previous question posed,

> the researchers sought to delve into assessing whether the use of cash and cheques still out-weigh the use of cards and electronic modes including online payment methods. Out of 22 respondents, 14 agreed with such statement, whereas six were neutral whilst two disagreed.

However an interesting point that was highlighted and which emerged in most respondents' comments was the fact that the selection of the payment method was highly dependent on the users' respective characteristics, particularly age.

Cost-Efficient, Regulated Innovative and Secure Retail Payments

Conscious of the indications towards future trends expected from younger generations, who will eventually take hold of the reins and steer the retail payments markets into the future, cost-efficiency, regulated innovative and secure retail payments were the subsequent areas the researchers opted to explore further. In addition, the researchers also opted to obtain a closer understanding as to the direction these were heading to, particularly in relation to any specific initiatives undertaken by the stakeholders interviewed.

The majority of respondents noted that their organisations favoured the use of cost-efficient retail payments, such as credit/debit cards, online payments and the like, as opposed to the other traditional methods, particularly in such instances where their business model has been specifically moulded to favour cost-efficient retail payments to the likes of e-wallets. One respondent also indicated that a particular project is in the pipeline specifically targeting cost-efficient retail payments, and hence market research is currently being carried out to effectively roll out the project plan in the coming months.

A minority of licence holders were rather impartial to such payment options given that the emphasis of the business operations evolved around cash-based retail payment methods. They specified that cards and online payments were areas which their organisation currently has not as yet explored in so much depth, given that they currently service a particular 'niche' market.

Target Customers and Customer Awareness

The importance of demographics was a recurring theme that interviewees reiterated quite often during their discussions with the researchers. In this

context, the researchers queried whether in the respective stakeholders' point of view, institutions such as PSPs and EMIs specifically targeted non-Maltese clients by availing themselves of the European passporting regime, whereby both PSPs and EMIs could provide their licensable activities in other EU and EEA jurisdictions. This may be done either by way of provision of services, or by freedom of establishment that is to physically set up a branch in such countries, as outlined in the 'Guidelines for passport notifications' issued by the Committee of European Banking Supervisors (2010), which has been succeeded by the European Banking Authority.

Responses to such suggested course of action were evenly spread between total agreement, total disagreement, whilst others opted to be neutral. Hence, feedback obtained provided the researchers with further clarity in outlining the fact that each respondent organisations' outlook on the matter was dependant on the market they each willingly opted to target – some solely local, others included a focus on non-Maltese, whilst a few opted for a balanced mix between local and non-local customers.

In conjunction with the above reactions, the researcher queried whether more awareness is required for customers to make informed decisions on the various retail payment methods available. An absolute favourable reply was received from all interviewees who individually stressed the importance that customers, irrespective of whether they are individuals or companies, require the necessary information to execute decisions on an informed basis.

Benefits for Malta's Economy

With reference made to unregulated innovative payment methods, the researchers inquired whether the sampled stakeholders were of the opinion that Malta's economy would stand to benefit from innovative and secure retail payments, and whether the regulation of virtual/crypto currencies would also prove to be beneficial to the country. An absolute majority were inclined to favour both stances, emphasising the fact that as an innovation-driven economy, the country must ensure it remains at the forefront of technological developments. This includes the promotion of innovation and security in retail payments, as some emphasised that the necessary measures need to be taken, particularly when using the 'cloud' to host particular services or to carry out transactions.

Some pursued further by stating that Malta, and all economies at large, require specific guidance and a practical solution for dealing with current unregulated virtual/crypto currencies such as the infamous 'Bitcoin'.

In view of the ongoing discussions and the haphazard courses of action proposed by the various global stakeholders, the EBA recently issued an opinion addressed to the EU Council, European Commission and European Parliament as well as to national supervisory authorities, outlining the requirements to be taken into account for the regulation of 'virtual currencies' (European Banking Authority, 2014a, 2014b). This opinion was made public on 4 July 2014 during the timeframe when the researcher was conducting the interviews. Hence, although the researcher did not specifically incorporate such opinion in the interviews to obtain specific reactions and feedback, the course of action Malta has taken as an economy in addressing virtual currencies reflects the same stance taken in the said opinion, which mainly outlines that national supervisory authorities are to: '*Discourage financial institutions from buying, holding or selling virtual currencies while no regulatory regime is in place*' (European Banking Authority, 2014a, 2014b).

Although the above best practice is implied in the local scenario, licence holders expressed the need for local regulators and supervisors to go beyond, and provide tangible guidance on certain aspects pertaining to innovation in the retail payment market in Malta.

Recommendations for Amendments to Current and Prospective Laws and Regulations

In view of the recent financial turmoil, Laws and Regulations pertinent to the financial services sector have undergone a major overhaul over the last five years and are expected to keep such momentum, at least until the markets stabilise and regain their consistency, which to date still appears to be 'work-in-progress'. The researchers questioned the interviewees whether, on the basis of their opinion and in their personal capacity, they would recommend any changes to the current and forthcoming legislative and regulatory amendments. With such responsibility borne in mind, the respondents provided various proposals on areas they believe merit further attention. The following provide an outline of the main aspects suggested:

- EU Directives and Regulations should provide a clearer interpretation and definition of payment accounts (which can be accessed electronically) and electronic money. This definition would help all jurisdictions adopt a harmonised interpretation of the related Regulations and clearly distinguish between licences issued in terms of the PSD and those issued in terms of the EMD;

- More industry consultation should take place at EU-level before Legislation and Regulations are endorsed, with the ultimate objective of making them user-friendly and including less ambiguity;
- Whenever changes to Legislation and Regulations are enforced, greater awareness needs to be taken into account of the costs incurred by the respective stakeholders, especially when such costs are then transferred to end-user customers;
- Further guidance is deemed necessary in relation to the interplay between anti-money laundering Laws versus payment systems and e-money institutions, as well as including further technological processes (such as biometrics) for the identification and verification of potential clients;
- Further initiatives are to be taken to enhance and strengthen customer protection towards micro-enterprises and
- Additional guidance and support provided by Regulators and Supervisors to licence holders (particularly PSPs and EMIs) is merited so as to assist them with embracing Legislative and Regulatory requirements as these unfold.

Ability to Promote Cost-efficient, Innovative and Secure Retail Payments

In order to consolidate the interviewees' opinions on their ability and proactive approach within the organisation towards promoting cost-efficient, innovative and secure retail payments, interviewees were asked to comment on their individual views on the matter. The Central Bank of Malta is compelled and committed to be a catalyst to the promotion of cost-efficient, innovative and secure retail payments in Malta. In this respect, the interviewee noted that: '*We have started several initiatives in order to understand where the market stands and to analyse trends. We also hope to embark on a National Retail Payments Strategy which will set strategic objectives and milestones that should be reached through concrete initiatives*'.

On the other hand, although the Malta Financial Services Authority does not promote the use of any particular methods of payment, the interviewee stated that: '*From our end, we will continue to process applications for the setting up of payment services institutions and electronic money institutions. During our application review process, we will also continue to ensure that all necessary controls and safeguards are put in place to ensure secure payment frameworks*'.

Envisaged Developments in the Retail Payment Market over the Next 5–10 Years

On a concluding note, the researchers inquired on the manner in which the respective interviewees envisage developments to unfold in the next 5–10 years, specifically related to the retail payment market. A variety of responses were obtained, each providing various insight into the diverse areas of the subject being investigated. A common factor relates to the recent global trends in the retail payment market. Consequently, it is envisaged that new players will enter the market bringing with them innovative business models coupled with the use of electronic payments that are expected to continue to expand in the coming years.

The more traditional use of cash and cheques will reduce accordingly given a concomitant increase and a stronger uptake of the use of cards, internet payments and e-Wallets. Mobile payments are also anticipated to become mainstream as smartphones will eventually become the new payment channel that will limit or potentially phase out the use of cash – a change definitely embraced by the younger and upcoming generations. Some respondents expressed their views that virtual currencies will take a greater upswing, particularly due to the 'fee-free' structures they promote, which in the eyes of many users will ultimately overcome the potential risks involved in dealing with such 'currency' – hence, prompt and robust regulation no longer remains an option.

Furthermore, biometric authentication is set on a journey of becoming one of the conventional authentication methods employed, as it advocates a secure and efficient way of processing customer identification and verification procedures.

Ultimately, an interesting and yet pivotal aspect raised by the majority of respondents is that although each stakeholder have their own views and perspectives on retail payments, the bottom-line remains that in order to achieve success, a collective effort is required from all stakeholders, given that individually they all contribute towards the bigger picture. Particular significance was placed on the fact that merchants, for instance, need to be willing to cooperate and promote innovation without hindering or setting barriers for other stakeholders by limiting payment options or imposing exorbitant fees; as this practice shall nonetheless end up eating away consumers' purchasing power. Such innovation has already materialised whereby merchants to the likes of M&S, Boots, WH Smith and Sainsbury's in the United Kingdom have already deployed hardware that supports contactless all over the United Kingdom (Munro & Pickup, 2014).

Implications of the Research

There are significant implications to be taken into account that predominantly are translated into the risks encountered when venturing into an unregulated ambit. Likewise, the manner in which these risks are altered may hypothetically expose customers to the possibility of being defrauded of their hard earned money. Hence, given that in such a dynamic environment time is of the essence, the EU as well as local Regulators and Supervisors are compelled to act fast in regulating and monitoring such disruptive innovation. On the other hand, licence holders are duty-bound to keep up to speed with this evolutionary process by engaging the necessary human resources that are the lynchpin for any organisation's success. Additionally this research has contributed towards the identification of trends that are set to prevail in the years to come, which imply that organisations need to adapt to change and tailor their organisational structure accordingly.

This essentially translates into keeping in touch with what consumers want, and how such wants vary as they transform themselves across generations; with particular focus on those individuals who have not as yet reached adulthood, and are expected to carve and shape the future trends in the next decade. Consequently, it is safe to assume that over the next 5–10 years, what are currently referred to as 'traditional' payment methods such as cash and cheques, will succumb to enhanced innovative options that emulate the physical purse into an electronic wallet that stores various card and payment account details, easily accessible via a mobile and innovative payment channels. The implications of this observation speaks volumes, given that the sanguine corollary effects for stakeholders that invest in such innovative solutions are deemed rather lucrative; particularly in the light of the exponential growth brought about by innovative solutions targeted towards the younger generations.

Recommendations for Future Research

In accordance with the findings of this research, an investment in innovation advocates the best outcome for all market participants. This translates into both human capital, as well as the technology to adopt and perform efficient operations.

Another recommendation revolves around the area of Legislation and Regulation, whereby additional effort is required particularly at EU-level.

As discussions develop and intense lobbying takes place, with the intention to buffer in, the impact of novel legislation as well as amendments thereto will subsequently affect all categories of licence holders. Ostensibly, micro and small enterprises tend to miss out or not avail themselves of certain advantages targeted towards the larger organisations. Therefore, enhanced local guidance from the Regulators and Supervisors is essential for all licence holders, in order to ensure a level playfield is retained amongst all market participants.

A further recommendation is for policy makers to hasten and take concerted action to address unregulated aspects pertaining to retail payments, such as the infamous virtual currencies. The inertia witnessed so far provides no solace whatsoever, whilst the prevailing uncertainty is discomforting as it poses innumerable risks to naïve customers. However, it is also to be noted that accelerating such process should not be carried out at the detriment of not adequately carrying out the necessary evaluation and assessment. All stakeholders are to remain abreast with the market's needs and demands, adequately assessing potential customers on the basis of their demographics, with special emphasis placed on the 'millennial' generation. Whereas when disruptive innovation comes to life, it is essential that quick action is taken to embrace or restrict such discoveries for the benefit of mankind.

A final recommendation is that all stakeholders, particularly merchants, are to facilitate innovation and not impose barriers to certain innovative payment channels and methods, or impose additional charges for consumers relating to supplementary fees accumulated along their value chain. This recommendation also refers to the other stakeholders that, either through regulation by for instance, restricting innovative authentication methods or operations, hinder such processes at the detriment of providing consumers with value added.

CONCLUDING NOTE

In response to turbulent financial market periods, humanity succeeds in evolving in such a manner to respond to the external changes occurring, with a view to containing any impacts or retaining them to a bare minimum. To this effect, following the financial crisis, Malta's economy has remained relatively unscathed mainly due to the prudence it has instilled in its Legislative framework and Regulatory regime, founded on European

legislative measures as well as home-grown practices that have stood the test of time. Nonetheless as an economy, Malta has invested significantly in embracing the potential of technology, human resources and innovation purposely to stimulate further growth and prosperity to achieve today's status of an 'innovation-driven' economy.

Hence, although the results of this progress might take a couple of years to fully establish, the developments in payments technology over the past years bear witness and have exposed some interesting trends as we move towards Europe 2020 growth model attributing towards an innovative and digital economy.

In carrying out this study purposely to gauge the new local trends in the retail payment market, mobile payment options, whether peer-to-peer or contactless, appear to be leading this drive, following the trend of demand in tandem with a multi-channel approach. In this context however, due consideration is to be given to consumers and their payment needs by providing the necessary information and creating awareness so as to carry out informed decisions whilst providing the necessary value added at the point-of-sale. This leads to adequately understand the profile, needs and demands of the various customer generations, and service them in timely and secure efficient manner providing innovative solutions, which as Steve Jobs aptly put it: '*Innovation distinguishes between a leader and a follower*' (Gallo, 2010).

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