COMPARING DIFFERENT EXCHANGE TRADED FUNDS IN SOUTH AFRICA BASED ON VOLATILITY AND RETURNS

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DECLARATION

I declare that the dissertation, which I hereby submit for the degree Masters of Commerce in Economic Sciences, is my own work and that all the sources obtained have been correctly recorded and acknowledged. This dissertation was not previously submitted to any other institution of higher learning.

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EDITING LETTER

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To whom it may concern

This is to confirm that I, the undersigned, have language edited the completed research of Wiehan Peyper for the Magister Commercii (Risk Management) thesis entitled: *Comparing different exchange traded funds in South Africa based on volatility and returns*

The responsibility of implementing the recommended language changes rests with the author of the thesis.

Yours truly,

Linda Scott

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ABSTRACT

Increasing sophistication of exchange traded fund (ETF) indexation methods required that a comparison be drawn between various methodologies. A performance and risk evaluation of four pre-selected ETF indexation categories were conducted to establish the diversification benefits that each contain. Fundamentally weighted, equally weighted and leveraged ETFs were compared to traditional market capitalisation weighted ETFs on the basis of risk and return. While a literature review presented the theory on ETFs and the various statistical measures used for this study, the main findings were obtained empirically from a sample of South African and American ETFs. Several risk-adjusted performance measures were employed to assess the risk and return of each indexation category. Special emphasis was placed on the Omega ratio due to the unique interpretation of the return series' distribution characteristics. The risk of each ETF category was evaluated using the exponentially weighted moving average (EWMA), while the diversification potential was determined by means of a regression analysis based on the single index model.

According to the findings, fundamentally weighted ETFs perform the best during an upward moving market when compared by standard risk-adjusted performance measures. However, the Omega ratio analysis revealed the inherent unsystematic risk of alternatively indexed ETFs and ranked market capitalisation weighted ETFs as the best performing category. Equal weighted ETFs delivered consistently poor rankings, while leveraged ETFs exhibited a high level of risk associated with the amplified returns of this category. The diversification measurement concurred with the Omega ratio analysis and highlighted the market capitalisation weighted ETFs to be the most diversified ETFs in the selection. Alternatively indexed ETFs consequently deliver higher absolute returns by incurring greater unsystematic risk, while simultaneously reducing the level of diversification in the fund.

Keywords: *Exchange traded funds, Omega ratio,* exponentially weighted moving average*, diversification, risk-adjusted performance.*

OPSOMMING

Toenemende gesofistikeerdheid in die indeksasiemetodes van beursverhandelde fondse (BVF) het dit genoodsaak om ‘n vergelyking te trek tussen die verskeie metodes. 'n Prestasie en risiko-evaluering van vier vooraf-geselekteerde BVF indeksasie kategorieë was gedoen om die diversifikasie voordele wat elk bevat te evalueer. Fundamenteel geweegde-, gelyke gewig- en hefboom BVF is op ‘n risiko en opbrengs basis in vergelyking met die tradisionele markkapitalisasie geweegde BVF geplaas. Terwyl 'n literatuuroorsig die teorie van BVF en die verskillende statistiese maatstawwe verskaf het, is die belangrikste bevindings empiries verkry deur van 'n steekproef Suid-Afrikaanse en Amerikaanse BVF gebruik te maak. Verskeie risiko-aangepaste prestasie maatstawwe was ingespan om die risiko en opbrengs van elke indeksasie kategorie te beoordeel. Spesiale klem was op die Omega verhouding geplaas as gevolg van die unieke interpretasie wat dit van die opbrengsreeks se verspreiding verskaf. Die risiko van elke BVF kategorie was geëvalueer deur gebruik te maak van die eksponensieel geweegde bewegende gemiddeld (EGBG), terwyl die diversifikasie potensiaal bepaal was deur middel van 'n regressie-analise wat op die enkele indeks model gebaseer is.

Volgens die bevindinge presteer fundamenteel geweegde BVF die beste in 'n opwaarts bewegende mark wanneer ‘n vergelyking gemaak word met standaard risiko-aangepaste prestasie maatstawwe. Die Omega verhouding het egter die inherente onsistematiese risiko van alternatiewelik-geïndekseerde BVF aan die lig gebring en het markkapitalisasie geweegde BVF as die beste presterende kategorie geïdentifiseer. Gelyke gewig BVF het konsekwent ‘n swak ranglys posisie getoon, terwyl hefboom BVF 'n hoë vlak van risiko vertoon het wat gepaard gaan met die verbeterde opbrengste van hierdie kategorie. Die diversifikasie maatstaf het ooreengestem met die Omega verhouding analise deur die markkapitalisasie geweegde BVF as die mees gediversifiseerde BVF in die keuse aan te dui. Alternatiewelik-geïndekseerde BVF lewer gevolglik hoër absolute opbrengste deur 'n groter hoeveelheid onsistematiese risiko aan te gaan en terselfdertyd word die vlak van diversifikasie in die fonds verminder.

Sleutelwoorde: *Beurs verhandelde fondse, Omega verhouding,* eksponensieel geweegde bewegende gemiddeld*, diversifikasie, risiko-aangepaste prestasie.*

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CHAPTER 1

INTRODUCTION, PROBLEM STATEMENT AND BACKGROUND OF THE STUDY

1.1 INTRODUCTION

The unstable global financial landscape of the past five years, since the 2008 financial crisis, has brought many challenges for investors. The uncertain economic conditions have been a result of many contributing macroeconomic factors such as low economic growth rates, high unemployment, the European debt crisis, and the ongoing fiscal difficulties in the United States. Difficult decisions were required concerning asset allocation strategies, to avoid further losses in the period after the financial crisis. Such decisions were necessary on institutional as well as individual levels, to better diversify portfolios to include less risky assets such as gold and money market instruments. Throughout the process of restructuring portfolios, investors consistently analysed the trade-off between a safer portfolio (*inter alia* lower risk) and a higher income generating allocation of funds (*inter alia* higher risk).

The financial markets have experienced extreme volatility, causing great challenges for investors from 2008 through to the present (June 2013). As Botha (2005:1) describes it, this kind of market volatility, increases the price return variability of investments and hence creates uncertainty or risk. All investment strategies, therefore, have to be centered on mitigating this price uncertainty associated with volatile markets. This is necessary to ensure that actual returns are as close to the expected returns as possible.

One strategy that investors considered was that of combining higher risk items, with lower risk items in their portfolios. The process of spreading an investment across different asset classes to eliminate some of the risk in a portfolio is known as diversification (Wuite, 2009:136). Although the diversification strategy has been used for many years prior to the crisis, the increasing number of products offering more financial diversification added a much greater need for investors to research and understand such products before investing in them. One such recent product development has been the creation of exchange traded funds (ETFs). The latest developments in the ETF market was analysed as part of this study to review the new investment possibilities that are presented to investors.

1.2 THEORETICAL BACKGROUND

An ETF is defined as a tradable depository receipt that gives investors a pro rata claim to the returns associated with a portfolio of securities held in a trust by a financial institution (Riley & Brown, 2009:1044). The structure of this product gives an investor exposure to a range of different securities. This broader level of exposure ensures that the investor receives a great deal of diversification in his/her portfolio. Through a single investment, it may be possible for an investor to gain exposure to shares, bonds and commodities. Traditionally ETFs have been structured in such a way as to track the returns of a specific index or benchmark (*inter alia,* ETFs historically delivered the beta or market average return). However, recent developments in the ETF market offer even more diversification to investors, and alternative ways in which the ETF index can be structured, are emerging.

ETFs now offer exposure to the market in a way that offers more diversification in a sense that an ETF provides a cost effective way to restructure a portfolio and gain access to a diverse variety of market segments. Mullaney (2009:354) summarises one of the greatest advantages of ETFs as being less volatile and less subjective to individual company (unsystematic) risk. It is exactly this characteristic of an ETF that has made it such a good instrument to include in an investment, as it reduces the effects of volatile market conditions, and thus creates a more balanced portfolio.

The combination of both actively and passively managed investment strategies in a portfolio has attracted a great deal of debate in the past (Wessels & Krige, 2005; Russel *et al*., 2010; Hull, 2011). Traditionally ETFs have been considered only as a passively managed investment, and hence, there has always been the need to combine these investments with other kinds of assets in the portfolio. However, Brown (2013) mentions that ETFs are not subordinated to actively managed funds, highlighting that some 80 persent of South African equity based unit trusts, over the past three to five years, failed to beat their benchmark indices.

Recent developments in the ETF market have changed the way in which this kind of investment is structured and therefore offers much greater flexibility to index the ETF in such a way as to gain maximum benefits from it. As ETFs develop, the basic structure of merely tracking a specific index is being replaced by more sophisticated methods of indexing. More advanced approaches are challenging the conventional passively managed ETFs, adding a degree of activeness to the index composition. ISA (2012) breaks the ETF selection down into three broad categories within which a typical ETF indexation would happen. A fourth category, as mentioned by Ashton (2011), can be added to the list. The fourth category is included due to the massive growth it has experienced globally. The four categories are as follows:

- Traditional indexing.
- Fundamental indexing.
- Equal weighted indexing.
- Leveraged ETFs.

Traditional indexing refers to the basic structure where an index is replicated as closely as possible by the fund. The goal is to offer the exact returns of the underlying index. This can include a variety of indices from almost any type of share, bond or commodity traded on an exchange. Some South African examples include SATRIX 40 ETF, RMB 40 ETF and Absa Newfunds GOVI. Weightings in these index ETFs are done on the basis of market capitalisation to best replicate the impact any price movements will have on the underlying index. This type of indexation follows the traditional view that an ETF can only be considered as a passive investment, where an investor will seek to take a view on a specific index and passively track this over a longer time period.

Fundamental indexation attempts to outperform classic benchmarks by screening securities based upon various financial measures (ISA, 2012). This evolution in the way ETFs are indexed means that the index is constructed using metrics such as sales, book value, cash flow, valuations and even dividends. Such selection criteria ensure that the assets that form part of the index will be periodically reevaluated to ensure that they still meet the required levels. This creates a slight value bias in the portfolio, which might see selections that could offer above normal returns. Examples of these kinds of ETFs in South Africa include SATRIX RAFI, SATRIX DIVI and Absa eRAFI overall. Each of the fundamental ETF funds may differ in terms of the review period. However, as fundamental company data is released annually, a fundamentally weighted portfolio is rebalanced and reconstituted annually. This offers the active managed element, which traditional passive index tracking ETFs do not have. According to Stewart (cited by Ashton, 2011), the concept of fundamental indexation is a much more efficient way to estimate the economic value of the underlying assets and therefore allows for a much better allocation of capital.

Equal weighted indexation, as a third category, offers an alternative to investors who might require a different method to track a portfolio of securities other than market capitalisation or fundamental company information. This method, as described by ISA (2012), assigns an equal weighting to each security, regardless of their market size, financial metrics or other factors. An example of this kind of ETF in South Africa (SA) is the Nedbank BettaBetta EWT 40 ETF, which equally allocates the same amount (2,5%) to each of the Top 40[1] shares. This balanced approach produces less volatility and a lower risk adjusted exposure to the Top 40. Market volatility is smoothed out by not letting larger market capitalisation companies carry too much weight in the index. Therefore, this kind of indexation outperforms well when the small and medium capitalisation stocks are in an upswing phase (Zeng & Luo, 2013).

The final category that was analysed within the research is the latest addition to the list. Leverage ETFs, also referred to as synthetic exchange traded products (ETPs), do not actually invest in the underlying assets, but replicate the performance of a certain index by the use of derivative products (Ashton, 2011). The use of these derivatives in the ETF structure makes leverage ETFs much riskier than the categories mentioned thus far. It is also for this reason that such products are not yet available in the South African market. The Collective Investment Schemes Control Act (45 of 2002) (CISCA) does not allow synthetic ETFs because no leveraged or derivative products may be used in collective investment scheme portfolio. However, globally these products have been doing very well. Ashton (2011) states that this part of the United States (US) market has grown by a third during 2011, compared to

[1] The Top 40 Index consists of the largest 40 companies ranked by full market volume, before the application of any investability weightings on the JSE All Share Index (Moneyweb, 2014).

only 8 percent growth for all other ETFs. The risk associated with such products are, however, much greater, as some of these products aim to sometimes deliver 200 percent or even 300 percent of the daily return of an index. Some other funds are designed to provide -100 percent, -200 percent or -300 percent of daily returns to allow gains during a market downturn (Johnston, 2010a). Negative returning ETFs ensure that a declining index essentially can be shorted to create a positive return for the investor.

The four categories mentioned above clearly illustrate the increasing complexities of the ETF market, as its development continues. The inherent structure of each category offers an investor some potential diversification benefit to their investment portfolios. However, some questions remain. Which indexation category carries the highest level of risk? When considering both the returns and risk of these categories, which category gives an investor the most diversification?

1.3 PROBLEM STATEMENT

Market volatility and the variable returns that an investor may experience remain the biggest problem that investors face during uncertain economic times. ETFs, as an alternative investment vehicle, might offer the diversification that such an investor seeks. However, ETFs do not offer a complete solution to the problem. Traditional index tracking ETFs will only offer returns to an investor when the combined performance of the market is positive. Therefore, during economic slowdowns or recessions these investments may lose a lot of value.

Therefore, these products historically needed to be complimented with other investment products or asset classes to eliminate the systematic risk of the market. With the development of fundamental indexation, equally weighted indexation, and leveraged ETFs, the aim is to reduce the effects of market risk. These products do not merely track the market, but have the ability to offer an outperformance of the market index actively. The more sophisticated ETF indexation methods claim to offer a more balanced and better-diversified portfolio than that which can be achieved with conventional ETFs.

The need existed to test how well these various categories of ETFs compared on the basis of risk (measured by its volatility) and return. The lack of such a cross-category analysis within the South African market prompted this research to be conducted. This required that various risk-adjusted performance measures and the price volatility of ETFs from each category needed to be measured and compared to similar metrics of ETFs in the other categories.

1.4 RESEARCH OBJECTIVES

The following objectives were formulated for the study by making use of a positivistic research approach:

1.4.1 Primary Objective

The primary objective of this study was to compare the returns and volatility of the four identified ETF categories in order to determine which ETF indexation category offered the greatest diversification potential.

1.4.2 Theoretical objectives

In order to achieve the primary objective a host of theoretical objectives were formulated for this study:

- To study ETFs as an investment class; this took into consideration the history, development, application, regulations and innovation within the ETF market.
- To study market volatility theory and the implications that volatility holds for investment strategies.
- To study various return performance measures and its use to make ETF selections.
- To study diversification theory and its application to ETFs.

1.4.3 Empirical objectives

In accordance with the primary objective of the study, the following empirical objectives were formulated:

- To measure the volatility and returns of various ETF categories.
- To draw a cross category comparison based on the measurements to determine the category with the greatest diversification potential.

1.5 RESEARCH DESIGN AND METHODOLOGY

This study comprised of a literature review and the use of statistical empirical methods to reach the objectives set above. Quantitative positivistic observations of ETF price data were used for the empirical portion of the study.

1.5.1 Literature review

The literature study focused on theory, past research, and current information with regard to ETFs, volatility and return performance measures. This involved the use of books, articles and Internet sources, as well as other academic studies.

1.5.2 Empirical study

The empirical study involved the use of statistical methods to be applied to the quantitative observations of ETF price data. Measurements of both the volatility and returns were made from the observations. These measurements served as the basis of comparison between the different ETF categories. The null hypothesis set for this study was as follow:

- H_0: ETF categories utilising more sophisticated indexation methods will not offer greater diversification than those based on more traditional indexation methods.

1.5.2.1 Data collection

Quantitative observations of daily ETF price data for the four ETF categories were obtained from both US and SA stock market sources. For three of these categories the data was restricted to South African traded ETFs. The fourth category (leveraged ETFs) is not yet traded in South Africa, and therefore data from the US market had to be used during the measurements for this category. Market prices for SA ETFs were obtained from the McGregor BFA (2014) database, while the Yahoo Finance (2014) database provided the historical prices for US ETFs.

The data was restricted to the most recent (December 2010 to January 2014) available three-year period. The lack of historical time series data for South African traded fundamentally weighted ETFs reduced the time period that could be considered. Returns measured over a shorter period would return skewed results due to the inclusion of once-off shocks.

The data collection process involved a non-probability method to be used to obtain the data for South African ETFs. Due to the more recent developments[2] in the ETF market, not all of the ETFs traded in South Africa have long dated historical price data. Numerous ETFs had only been traded for a period of less than two years, and therefore the data collection was restricted to include only those ETFs with historical data of more than three years. The selection of the ETFs to be included in the study from the US market was made following the same process and time period as to keep comparisons consistent.

From the 38 ETFs currently traded in South Africa, two to three ETFs were selected in each category to allow for roughly one third of the market to be analysed. The data selection from the US was of a similar size (two to three ETFs per category). These positivistic quantitative observations underwent numerous statistical measurements as mentioned in the data analysis below.

1.5.2.2 Data analysis

The measurement of risk and return performance within this study centered on both the exponentially weighted moving average (EWMA) method to measure volatility and a set of risk-adjusted performance measures (with special attention to the Omega ratio)[3] to measure the return performance.

The measurement of volatility using an exponentially weighted moving average (EWMA) model allowed for a measurement that took into consideration the heteroskedasticity (non-constant variance) of the data. This ensured that conditional volatility was accounted for, by allowing more recent observations to carry a greater weight in the calculations. This was particularly important when dealing with financial data where more recent volatility observations have a greater impact on the trend.

[2] Rapid expansion of the SA ETF market has seen the addition of a number of fundamentally weighted ETFs since 2010.
[3] The unique benefits that the Omega ratio provided during the analysis is described in detail in Section 4.3.3.

The EWMA forms part of the autoregressive conditional heteroskedasticity (ARCH) family of models, which accounts for lagged variance and lagged squared returns that makes this ideally suited to capture the conditionality in the data.

Risk-adjusted performance of the returns was measured using various performance measures, including the Omega ratio. The non-normal distribution of returns associated with ETFs, called for a measure that does not make assumptions about the shape of the distribution. The Omega ratio overcame this problem as it was calculated directly from the observed distribution, and required no estimates (Keating & Shadwick, 2002). The Omega ratio, therefore, provided a measure where the risk and return characteristic of a returns series could be measured unequivocally. The Omega could be used subsequently to rank and evaluate portfolios consistently (Keating & Shadwick, 2002).

Accounting for the volatility (as measured by EWMA), and the performance of the returns (as measured by the Omega ratio), the four identified ETF categories were compared. In addition to the comparison of the risk and return rankings, the single index model was used, along with the standard error of estimate (SEE), to determine the diversification potential for each ETF indexation category.

1.6 CHAPTER OUTLINE

This study comprises of the following chapters:

1.6.1 Chapter 1 - Introduction, problem statement and background of the study

The first chapter focuses on the background and the aim of the study. The problem statement, research objectives, as well as the research method are discussed.

1.6.2 Chapter 2 - Exchange traded funds

Chapter 2 provides a thorough discussion about the workings of an ETF fund. This includes the history and the development of ETF markets in South Africa and globally. ETFs as an investment vehicle are also distinguished from similar investment vehicles such as hedge funds, mutual funds and unit trusts. The determining factors for investing in ETFs are analysed to see how these characteristics form part of the increased growth within the market sector. The risks involved with the use of ETFs, as an investment vehicle, are highlighted. The regulation that currently governs the ETF market is examined in order to illustrate why specific categories of ETFs are not yet traded on the South African market. Chapter 2 concludes with a brief look into various strategies that can be used when investing in an ETF fund.

1.6.3 Chapter 3 - Diversification, return performance measures and volatility

Market volatility theory is discussed in Chapter 3 of this dissertation. The concept of diversification as a means to mitigate market volatility is analysed in depth. Furthermore, the performance measures used to calculate the performance of a return series are discussed in depth. Various performance measures are compared to the Omega ratio in order to highlight its importance during this study. The measurement tools required to analyse market volatility and the performance measures are discussed to aid the statistical analysis followed in Chapter 4.

1.6.4 Chapter 4 – Results and findings

Based on the theoretical foundation from the preceding chapters, Chapter 4 provides the empirical analysis of this research. The volatility and return performance measures are calculated and the category rankings are presented. Furthermore, the diversification potential of each ETF indexation category is provided by utilising the diversification measurement.

1.6.5 Chapter 5 - Summary, conclusions and recommendations

A summary and discussions of the results of this study, as well as recommendations for future research, are presented in Chapter 5.

CHAPTER 2
EXCHANGE TRADED FUNDS

2.1 INTRODUCTION

This chapter provides the theoretical foundation and addresses the first objective of the study by describing exchange traded funds (ETFs) in extended detail. Firstly, the theory underpinning ETFs is presented by means of an overview of the efficient market hypothesis (EMH). The creation and redemption process, whereby ETFs are issued into or extracted from the market, is defined as a key feature of ETFs that help to ensure liquidity and at the same time reduce arbitrage scenarios for market participants. The various types of ETFs that are traded within the ETF market are also described to illustrate the wide array of application possibilities for ETFs. Furthermore, the numerous advances that have been made with regards to innovation in the ETF market are explained by reviewing the historical developments since the inception of ETFs.

The use of ETFs as an alternative investment class requires that a clear distinction be made between ETFs and other similar investment products. A direct comparison is provided between ETFs, hedge funds, unit trusts and index funds to highlight the key differences that ETFs have to such substitute investment classes. ETFs are shown to hold significant benefits over all of the rival investment classes; however, they do present some limitations. The risks involved with ETFs and subsequent regulations governing the ETF market are presented to illustrate some of the restrictions of ETFs. Finally, some basic ETF trading strategies are outlined to illustrate how an investor can trade within the ETF market.

2.2 ETFS AND THE EFFICIENT MARKET HYPOTHESIS

Traditionally, ETFs have been classified as passive investment vehicles, due to the index tracking nature of these products. This stands in direct contrast to active fund managers who attempt to outperform set benchmark indexes. The abnormal rate of return[4] which an active manager seeks to obtain is known as alpha (Reilly & Brown, 2009:504). ETFs, on the other hand, seek to deliver beta (Brown, 2013a). Beta

[4] Difference between the portfolio's actual return and expected return.

refers to the systematic risk that a portfolio might hold due to a covariance with the market portfolio (Levy, 2002:548).

This implies that an ETF that mimics the price movements and holdings of a preselected index perfectly will carry the same amount of market risk as the tracked index. Conversely, active managers will employ various strategies to obtain returns that are higher than the benchmark. Reilly and Brown (2009:504) state that the strategy to add alpha to a portfolio can be classified under two broad categories, namely (i) tactical adjustments[5], and (ii) security selection[6]. Active managers, therefore, believe that through a comprehensive asset valuation analysis and tactical asset allocation, they are able to assess which investments are under or overvalued and hence structure the portfolio to deliver above normal risk-adjusted returns. Passive managers, on the contrary, believe that the capacity to outperform the market does not exist, as all information is priced into the market already (Hirt *et al*., 2006).

The theory on which passive investment management is built can be found in the efficient market hypothesis (EMH). The efficient market hypothesis was first introduced by Fama (1970) and holds that the capital market is efficient when the prices of securities in the market fully reflect all the available information about the particular securities. Marx *et al*. (2008:31) sets out three assumptions of such an efficient market. Firstly, the EMH requires large numbers of independent and profit maximising competitors to be active within the market. Second, the information that comes to the market must arrive in a random fashion. Lastly, security prices must rapidly reflect the effect of the new information. Not all markets qualify for all three assumptions in the strictest form, and subsequently the EMH can be described to consist of three forms depending on the information set available. The three forms include the weak-, the semi-strong, and the strong-form EMH. The weak-form EMH asserts that prices in the market reflect all past trading information (Bodie *et al*., 2010). The semi-strong form asserts that prices are a reflection of all public

[5] Tactical adjustments refer to the restructuring of a portfolio to take advantage of the correct equity style or insuring the optimal time to enter into a market sector (Reilly & Brown, 2009:504).
[6] Security selection refers to the stock-picking skills of the portfolio manager (Reilly & Brown, 2009:504).

information, while the strong form incorporates all relevant information, including insider intelligence into the price determination (Bodie *et al*., 2010).

The EMH subsequently follows that in an efficient market (strong form), the expected returns of the securities should be in line with the risk (Reilly & Brown, 2009:141). All securities are therefore fully reflective of their intrinsic value and no situation can arise in which a security could carry consistently higher or lower returns than what is expected from an asset with a similar risk profile. The EMH (in any of its forms) holds the implication for portfolio managers that the possibility to outperform the market consistently is not achievable (Hirt *et al.*, 2006:149).

The EMH implies that the active fund manager's strategies will not deliver alpha on a consistent basis, as all the information which the manager might have access to has been factored into market prices. The ability to, therefore, derive above-normal risk-adjusted returns is eliminated. Reilly and Brown (2009:164) indicate that the only way to overcome this limitation is for the active manager to have access to a superior analyst. Only with such a superior analyst, who has unique insights and analytical ability, can a professional money manager obtain returns that are consistently above the normal return experienced by the market. Passive investors use this very notion as the basis for their investment strategies. Due to the cost and risk involved with employing a superior analyst, it becomes much more effective to follow a buy-and-hold strategy, where the market is tracked in general (Reilly & Brown, 2009:141). ETFs are ideally suited to offer investors such index-tracking opportunities.

The EMH provides the theoretical foundation upon which the rational for ETFs are based. To comprehend the creation process, structure, and functioning of an ETF clearly, the study will review the fundamental characteristics of such an investment product.

2.3 ETF FUNDAMENTALS

In order to comprehend ETFs as an investment vehicle, it becomes necessary to study the basic ETF structure. As highlighted in the Chapter 1, exchange-traded funds represent a pool of assets containing shares, bonds, property, and in some instances derivatives that are traded on an exchange. Then, shares are created that give holders a partial claim to the underlying assets contained within the fund. Shares that are created from an exchange-traded fund can subsequently be bought and sold in the secondary market. ETF shares, as defined by Jones (2010:54), are a passive portfolio offering targeted diversification and trades like a share on an exchange.

The Securities and Exchange Commission (SEC) sets various rules, which state that an ETF can be defined as a registered open-ended management investment company that exhibits the following characteristics (SEC, 2001):

- An ETF issues (or redeems) creation units[7] in exchange for the deposit (or delivery) of basket assets, the current value of which is disseminated on a per share basis by a national securities exchange at regular intervals during the trading day.
- Identifies itself as an ETF in any sales literature.
- Issues shares that are approved for listing and trading on a securities exchange.
- Discloses each business day on its publicly available web site the prior business day's net asset value (NAV) and closing market price of the fund's shares, and the premium or discount of the closing market price against the NAV of the fund's shares as a percentage of the NAV.
- An ETF either should be representative of a set benchmark index, or discloses publicly (each day on its web site) the identities and weightings of the component securities and other assets held by the fund.

Following from the above mentioned definitions of an ETF, the creation and redemption process, whereby ETF shares are formed, will be discussed in the following subsections. The role of ETF redemption and the influence this has on reducing arbitrage and keeping an ETF share price in line with the value of the underlying assets (NAV) will also be analysed.

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[7] Creation and redemption units are discussed in Section 2.3.1

2.3.1 ETF creation and redemption

The process of creating an ETF starts when an ETF manager (known as a sponsor) files a plan with the exchange regulator to create an ETF. Once this plan has been approved, only authorised participants (generally market makers, specialists or large institutional investors) are permitted to create or redeem the ETF shares. Sponsors and authorised participants (AP) could also be the same party (McWhinney, 2011). In order to create the ETF shares, the authorised participant has to deliver a basket of securities to the fund equal to the current holdings of the fund. After delivery has been made, the authorised participant receives a large block of ETF shares (also known as creation units), representing a block of 10 000 to 600 000 ETF shares, with 50 000 being the typical size (iShares, 2013). As McWhinney (2011) states, this transfer of securities is done on an in-kind basis[8] and therefore has no tax implications.

The construction of the creation units represents the primary market in which ETF shares are traded. The authorised participant can subsequently sell the ETF shares to other investors in the secondary market in smaller quantities. Utilising this creation process, the bid for ETF shares can always be met, as authorised participants can create additional shares on demand (iShares, 2013). New ETF shares can be created and sold into the secondary market when enough of the underlying assets that the ETF fund consist of have been accumulated and exchanged for creation units.

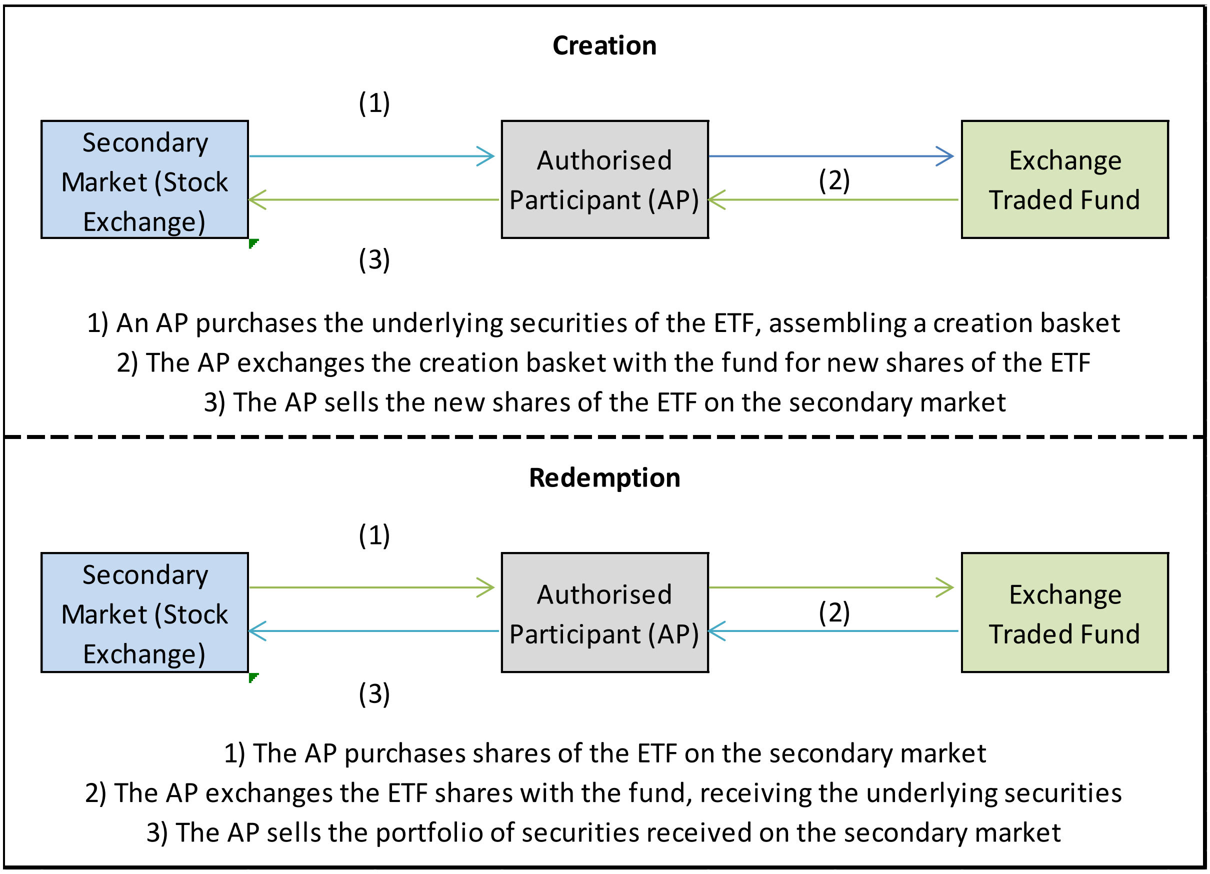
The opposite strategy, known as the redemption process, can also be followed when demand for the ETF shares are low and an over-supply exists in the market. The authorised participant can buy enough ETF shares in the secondary market to form a creation unit. The creation unit may then be exchanged with the fund for the underlying securities that are represented by the creation unit. McWhinney (2011) states that this option is generally only available to institutional investors due to the large number of shares required to form a creation unit. When the authorised participant redeems their shares, the creation unit is destroyed and the securities are

[8] Securities are traded for securities.

turned over to the redeemer. However, smaller retail investors are limited to only selling the ETF shares in the secondary market.

The ETF creation and redemption process helps keep ETF supply and demand in continual balance and provides a hidden layer of liquidity not evident by looking at trading volumes alone (iShares, 2013). Figure 2.1 graphically depicts the creation and redemption process.

Figure 2.1: ETF creation and redemption process



Source: Jacobs (2012)

The process whereby ETFs are created differs significantly from that of other investment vehicles such as unit trusts or mutual funds. The greatest difference is that no cash is exchanged during the creation or redemption of ETF shares. Significant tax benefits are available to authorised participants when in-kind transactions[9] are undertaken. However, when dealing with mutual funds, investors

[9] Exchanging securities for securities.

provide cash, which is used to purchase the representative assets of the fund shares. In order to redeem their investments, investors of mutual funds must cash in their shares, which in turn may require capital gains taxation (McWhinney, 2011).

Unlike ETFs, closed-end funds have a static number of shares; whereas, with ETFs an authorised participant has the ability to generate more ETF shares through the creation process as demand arises. As such, closed-end funds could be trading at premiums (higher than), or discounts (lower than), the NAV of the underlying securities, whereas the ETF share price trades near its NAV most of the time (Jacobs, 2012). ETF share prices that differ significantly from the NAV create an arbitrage situation that allows profits to arise from such discrepancies. The way ETFs deal with arbitrage situations will be discussed in the next subsection.

2.3.2 ETF arbitrage

An arbitrage situation originates with ETFs when the value of the ETF share deviates from the NAV of the underlying securities in the fund. The NAV represents the intrinsic value of the ETF shares, but the prices of the ETF shares on the market may fluctuate during the trading day (Anon, 2013a). Such a divergence in prices allows the authorised participants (APs) to take advantage of the difference and realise a profit from it. Due to the creation and redemption process as mentioned above, the differences between the ETF share price and the NAV are eliminated easily. The market equilibrium is reached when the ETF share prices trade at a level similar to their NAV (Jacobs, 2012). McWhinney (2011) mentions that the creation and redemption process works in two ways to establish this equilibrium:

- If the underlying securities are trading at a lower price than the ETF shares, arbitrageurs buy the underlying securities, redeem them for creation units, and then sell the ETF shares on the open market for a profit.
- If the underlying securities are trading at higher values than the ETF shares, arbitrageurs buy ETF shares on the open market, form creation units, redeem the creation units in order to get the underlying securities, and then sell the securities on the open market for a profit.

The supply and demand forces in the secondary market will move either the ETF shares or the price of the underlying securities in such a direction as to eradicate the arbitrage situation that existed. The three major reasons why an arbitrage situation may arise are as follows (Jacobs, 2012):

- The underlying components of the ETF may not be trading during the same hours as the ETF, or trading in a component security may be halted. In both instances the price of the ETF will reflect a future expected price once trading in the underlying assets resume.
- The underlying components of the ETF may contain securities that trade occasionally, or are based on relatively wide bid-ask spreads[10] (for example corporate bonds or municipal securities) and are therefore difficult to price based on last sale data. Fixed income ETFs are very often faced with this problem.
- An ETF may temporarily be closed to creations, meaning that the fund will not allow APs to exchange the underlying securities for shares of the ETF. An arbitrage scenario occurs when demand increases for this particular ETF during the time that the creation and redemption process is closed.

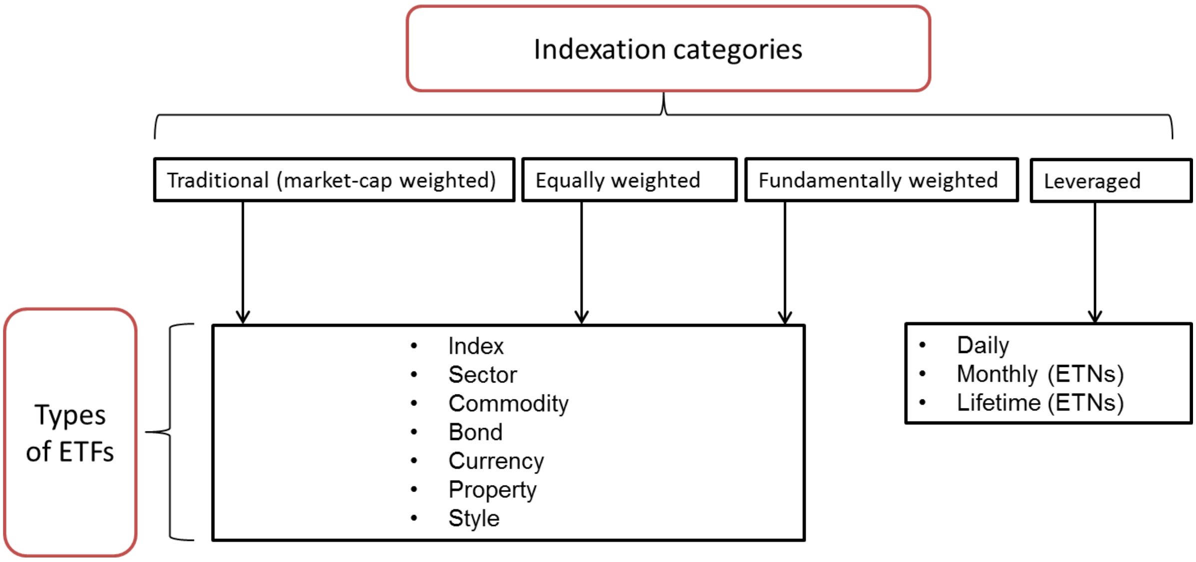
The creation and redemption process, as discussed in the preceding section, is therefore important in dealing with the arbitrage situation that may arise with ETFs. According to the ETF categories introduced in Chapter 1, construction of ETFs occurs in different ways. The fourth ETF indexation method looks at leveraged ETFs for which the creation process differs from that of the other three stated categories. Due to the nature of the underlying assets within a leveraged ETF[11] (*inter alia* swaps, futures and other derivatives) such a fund may experience high portfolio turnover. Portfolios are rebalanced daily in response to market movements and do not experience a significant level of in-kind creation or redemption transactions. The risks of leveraged ETFs will be discussed in Section 2.7.

With the clear breakdown of the rational for ETFs and the process whereby it is created, various types of ETFs will be analysed in detail below. The four broad

[10] The difference between the bid (buy) and ask (sell) price of a security (Wuite, 2009:360).
[11] The exact working and cash-flow diagram of a leveraged ETF is discussed in Section 2.7.2.2

categories of ETF indexation (traditional, fundamental, equally weighted and leveraged) as introduced in Chapter 1 can further be broken down into various types of ETFs that may fall within these categories. The types of ETFs include index-, sector-, commodity-, bond-, currency- and property ETFs, and will be discussed in detail below. Figure 2.2 provides a graphical representation of the distinction between the indexation categories and the various types of ETFs on offer.

Figure 2.2: Indexation categories and types of ETFs



Source: Compiled by the author

2.4 TYPES OF ETFS

The types of ETFs that will be considered look at the various asset classes that ETFs cover. The ability to invest in such a wide variety of sectors also adds to the appeal of ETFs. As new ETFs are developed, the spectrum of asset classes and indices covered by ETFs expands at a similar rate.

2.4.1 ETFs vs ETNs

Most exchange traded products (ETPs) are in actual fact not pure ETFs, but should rather be classified as exchange traded notes (ETNs). Unlike the structure of ETFs, ETNs represent senior[12], non-bespoke[13], unsubordinated[14], uncollateralised[15] debt

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[12] Senior debt holds the first claim on assets when a company goes insolvent (Wuite, 2009:348).
[13] Not custom built.
[14] The level of subordination deals with the seniority of debt. ETNs are first in line to make a claim on the assets in the case of insolvency (Wuite, 2009:369).

securities that give the holder a return, which is linked to the underlying securities or benchmark (JSE, 2011). The underlying securities for ETNs could therefore include a variety of alternative assets such as oil, precious metals and agricultural products.

ETNs give the investor a cost effective opportunity to access markets in which it would otherwise be challenging to gain exposure (JSE, 2011). ETNs have the added advantage of not presenting any tracking errors[16] as issuers guarantee to deliver the exact returns of the underlying securities. Although ETNs are highly regarded products to include in a well-balanced portfolio, the focus of this study will be placed on ETFs alone. Therefore, only ETPs that follow an ETF structure will be considered for this research. As such, a separation will be made between ETNs and ETFs during the analysis of the various types of ETPs that are in existence.

2.4.2 Index ETFs

As will be noted in Section 2.5, traditional ETFs look at tracking a broad equity market index. Tracking of an index ensures that the returns associated with the index are also experienced in the price movement of the ETF. Examples of such index tracking ETFs in South Africa focus mostly on the Johannesburg securities exchange (JSE) top 40 shares. Specific index tracking ETF products available in the South African market include the Absa Newfunds SWIX 40 ETF, RMB 40 ETF, SATRIX 40 ETF and Stanlib Top 40 ETF (etfSA, 2013). Globally, other exchanges offer similar products that track a number of shares in the market. The S&P 500 and NASDAQ-100 are but a few examples of stock indices that are tracked by index ETFs. An index ETF allows an investor to gain exposure to the broad equity market and track the overall market performance (Brown, 2013a).

The alignment of the benchmark index and the portfolio (ETF fund) is achieved in three ways, by holding the exact contents of the index, by using a representative sample of securities (SEC, 2001), or using quadratic optimisation techniques (Reilly & Brown, 2009:506). Full index replication requires a portfolio to be aligned completely with the benchmark index. In such an instance, the constructed portfolio

[15] No collateral is given to support the debt.
[16] See Section 2.7.1.

must have a beta of one, mimicking the market movement of the benchmark index perfectly (Marx *et al*., 2008:254).

In contrast to a full replication of the index, a representative sample of securities could be included in the portfolio to track the index as closely as possible. The capital required to create a representative sample fund is greatly reduced compared to full replication, as not all the securities in the index need to be purchased (Reilly & Brown, 2009:506). Representative sampling involves holding a smaller proportion of the securities that make up the benchmark index. The difference in the rate of return received form the sample of securities compared to the benchmark index can be obtained with the use of a swap[17] transaction or other financial derivatives.

Reilly and Brown (2009:506) introduced a third index portfolio construction method called the quadratic optimisation technique. This involves the use of computer programming to analyse historical information on price changes and correlations between the securities. A series of equations are applied to the data to determine the optimal composition of a portfolio that will minimise return deviations from the benchmark index. Jackson and Staunton (2001:139) state that quadratic programming involves two extensions. Firstly, selection of a confidence interval for the weights assigned to assets included in the portfolio and second, selection of an exposure analysis that demonstrates the way in which the fund's style changes over time.

When the returns experienced by the portfolio of securities deviate from the returns of the index, tracking errors occur. Such a deviation could see returns that exceed or fall short of the index returns. Tracking errors are augmented greatly when a select sample of securities or quadratic optimisation is utilised instead of full replication (Blitz & Huij, 2012). Additional driving factors for tracking errors include transaction costs, fund cash flows, dividends, benchmark volatility, corporate activity and index composition changes (Frino & Gallagher, 2001). For investors using ETFs as a hedge against market movements, a tracking error introduces additional losses.

[17] Section 2.7.2.2 describes this process in more detail.

2.4.3 Sector ETFs

Sector ETFs follow the same basic structure as index ETFs, but instead of replicating the market as a whole, they aim to track a subsector of the market. The RMB MidCap ETF is an example of a sector ETF in the South African market, tracking the medium capitalisation stocks on the JSE by including 60 companies ranked from number 41 to 100 in terms of its market capitalisation (etfSA, 2013). Similarly the SATRIX INDI 25, SATRIX FINI 15 and SATRIX RESI 10 all represent sector ETFs in South Africa that seek to track the top shares in the industrial, financial and resources sectors respectively (etfSA, 2013).

2.4.4 Commodity ETFs

The South African market contains numerous examples of commodity ETNs, including the RMB Oil ETN, Absa NewWave Silver ETN, Standard bank Copper ETN and Standard Corn ETN to name but a few (etfSA, 2013). The total number of ETNs available in the South African market stood at 14 as measured during April 2013 (etfSA, 2013).

The Absa NewGold ETF, the only South African commodity ETF, differs from traditional ETFs by tracking the rand price of gold rather than investing in a portfolio of gold shares or bonds (Nedelijkovic, 2012). Therefore, in addition to providing investors with a diversification tool, the NewGold ETF also hedges against depreciations in the currency.

2.4.5 Bond ETFs

Bond indices provide investors with added diversification by broadening the asset class exposure of the portfolio. Chordia *et al.* (2004) refer to the added liquidity that bond markets experience when expansionary monetary policy is applied during economic crisis periods. The liquidity benefits of particularly government bonds provide investors with the added assurance that stable yields can be expected from bonds during recessionary periods. Additional portfolio stability is gained through the ability to track government bond indices.

Four bond ETFs traded in South Africa in 2013, including the Absa NewFunds GOVI, Absa NewFunds ILBI and RMB Inflation Plus ETF (etfSA, 2013). The first two ETFs track the South African Government Bond Index (GOVI) and reinvest all coupons that are earned to create a total return product. The latter two ETFs aimed to track South African government inflation-linked fixed interest bonds, therefore, insuring protection against inflation while offering positive real return to investors.

2.4.6 Style ETFs

Brown (2013a) defines a style ETF as an instrument that invests in indices covering a particular investment theme. The themes covered by such ETFs include a host of categories. For example, in South Africa, the Absa NewFunds NewSA ETF selects shares based on their BEE[18] credentials. The Absa Newfunds Shari'ah Top 40 ETF is another example of an investment theme ETF, investing in a portfolio of Top 40 shares based on Islamic investment principles for share selection. Additionally, the Nedbank BGreen ETF holds a portfolio that includes companies based on their environmental ratings (etfSA, 2013).

Other style ETFs focus on the exchange rate, relative price momentum and dividend payouts (etfSA, 2013). The SATRIX DIVI (which falls within the fundamental indexation category) can also be classified under the style ETF type. The SATRIX DIVI selects 30 shares based on their dividend payout potentials over the forthcoming year (etfSA, 2013).

Furthermore, style ETFs also include balanced ETFs, which represent a fund that holds a balanced portfolio of asset classes. Absa is currently the only issuer of such ETFs, trading the NewFunds MAPPS - Protect ETF and Newfunds MAPPS – Growth ETF (etfSA, 2013). The NewFunds MAPPS – Protect ETF seeks to protect an investor against adverse price movements in equity markets by holding 40 percent equities, 15 percent government bonds, 35 percent inflation linked bonds, and 10 percent cash within its portfolio. In contrast to the Protect ETF, the NewFunds MAPPS – Growth ETF is much better aligned to take advantage of equity movements by holding 75 percent of the fund in equities and less in bonds, index-linked bonds and cash respectively (etfSA, 2013).

[18] Black economic empowerment

2.4.7 Currency ETFs

Similar to commodity ETFs the majority of currency ETFs do not follow the ETF structure, but are rather ETNs. The currency ETNs are structured to offer exposure to the performance of a single currency or an index that contains a basket of currencies (JSE, 2011). Currency ETNs traded in South Africa include the Absa NewWave GBP ETN, Absa NewWave EUR ETN, and Absa NewWave USD ETN (etfSA, 2013). Investors seeking exposure to the pound, euro and dollar can use such ETNs as they comprise a total return product where investors get access to the foreign exchange spot changes.

2.4.8 Property ETFs

Traditionally, property has performed very well during times of economic uncertainty. Cairns (2013) states that over a 60-month period, ending in Feb 2013, 11 out of the 15 best performing collective investment schemes (CIS)[19] traded in South Africa were real estate funds. The inclusion of property in a well-diversified portfolio is therefore of great importance to provide solid growth to the portfolio. By tracking the performance of property shares listed on the JSE, a property ETF allows for diversification to other asset classes.

Two Property ETFs were trading in the South African market as at April 2013, namely the Proptrax SAPY and Proptrax Ten. While the Proptrax SAPY invests in the top 22 property shares on the JSE, the Proptrax Ten invests in the top 10 property shares on the JSE (etfSA, 2013). The Proptrax Ten also differs from the Proptrax SAPY in terms of the indexation methodology used (Brown, 2013a). The Proptrax Ten is based on the equally weighted method giving each of the 10 property shares roughly a 10 percent weight in the portfolio, whereas the Proptrax SAPY is based on market capitalisation (Grindrod, 2013).

2.4.9 Leveraged ETFs

Leverage ETFs were introduced in Chapter 1 as one of the four ETF categories to be analysed in the study. SEC (2009) defines a leveraged ETF as a product that seeks to deliver multiples of the performance of the index or benchmark that it tracks.

[19] Collective investment schemes refer to the collective name for all investment companies operating in South Africa. This includes unit trusts and ETFs.

Following the same principles, inverse ETFs seek to deliver the opposite of the performance of the index or benchmark they track. Leverage ETFs and inverse ETFs track a wide variety of benchmarks ranging from broad market indices to commodities and currencies.

The leveraged factor, which leveraged ETFs aim to deliver, ranges from +100 percent, +200 percent or +300 percent to -100 percent, -200 percent or -300 percent of the movement in the underlying market (Stevenson, 2012:128). To accomplish their objectives, leveraged and inverse ETFs pursue a range of investment strategies through the use of swaps, futures contracts, and other derivative instruments (SEC, 2009). These trading strategies hold significant risks[20], to which traditional ETFs are not exposed. Johnston (2010a) highlights three key differences in the way leveraged ETFs are structured, through which the risk-return profile for the ETF change completely. The three sub-categories of leveraged ETFs include daily leveraged ETFs, monthly leveraged ETFs, and lifetime leveraged ETFs (Johnston, 2010a). The major difference among the three sub-categories relates to the reset rate/rebalancing frequency of each category. The reset rate refers to the period over which the ETF promises to deliver the desired returns. Subsequently, each of the three sub-categories will be discussed to highlight the differences between them.

2.4.9.1 Daily leveraged ETFs

Most leveraged ETFs fall into the daily leveraged ETF category (Johnston, 2010a). ETFs listed under this sub-category aim to deliver their stated return on a daily basis. At the end of each trading session, the leverage is reset and the original leverage is offered again the next day. SEC (2009) cautions that the performance of a daily resetting leveraged ETF could differ significantly from the performance measured over a longer period (*inter alia* a month or a year). Johnston (2010a) attributes the differences in returns to the change in the underlying index over the relevant time period, as well as to the path that it follows over such a period.

Daily leveraged ETFs perform differently in trading markets compared to trending markets. During volatile markets (*inter alia* trading markets), the underlying index

[20] Section 2.7 discusses the risks in more detail

would oscillate on a daily basis and force returns that are measured over a longer period to be lower than the promised daily returns. The strong upward or downward direction of price movements experienced in a trending market could cause a daily leveraged ETF to exhibit a return over the long-term that is greater than the simple product of the daily target (Johnston, 2010a).

2.4.9.2 Monthly leveraged ETNs

Monthly leveraged ETFs differ from daily leveraged ETFs in terms of the frequency with which the leverage is reset. Monthly leveraged ETFs seek to deliver the stated leverage over the course of a month. Unlike daily leveraged ETFs that are very sensitive to the path the underlying index follows over the course of a month, a monthly leveraged ETF will still produce the desired returns, even when daily returns fluctuate vastly throughout the month. Johnston (2010a) states that exchange-traded products offering leveraged exposure over a monthly time frame are structured as ETNs. The focus of this study will only be on exchange-traded products that follow a typical ETF structure, hence monthly leveraged ETFs will not be considered in this study. The impact on return performance between daily and monthly ETFs is, however, worth considering.

The effect that the different rebalancing rates have on the return for both daily and monthly leveraged ETFs is illustrated in Figure 2.3. The ProShares UltraShort Dow Jones–UBS Crude Oil ETF (SCO) and PowerShares DB Crude Oil Double Short ETN (DTO) are listed on the graph. Both products track oil as the underlying index. SCO resets its exposure on a daily basis, while DTO resets on a monthly basis. The difference in performance is more than 20 percent in favor of the monthly rebalancing product (Johnston, 2010b).

Figure 2.3: Return comparison of daily and monthly leveraged ETFs

Source: Johnston (2010b)

2.4.9.3 Lifetime leveraged ETNs

The third sub-category of leveraged ETPs offer leveraged exposure over an even longer time period. Johnston (2010a) states that similar to monthly leveraged products, the lifetime leveraged products are also structured as ETNs. Such debt instruments carry set maturities and the Lifetime leveraged ETNs seek to deliver a predetermined leverage over the lifetime of the note. As with monthly leveraged ETNs, the structure of the Lifetime leveraged ETNs disqualifies it from being considered for the study.

After considering the various types of ETFs that can be included within the ETF indexation categories, the origins of the ETF structure and the developments that followed since its inception will be discussed.

2.5 HISTORY AND DEVELOPMENT OF ETFS

The popularity of the ETF, and the growth that it has exhibited since its inception, has put great emphasis on this evolutionary product. The way in which financial markets have changed to accommodate the ETF is key to its growth. This subsection will look at some of the changes that were instrumental in setting the stage for the development of ETFs. A complete overview of the history of the ETF system will be discussed from its origins to its current standing in the markets today.

Gastineau (2010:20) mentions that the ETF structure has its origin in portfolio trading (also known as program trading), which was widely used in the 1970s, representing the first modern financial structure through which a portfolio could be traded with a share. The ability to trade an entire portfolio as a basket is a key characteristic of portfolio trading that would later pave the way for ETFs. The structure of portfolio trading allowed an entire basket to be purchased by placing a single order with a brokerage firm.

New technologies in electronic trade played a significant preliminary factor in the evolution of ETFs, making it possible for large investment banks to execute such portfolio trades. Gastineau (2010:20) credits the S&P 500 index futures contracts, traded on the Chicago Mercantile Exchange, as one of the earliest examples of such a product.[21] Early products allowed for an arbitrage link between the futures contract and the shares in the index underlying the future. In turn, this created the possibility to exchange a portfolio position (long or short) for a shares index future position (long or short). The in-kind creation and redemption process seen in ETFs today follows very similar principles of exchanging securities for other securities.

While there were many advantages to this new system of portfolio trading, small retail investors were sidelined by the sizes of such contracts and the accompanying variation margins[22] (Gastineau, 2010:25). As such, the need for a low cost product that was accessible to individual investors became more apparent. The next development towards an ETF appeared in the form of index participation shares (IPS) and offered a low cost product suitable for retail investors.

Gastineau (2010:25) states that the first IPS traded on the American Stock Exchange and Philadelphia Stock Exchange in 1989. The trading in these products was however short-lived after a court ruled that the IPS was a futures product and needed to be traded on a futures exchange (Gastineau, 2010:25). A similar product to the IPS, known as Toronto Index Participation Shares (TIPs), started trading on the Toronto Stock Exchange in 1990. TIPs were warehouse receipt-based share

[21] Similar products also originated on other exchanges.

[22] Through a mark-to-market process, the daily losses experienced with a futures trade will require additional cash or variation margin to be paid to the exchange (Wuite, 2009:399).

portfolio instruments designed to track the TSE-35 stock index. As described by Gastineau (2010:25), its low (or sometimes even negative) expense ratios proved to be a unique feature, which led to its success. This was possible because securities-lending revenue on Canadian stocks exceeded lending revenue on similar US stocks. Gastineau (2010:26) states that the popularity of TIPs led to the development of a product for the US market that would satisfy the SEC regulations. One such portfolio share was developed subsequently in the US market named the Standard & Poor's depositary receipt (SPDR) (Stevenson, 2012:61).

In January 1993 the first modern day ETF came into existence. The SPDR ETF, or "Spiders" as a play on the acronym, was established. This soon became a very popular product and is still the largest ETF in the world today (Lawrence, 2008). Due to the success of the SPDR, a MidCap SPDR was also introduced in 1995. The original SPDR differs slightly from conventional ETFs in that it represents a unit trust[23] with an S&P 500 portfolio, which unlike most US unit trusts, can be changed as the index composition changes (Stevenson, 2012:62).

Wiandt and McClatchy (2002:82) indicate that after the initial successes of the SDPR product, other market participants joined the market by 1996. Barclays Global Investors added the first fund that exposed investors to global markets by introducing the World Equity Benchmark Shares (WEBS). WEBS was later renamed to iShares MSCI Index fund as the ETF tracked MSCI[24] country indexes. WEBS restructured the organisation of the ETF into a mutual fund instead of the unit trust[25] structure used until that time (Pennathur *et al*., 2002). From 1998 onwards, more specialisation was initiated as sector ETFs were introduced. The first sector ETFs tracked the nine sectors of the S&P 500. Other exchanges soon followed with the tracking of the Dow Jones Industrial Average and NASDAQ 100 (Stevenson, 2012:64).

In the 12 months between November 2011 and November 2012, the US ETF market has seen an increase of 23.9 percent (or $249.81 billion – approximately R2498

[23] Unit trusts are discussed in detail in Section 2.6.2
[24] The Morgan Stanley Capital International set of indices constructed to aid investors in benchmarking their returns (Wuite, 2009:259).
[25] A clarification of the unit trust and mutual fund terminology is given in Section 2.6.2.1.

billion) in ETF assets. Global ETF assets rose by $51.31 billion (R510 billion) during the same period (ISA, 2013). The number of ETFs on offer by global financial institutions continues to grow at an alarming rate with new ETFs being issued on a daily basis.

The first South African ETF was created in late 2000. The SATRIX 40 ETF, which tracks the performance of the Top 40 shares listed on the JSE, was the first South African ETF (Brown, 2013a). South Africa has seen similar growth with the expansion of new product offerings. ETP is an umbrella term that refers to both ETFs and ETNs. This market sector saw 15 new additions during 2012 in South Africa, bringing the total to 61, up from 30, two years before and 17 in 2008 (Planting, 2013).

The EMH, as discussed in the beginning of the chapter, highlighted the key differences in the approach that many investors follow in regard to the active and passive investment styles. In order to establish the key differences between closely related products such as hedge funds, index funds and mutual funds, a breakdown will be made of each, and how each varies from ETFs.

2.6 ALTERNATIVES TO EXCHANGE TRADED FUNDS

As stated in the aforementioned sections, this study will only focus on ETPs that follow a structure of an ETF, therefore no ETN will be included in the analysis. However, while this study focuses on exchange traded funds, it will also involve a comprehensive review of alternative investment vehicles that exhibit similar structures as ETFs. Characteristics of asset classes such as unit trusts, hedge funds and index funds, which differ marginally from ETFs, must be considered in order to distinguish them from ETFs.

The purpose, structure and basic functioning of alternative investment vehicles will be reviewed and compared to that of ETFs. The cross-asset class comparison will differentiate ETFs from other asset classes, and as such will exclude any instruments that constitute these alternative classes.

2.6.1 Hedge funds

Hedge funds have been in existence since as early as 1949 and have been offering investors an alternative to the regular investment strategies offered by many other assets managers (Reilly & Brown, 2009). However, over the period between 2003 and 2012, hedge funds have failed to outperform other investment vehicles, while at the same time incurring much higher costs to implement the strategies which are used to obtain the returns (The Economist, 2012). Hedge funds and their main functions, characteristics and strategies will be reviewed in comparison to ETFs.

A hedge fund can be classified as an investment vehicle designed to manage a private, unregistered portfolio of assets according to a host of possible strategies (Reilly & Brown, 2009:1045). Most hedge funds are registered as a limited partnership, which sees investors contributing to the fund as silent partners (Marx *et al.*, 2008:14). As silent partners with management duties, the participation for investors in the fund is limited to the subscription and profits. The pool of private capital is placed under management of the general partner or fund manager who in most instances also contributes some of his personal capital towards the funds (Marx *et al.*, 2008:14). According to Fung and Hsieh (2006), the hedge fund manager is compensated on two levels for the duties that he fulfills. Firstly, a standard management fee is received, and second, a performance allocation fee is applicable on all returns that exceed a pre-specified profit level (also known as the hurdle rate). Hurdle rates of 20 percent or higher are found in the industry (The Economist, 2012). Thus, great emphasis is placed on achieving the highest possible return for the fund, by obtaining the maximum alpha[26] value.

According to Marx *et al*. (2008:14), the main objective of hedge funds is to exceed the returns offered by the markets, under all conditions, by implementing various investment strategies and allocating funds to virtually any asset class. Hirt *et al.* (2006) specifies that the strategies followed by hedge funds include the traditional investment in shares and bonds, however, their strategies also extend to much riskier alternatives such as short selling of shares, making use of market arbitrage, dealing in financial derivatives (futures and options) as well as using financial

[26] Alpha represents the return of the fund in excess of that induced by the market index (Bodie *et al*., 2010).

leverage[27] to obtain higher returns. As confirmed by Jones (2010), such alternative strategies fall well outside the mandate of mutual funds that are restricted by regulations from employing such risky strategies. Hirt *et al*. (2006) confirms the risky nature of hedge fund activities by describing their approach as "speculative investing".

Such high-risk investment strategies are not suitable for the everyday investors who seek to have a stable growth in their investment portfolios. The use of hedge funds by investors is, therefore, limited to only a selected group of investors who can use hedge funds as part of a much broader, more diversified portfolio. Marx *et al*. (2008:14) points out the exclusivity of hedge funds by indicating that in the US such funds are restricted to the high net-worth individuals who are required to invest a minimum of $250,000 to $1,000,000. Levy (2002) states that some funds even have a minimum investment level as high as $10,000,000. Investors are also required to remain invested in the fund for extended periods of time, with a lock-in period that could range between three to five years (Marx *et al.,* 2008:15). Investors with the necessary minimum capital invest in hedge funds, despite the risky strategies applied by fund managers, due to the lower correlation with traditional asset classes and the diversification benefits that this holds (Reilly & Brown, 2009:907).

Globally the hedge fund industry has been experiencing turbulence throughout the financial crisis of 2008. According to Coronation fund managers, the size of the global hedge fund market grew to a peak in 2007 with 7600 hedge funds in existence at the time (Coronation, 2012:125). Following the global recession, the figure declined to 6800. The decline in the number of hedge funds stands in direct contrast with the ETF market, where funds allocated towards such products have seen substantial growth.[28]

Regulation surrounding hedge funds has not been as restrictive when compared to regulation governing other forms of financial institutions. Reilly and Brown (2009) ascribe this difference in regulation to the private partnership company structure that

[27] Financial leverage refers to the amount of debt employed to obtain the capitalisation of the firm (Bodie *et al*., 2010:457).
[28] See Section 2.5 for figures illustrating the growth of the ETF market.

sees fewer restrictions in regard to where and how investments can be made. One drawdown to this structure is the limitation on how often and in which amounts capital can be withdrawn from the fund.

In the South African market there are currently about 130 hedge funds in existence, with approximately R30 billion under management (Coronation, 2012). Hedge funds in South Africa are not regarded as collective investment schemes (CISs) and are, therefore, not permitted to advertise publicly. However, the Financial Services Board (FSB) subjects the fund managers to licensing requirements. As such, hedge funds in South Africa are governed under the rules of Financial Advisory and Intermediary Services Act (FAIS) and not under the Collective Investment Schemes Control Act (45 of 2002) (CISCA) to which ETFs must adhere (Coronation, 2012).

The apparent differences between ETFs and hedge funds clearly separate the two investment vehicles in terms of their uses for investors. ETFs are much better suited to the investor looking to capture the overall movement in the market; whereas, a hedge funds manager will look to achieve alpha for investors by applying higher risk investment strategies. Table 2.1 highlights the main differences between ETFs and hedge funds.

Table 2.1: Comparison between ETFs and hedge funds

	ETFs	**Hedge funds**
Restriction on investment	Traditionally a passive investment approach.	Follows a wide variety of strategies (active approach).
Transparency	Complete transparency on the holdings in the funds. Exact allocations need to be published.	Trading strategies unknown outside of partnership.
Management structure	Issued by an authorised participant.	Managed by a general partner who earns fees based on performance.
Publicity	Allowed to advertise.	Not allowed to advertise.
Exclusivity	Available to the general public at low/reasonable buy-in costs.	Requires a large amount for buy-in (Restricted to high net-worth individuals).

Liquidity	Liquid, trades on the exchange daily.	Illiquid, may not be able to redeem at any time.
Ease of redemption	ETF shares can be bought and sold at any time.	Usually locked in for a predetermined time period.
Fees	No asset management and in most cases no performance fees (some exceptions).	Subjected to management fees and performance based fees.
Number of investors	No limit to the number of investors who can invest in fund.	Limited to the partners.
Investment objective	Tracks the performance of a predetermined benchmark.	To obtain above-normal returns for investors.

Source: Adapted from Marx *et al*. (2008)

While hedge funds are uniquely different from ETFs, other investment vehicles such as unit trusts (mutual funds) and index funds border much more closely on the characteristics of an ETF. Subsequently, such alternative investment vehicles will be discussed and compared to ETFs.

2.6.2 Unit trusts, unit investment trusts and mutual funds

Unit trusts are the investment vehicle most similar to ETFs. Although many parallels exist, a few key differences need to be highlighted in order to distinguish ETFs from unit trusts. The efficient market hypothesis, as introduced at the beginning of the chapter, highlighted the principal concept that separates the two approaches to investing taken by both ETF investors and unit trust investors. Subjecting to the notion of the EMH changes the investor’s strategy not to strive for an outperformance of the market, but rather to track the broad market. The active versus passive management approach, which seeks to deliver either alpha or beta respectively, lies at the core of the ETF and unit trust comparison. In order to highlight the differences and similarities, a full discussion follows about unit trusts.

2.6.2.1 Definition and terminology

A unit trust can be classified as a pool of funds obtained from investors, which is subsequently invested into shares, bonds and money market instruments. Then the pool of funds is divided into identical units, where each unit represents the same proportion of assets as in the portfolio (Coronation, 2012:41). The units give the investor a claim on the gains, losses, income and expenses from the portfolio on a proportional basis. Investors can profit from their investments in one of two ways. Firstly, capital gains can be experienced when the price of the unit appreciates over time. Second, income can be gained from the dividends and interest received from the underlying assets in the fund (Coronation, 2012:41). Such income distributions can be reinvested into the fund when an investor buys additional units.

South Africa follows a slightly different naming convention than the US and Europe when referring to such a participatory investment product. Traditionally, the name mutual fund is used for similar products in the US and European markets. In order to keep referrals consistent in the research, all mutual fund denominations will be changed to unit trusts. Wuite (2009:395) confirms that the term mutual fund and unit trust can be used interchangeably.

One important separation that needs to be highlighted with regard to the terminology is the use of the name, unit investment trust, within the US markets. Bodie *et al*. (2011:122) states that a unit investment trust refers to a pool of money, which similarly to a unit trust, invests in a host of different assets. The major difference from the conventional unit trust is that such an investment has a finite lifespan and no asset allocation adjustments are made for the full duration of its lifespan. Unit investment trusts are thus unmanaged funds. Therefore, ETFs as a whole can be considered as forms of a unit investment trust when considering that most ETFs invest in a fixed index, which does not change for the lifetime of the ETF.

South African naming conventions for unit trusts follow from the Collective Investment Scheme Control Act (45 of 2002) (CISCA) (Coronation, 2012:18). In order to eliminate terminology confusion as stated above, a recent change to CISCA sees the usage of a more precise description for key terms in the definition of a unit trust. Coronation (2012:18) states that a “unit trust fund” is now more appropriately named “a portfolio of a collective investment scheme”. Similarly, more correctly the unit of the fund is referred to as a participatory interest in a collective investment scheme.

2.6.2.2 Open-ended and closed-ended funds

In addition to the above terminology distinctions, further separation should be noted between the two broad types of investment companies that exist. Open-ended and closed-ended funds differ in the way in which additional shares issued by the fund are managed. Table 2.2 provides a breakdown of the main differences between the two investment company types.

Table 2.2: Investment companies types: Open-ended versus closed-ended funds

Open-ended	Closed-ended
Issues additional shares on demand.	Cannot increase or decrease number of shares easily. Requires shareholder approval to change.
Shares are not traded on an exchange.	Shares are traded on an exchange.
Price determined by NAV and not supply and demand.	Price determined by supply and demand.
Price rarely deviates far from the NAV.	Very often traded at a premium or discount to NAV.

Source: Levy (2002)

Unit trusts (mutual funds) are considered as those investment companies that follow an open-ended structure. Bodie *et al*. (2011:124) state that open-ended investment companies represented about 90 percent of the unit trust market as measured during 2011. Jones (2010:54) contributes the decline in the popularity of closed-ended funds to the stock market crash in 1929. Closed-ended funds still in existence in the US are based mostly on a municipal bond portfolio (Jones, 2010:54).

The comparison above highlights another key difference between ETFs and unit trusts. Whereas the open-ended unit trusts are not listed on an exchange, an ETF is listed on a stock exchange. Brown (2013b) states that this makes ETFs more transparent, as investors are able to trade ETFs throughout the day. The continuous trading on the exchange and compulsory market makers helps ensure liquidity.

Hence, ETFs do not fall into either of the two investment company types, but constitute a third type of investment company.

2.6.2.3 Unit trust fees and expenses

An important point of comparison between unit trusts and ETFs is the fee structure that both investment vehicles follow. ETFs hold a key advantage over their unit trust counterparts through the much lower total expense ratios (TERs) that they exhibit. In many instances, ETFs can have from 1 percent to 2 percent lower TERs than that of a similar unit trust (Brown, 2013b). Kostovetsky (2003) states that such a variation in costs could ultimately be the difference between beating the market and falling short. In order to understand fully where this difference in costs between the two investment vehicles originates from, a detailed breakdown and cost comparison will be performed.

Both ETFs and unit trusts are subjected to two broad categories of costs. Jones (2010:66) labels the two categories as fees and expenses. The difference is found in the way such costs are allocated to the investor. Whereas fees are attributed directly to the investor, the expenses are attributed to the fund as a whole, and therefore, indirectly distributed to the investors of such a fund. Chong *et al.* (2011) state that the categories should be labeled as shareholder service fees and operating expenses respectively. Table 2.3 highlights some examples of costs that fall within each of the two categories.

Table 2.3: Investment costs breakdown

Shareholder service fees	Operating Expenses
Sales charge/commission (Load fee).	Management fees.
Redemption fee.	Distribution fees.
Exchange fee.	Other expenses (legal & accounting).
Annual account fee.	

Source: Chong *et al.* (2011)

Chong *et al.* (2011) found that on average ETFs have much lower management fees than unit trusts, and practically zero shareholder service fees. This is due to the passive nature of ETFs that require substantially less trading costs to be incurred, and ultimately drives down the management fees. Both operating expenses and shareholder service fees are lower for ETFs. The ultimate result is greatly reduced TERs for ETFs when compared to unit trusts. Table 2.4 gives a cost comparison of selected South African equity unit trusts and equity ETFs.

Table 2.4: South African equity ETF and equity unit trust TER comparison

ETFs	**TER**
SATRIX 40 ETF	0.45%
RMB 40 ETF	0.21%
Stanlib Top 40 ETF	0.48%
Index unit trust	**TER**
Momentum Top 40 index fund	0.87%
Stanlib index fund	0.63%
Unit trusts	**TER**
Allan Gray equity fund	2.54%
Absa Select equity fund	1.71%
Analytics managed equity fund	1.50%
Coronation equity fund	1.14%

Source: Moneyweb (2013)

The TER comparison reveals that ETFs hold a great advantage over unit trusts when compared on the basis of costs alone. All three ETFs included in the comparison seek to track the JSE Top 40 shares. When compared to index funds ETFs hold only a slight advantage.[29] However, when compared to pure equity unit trusts (all of which seek to outperform the overall equity market), the cost savings for ETFs are more apparent. The additional trading costs that actively managed unit trusts incur as a result of attempting to outperform the overall market, contribute greatly to the increased management fees.

[29] To be discussed in Section 2.6.3

While traditional unit trusts require performance and asset management fees, the ETF market has eliminated such costs. Anon. (2010) reports that TERs based on South Africa's ETFs are on average 50 basis points (0.5%), while TERs for unit trusts can easily reach up to 200 basis points (2%). The low cost with which an ETF can be obtained makes this a very attractive investment, as less of the returns generated go towards covering the fees.

2.6.2.4 Unit trusts and ETFs – Similarities and differences

With such a close link between unit trusts and ETFs, the line between such products can be blurred sometimes. In order to distinguish ETFs from unit trusts fully, various similarities and major differences will be highlighted.

Apart from the basic similarities that both ETFs and unit trusts are run by a fund manager and that the value of such a fund is determined by its NAV, a few other comparisons also exist. Brown (2013b) states that three key similarities tie ETFs and unit trusts together; the three areas of similarity are:

- regulatory control;
- structures; and
- investment avenues.

Regulatory control refers to the rules and regulations governing both investment products. ETFs and unit trusts are classified as collective investment schemes in South Africa (Coronation, 2012). This subjects the two products to CISCA, the Financial Advisory and Intermediary Services Act (FAIS) and the Financial Intelligence Centre Act (FICA). A more in-depth discussion about the regulation governing ETFs will be done in Section 2.8.

The collective investment scheme (CIS) structure of ETFs and unit trusts require that all assets for such funds are held in registered trusts. This business format ensures that approved trustees and custodians are appointed to oversee the daily reporting of NAVs, control asset- and liability matching, and administer pricing.

The third similarity relates to the various avenues that investors follow when selecting a suitable investment product. Both ETFs and unit trusts qualify to be included in a retirement fund. The ability to invest in such products by the use of either a monthly debit order or a once-off lump sum investment makes both products highly suitable to recurring savers or retail investors.

With such close links between ETFs and unit trusts, confusion can easily occur when understanding their differences. Trading practices and valuation techniques are key areas of dissimilarity. Table 2.5 highlights the major differences between ETFs and unit trusts.

Table 2.5: Trading and valuation comparison between ETFs and unit trusts

	ETF	**Unit Trust**
Point of sale	Primary market: Authorised participants and fund providers. Secondary market: Brokers.	Primary market: Fund providers and brokers.
Frequency of trading	Continuous trading on exchange throughout trading day.	Transacted once a day based on previous closing price.
Value at which they are traded	Intraday on price, end of day on NAV.	NAV only, end of day.
Determination of price	Supply and demand of shares traded.	Based on NAV only.
Price bid-ask spreads applicable	Yes.	No.

Source: Stevenson (2012:69)

From the preceding discussions about unit trusts, it becomes clear that unit trusts and ETFs have numerous comparable features, but the differences between them clearly distinguish ETFs as a separate investment vehicle. The listing of ETFs on a stock exchange, the lower TERs of ETFs, the price determination via supply and demand, and the passive nature of their investment mandates clearly put the ETF in a different category than its actively traded open-ended unit trust counterpart.

2.6.3 Index funds

The final alternative investment to ETFs that will be considered is an index fund. An index fund can be considered a passively managed unit trust or mutual fund, functioning exactly like other active unit trusts (Kostovetsky, 2003). However, the major difference is that an index fund does not attempt to outperform the market, but rather replicates the performance of a predetermined benchmark index (Haugen, 1986:143). Such a replication of the index is performed by buying the securities in the exact weighting as the index, with the fund manager only making alternative asset allocations when the composition of the index changes (Reilly & Brown, 2009:509).

Because of its index-replicating characteristic, an index fund is related very closely to an ETF. The primary function of both is to replicate the returns of a set benchmark index. However, as a unit trust, index funds are still subjected to all the differences that exist between ETFs and unit trusts as stated in Section 2.6.2.

Because both index funds and ETFs track the same index in many instances, the differences between them are often difficult to extricate. Three main areas of comparison include the operating expenses, shareholder costs and tax efficiency.

As analysed in Table 2.3, the operating expenses of an investment fund are those expenses that the fund needs to incur to perform the day-to-day operations. Kostovetsky (2003) found that the TERs of ETFs were much lower than those were of index funds, due to the way in which operating expenses are processed. The data presented in Table 2.4 concurs with such findings. This occurs because ETFs are listed on a stock exchange where the shareholder accounting function is administered by the brokerage house. The accounting function must, however, be performed by the index fund itself, driving up the TER (Kostovetsky, 2003).

The second area of comparison focuses on the shareholder service fees charged by index funds and ETFs respectively. As indicated in Table 2.3, a noteworthy element of the shareholder fee can be attributed to the sales charge/commission or load fee as it is also known. Bodie *et al*. (2011:91) points out that the load fee refers to the amount paid to the fund in order to purchase the participatory interest in the fund. Kostovetsky (2003) indicates that most index funds are in fact no-load funds, and as such do not charge a commission when buying into the fund. Jones (2010:68) suggests that the existence of load funds have declined over the past 20 years, with a definite move to no-load funds within the unit trust industry.

This change in the fee structure of index funds stands in direct contrast to ETFs. A retail investor who cannot make use of the in-kind creation and redemption process involved with acquiring new ETFs needs to buy them on the secondary market. This involves paying a commission to the brokerage house and a fee to the market makers. As such, the shareholder service fees involved with buying ETFs are for the most part higher than that of index funds (Agapova, 2010).

The third factor that distinguishes ETFs and index funds is the tax application differences. Capital gains tax regulations differ substantially between ETFs and index funds. When index funds sell the underlying assets in the portfolio and capital gains are realised, such gains needs to be taxed, and the costs distributed to shareholders. ETFs, on the other hand, technically do not need to realise a capital gain due to the creation and redemption process at work. As highlighted in Section 2.3.1. an authorised participant makes an in-kind transaction when redeeming ETF shares. Hence, no capital gain is created effectively, greatly reducing tax implications for ETFs.

The slight differences as set out above alter the way in which these two investment products perform. A strong point of comparison is the ability of the fund to deliver returns as close to that of the index that they seek to track. The tracking error, as discussed in Section 2.4.2, highlights how well both funds are able to deliver when comparing each to its benchmarks. To this extent, ETFs have not shown to perform meaningfully better than index funds. Chong *et al.* (2011) and Svetina (2010) both discovered large tracking errors present with ETFs, with the latter concluding that the returns offered by selected ETFs were “statistically indistinguishable” from that of its index fund counterpart. Chong *et al.* (2011) found mixed results in the comparison of the tracking errors exhibited by both ETFs and index funds.

Kostovetsky (2003) attributes the mixed results to the degree of difficulty involved in modeling tracking errors. Utilising the paper benchmark in tracking error calculations is misleading due to the existence of inefficiencies[30] in the stated benchmark. However, ETFs hold one key advantage over index funds in this regard; ETFs are much better able to track indices that are not investable through index funds. Svetina (2010) points out that almost 83 percent of ETFs track such narrow segments of the market that no index fund counterpart exists for the same market segment. As such, open-ended index funds and ETFs can only be seen as non-perfect substitutes for one another (Agapova, 2010).

The previous sections compared the ETF to the alternative investment vehicles with which it is often confused. With this clear distinction between ETFs, hedge funds, unit trusts and index funds, the research will focus specifically on ETFs. Risks involved with ETFs, as well as the trading strategies followed by investors dealing in ETFs, will be discussed in more detail in the following sections.

2.7 RISKS OF ETFS

The previous sections highlighted some of the key advantages that ETFs hold over alternative investment products. The lower TERs, enhanced levels of transparency, and the ability to have intra-day trading due to ETF listings on a stock exchange are some of the characteristics that make them very attractive investment tools, however, ETFs are not free from potential risks. Tracking errors and counterparty risk, as two of the major risks involved with ETFs, will be discussed subsequently.

2.7.1 Tracking errors

As a passive index-tracking product, ETFs are intended to deliver the returns of a set benchmark. Very often differences arise in the return experienced by the ETFs and the return shown by the reference index. This is known as the tracking error of the ETF (Blitz & Huij, 2012). Stevenson (2012:147) separates tracking errors from

[30] The inefficiencies arise due to the factors that create arbitrage positions between the market prices and the NAVs as listed in Section 2.3.2.

tracking differences. As such, tracking differences are considered the difference between the performance of a fund and its benchmark over a specified period. Tracking errors on the other hand are seen as the annualised deviation of daily tracking differences (Stevenson, 2012:147).

As noted in Section 2.6.3, the tracking errors of ETFs are a noteworthy point to consider when comparing them to alternative investments. ETFs did not hold any significant advantage over index funds in this regard. Through Section 2.4.2, it is clear that the origin of such tracking errors is very often a result of imperfect index replication. To this extent, it was shown that funds that use full replication of an index exhibited much lower tracking errors than those that used statistical replication of the index (Blitz & Huij, 2012).

Frino and Gallagher (cited by Kostovetsky, 2003) attribute the existence of tracking errors to a combination of factors such as transactions costs, fund cash flows, dividends, benchmark volatility, corporate activity, and index composition changes. Therefore, tracking errors can very easily become an important risk to consider when investing in such a product. The negative effects of tracking errors to investors are clearly stated by Blitz and Huij (2012), who argue that if ETFs have abnormally high tracking errors, it is questionable if ETFs “should be classified as passive funds” at all.

2.7.2 Counterparty risk

ETFs are listed on registered stock exchanges; the misperception could easily arise that these product are subsequently free of any counterparty risk. However, the managers of ETFs engage in certain activities when administering the management of the fund, which largely exposes the fund to counterparty risk. Stevenson (2012:148) points out that counterparty risk arises within ETFs due to two factors:

- securities lending; and
- swap based ETF structures (synthetic ETFs).

2.7.2.1 Securities lending

Similar to many pension funds, insurance funds, and other more actively managed unit trusts, ETFs also makes use of securities lending. Securities lending, as defined by Wuite (2009:345), is the act of "borrowing a security for purposes of covering or creating an investment position (typically a short position)". In this situation, the party lending out the securities is able to charge a fee for such a service. Because the exchange-traded fund consists of a pool of securities, the ETF managers can very easily engage in securities lending to earn an additional income fee. This additional source of revenue for the fund helps in reducing the overall cost charge for the ETF investors.

Although the reduced costs can easily be seen as an advantage, there is a risk involved that must be considered. Stevenson (2012:148) highlights the risk that such an activity on the manager's side holds for investors by pointing out that during the 2008 financial crisis many funds suffered sizeable losses due to securities lending activities. Investors of ETFs are thus required to take note whether or not an ETF does engage in securities lending to ensure that the product is in line with their risk profile.

2.7.2.2 Synthetic ETFs

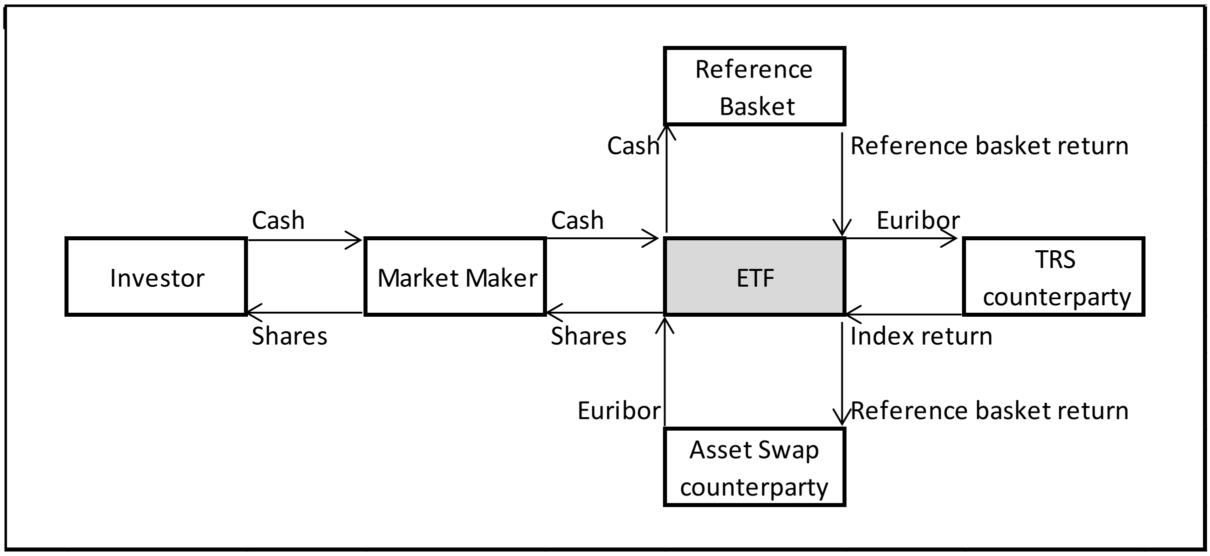
The second component of counterparty risk present in ETFs relates to the structure followed to obtain the desired returns. As highlighted above, some ETFs do not use full replication to track the returns of the index. Statistical sampling is the other alternative through which the ETF replicates the returns of an index by holding only a representative sample or reference basket (Reilly & Brown, 2009:506). In order to continue to offer the investor a return as close to the benchmark index as possible, the manager must enter into a swap transaction.

A total return swap (TRS) is a swap transaction where the return on an asset (such as the reference index) is exchanged for a selected return (such as JIBAR[31] or

[31] The Johannesburg Interbank Ask Rate (JIBAR) is the overnight rate that banks use to price short-term funding that they provide to each other (Wuite,2009).

Euribor)[32] plus a spread (Hull, 2008). Stevenson (2012:148) states that the swap-based ETF then uses the TRS to pay or receive the difference between the daily return of the portfolio of assets and the EFTs benchmark index. Figure 2.4 shows the cash flow that originates from a swap-based ETF structure.

Figure 2.4: Cash flow that originates from a swap-based ETF structure



Source: Stevenson (2012)

The one advantage of using such a swap-based ETF structure instead of the traditional physical replication of an index is that the likelihood of tracking the index more closely is greatly improved. This follows from the basic principle that the TRS counterparty will deliver the exact return of the index that the ETF aims to track. Therefore, the synthetic ETF structure is positioned at great risk when dependence is placed on the counterparty to deliver the desired returns. The ability of the counterparty to honor the agreement and deliver the set rate of return timeously will be dependent on the credit rating of such a swap provider.

Stevenson (2012:150) highlights some further complications that could arise with the above-mentioned ETF structure by pointing out the potential conflict of interest between the ETF manager and the swap provider. The reason for such a conflict of interest arises from the scenario in which the ETF manager and the swap provider are functioning as part of the same investment bank. Whereas the ETF manager

[32] The Euro Interbank Offer Rate (EURIBOR) is the European equivalent money market rate (Wuite, 2009).

would like to maintain the highest quality of assets in the ETF portfolio, the investment bank, on the other hand, would like to off-load some of its lower quality assets into the ETF portfolio. The overall balance sheet objective of the investment bank ultimately drives the decision-making, sidelining the interests of the ETF, and quality of utilised assets.

The synthetic structure as set out above is also used in the case of leveraged ETFs to obtain the geared returns of a specified index. By entering into the swap agreement, the TRS rate of return can be adjusted to deliver two times, three times, negative two times, or even negative three times the benchmark index (Johnston, 2010a). This allows the ETF to offer investors the leveraged returns. Section 2.4.9 illustrates the ways in which the reset rate/rebalancing rate of either daily, monthly or lifetime leveraged ETFs can have significant ramifications to investors in regard to the compound return experienced over time (Johnston, 2010a). One additional risk that an enhanced synthetic ETF holds is its characteristic to show great deviations between the daily returns of an index and the compound returns of the ETF over a longer period (ProShares, 2011). Volatile markets could see compound returns move significantly away from the stated daily rate of return.[33]

JPMorgan (2008) states that the more sophisticated leveraged ETFs present additional challenges such as less transparency, more turnover as well as the requirement for persistent rebalancing. In addition, the in-kind creation and redemption process present in traditional ETFs is not dealt with in a similar way in synthetic ETFs. One major risk that investors face as a result of the increased portfolio turnover and a greatly inferior creation and redemption process is that leveraged ETFs are not as tax efficient as their traditional ETF counterparts (Dirextion, 2012). Ramaswamy (2011) contends that as the volumes of these synthetic ETFs continue to grow, a build-up of systemic risk in the financial sector could potentially occur.

[33] The compound return of a two times leveraged ETF may move up by 44 percent over a two day period, while the underlying index moved up by only 21 percent (42 percent would be the normal expectation) (ProShares, 2011).

The preceding discussion about the risks involved with ETFs highlights the need for regulation in the ETF industry that will protect investors against the negative consequences of such risks. The following section highlights the regulation that is currently governing the South African market, and how this has limited the use of leveraged ETFs in the market place.

2.8 REGULATION GOVERNING ETFS

As discussed previously, one of the similarities between unit trusts and ETFs is the regulatory control to which both investment vehicles are subjected. Unit trust and ETFs were both found to be classified as Collective Investment Schemes (CISs) which must adhere to the Collective Investment Scheme Control Act (45 of 2002) (CISCA). This act became effective in March 2003 and replaced the two acts in existence at the time – the Unit Trusts Control Act and the Participation Bonds Act (Van Wyk *et al*., 2012:184). CISCA aims to set regulatory standards to which managers of such funds must adhere. This provides the framework that stipulates how the manager should handle the administration, operations, marketing and sales of the fund.

The overall majority of investment funds are structured in the form of a trust (Coronation, 2012). CISCA states that a registered trustee must be appointed to oversee the operations of the trust and ensure good governance, and fiduciary and regulatory compliance (Van Wyk *et al.*, 2012:185). Furthermore, CISCA states that the manager of a scheme may not serve as the trustee of the assets. This provides an additional segregation of duties, which increases the protection for investors.

In addition to CISCA, the FAIS and the FICA also governs ETFs in South Africa. FAIS sets the code of conduct to which financial advisors need to adhere, which includes the disclosure requirements of assets under management to provide transparency and improved investor protection (Van Wyk *et al*., 2012:120). FICA, on the other hand, serves to detect any suspicious transactions and money laundering activities by forcing financial institutions to conduct thorough customer identification and verification checks (Wuite, 2009:164). Considering the stringent regulatory requirements to which ETF issuers must adhere, it becomes understandable that only a select few institutions qualify as FSB approved management companies

(Mancos). Brown (2013c) states that currently only eight Mancos are registered in South Africa, including:

- SATRIX Managers (Pty) Ltd;
- BettaBeta Collective Investment Scheme (Nedbank Capital);
- zShares ETF Scheme (Investec);
- BIPS Investment Managers (Pty) Ltd (Rand Merchant Bank);
- Property Index Tracker Collective Investment Scheme;
- x-Market Investment Holding (Pty) Ltd (Deutsche Bank);
- New Funds Collective Investment Scheme (Absa Capital); and
- Stanlib Collective Investments Limited.

One of the key distinctions between ETFs and unit trusts is that ETFs are listed, and trade intra-day on an exchange, while unit trusts are not. Therefore, as listed securities, ETFs must adhere to all rules and regulations applicable to publicly listed companies (Brown, 2013c).

Another piece of financial regulation of which investors and particularly those planning for retirement should be aware, is Regulation 28 of the Pension Fund Act. Regulation 28 sets limits to the amount that a retirement fund may invest in for each asset class represented in the fund (equities, bonds, listed property, cash and global investments) (Alexander Forbes, 2011). The limits are set in place to ensure that a portfolio is diversified well, and not weighted too heavily towards a particular asset class. By November 2013, Regulation 28 limited the exposure to the various asset classes in the following way; 75 percent in equities, 25 percent in property, 25 percent in foreign assets, 25 percent in immovable property, 10 percent in commodities and 15 percent in hedge funds, private equity funds and any other asset not referenced (Alexander Forbes, 2011). Consequently, not all ETFs qualify as a suitable retirement product because the asset allocations in such funds exceed Regulation 28 limits. In attempting to address this problem inherent in ETF portfolios, etfSA launched a retirement annuity fund in Aug 2013, which consists of a portfolio of ETF shares, which comply with Regulation 28 (etfSA, 2013).

Although regulations governing ETFs have been shown to be robust and far reaching, some commentators such as the Bank of England still fear that the increased use of ETFs compromises financial stability (Foster, 2012). The main reason for this is the increased use of leveraged/synthetic ETFs; a product not yet available in the South African market.

Strict regulations currently prohibit South African investors from utilising leveraged ETFs. South African regulators have taken an extremely conventional and conservative stance in regard to leveraged products as part of an investment portfolio. The Financial Services Board (FSB), notice 80 of 2012, states, "a manager may not include exchange traded funds or ETNs, which are capable of obtaining leveraged exposure to the underlying asset". The US market, on the contrary, allows investors access to synthetic ETFs so long as they are handled in a responsible manner (SEC, 2009). A synthetic ETF is able to obtain the desired leveraged returns by utilising interest rate derivatives in its structure. The FSB has further restricted the possibility for issuers to create such leveraged products by stating the following, "The manager must ensure that an unlisted transaction for the swap of interest rates is not used to leverage or gear the portfolio, and is covered at all times" (FSB, 2012).

South African regulatory restriction on leveraged ETFs is however not an isolated situation, as globally, regulators are becoming increasingly aware of the risks inherent in leveraged ETFs (Johnson *et al*., 2012). The focus of all the regulations is to inform potential investors better about the apparent risks. This research, therefore, acknowledges the risks of such products and assents that "inverse and leveraged ETFs that are reset daily typically are unsuitable for retail investors who plan to hold them for longer than one trading session, particularly in volatile markets" (FINRA, 2009). Given that leveraged ETFs are not suitable to all investors, those who possess the necessary skills, however, should still have the opportunity to invest in them. This research will subsequently draw on data from the US market to perform risk and return comparisons to ETFs listed in the South African market.

The nature of regulations prevents South African investors from utilising certain ETF investment practices available elsewhere in the world. The discussion on ETFs will conclude by examining the trading strategies available to investors willing to trade ETFs.

2.9 ETF TRADING STRATEGIES

The EHM, as introduced in the beginning of this chapter, highlighted the passive nature of ETFs and how these stand in contrast with the actively traded investments such as unit trusts. As such, the trading strategies followed by investors dealing with ETFs are also unique. Furthermore, it has been indicated that the ETFs are listed on stock exchanges. This opens up the possibilities to a host of strategies not accessible to unit trust investors. The possibility to incorporate sophisticated trading techniques such as options trading, future contracts and short selling provides ETF investors with additional opportunities to closed-ended and open-ended investment companies.

2.9.1 Short selling

Bodie *et al*. (2010) state that short selling of a stock refers to the trading strategy that involves borrowing a share and then selling it, with the expectation that the price of such a share will decrease in time. The short-seller will subsequently be able to purchase such a share at a cheaper price and return it to the lender, while realising a profit. ETFs as listed shares on a stock exchange are able to be short-sold, which gives the added opportunity to make profits, even when the market is declining.

Lydon and Wasik (2008:129) state that the one advantage of ETFs in this regard is their exemption from the uptick rule, which sees the prohibition of regular stocks from short selling in times of market downturns. The ability to short-sell ETFs has however attracted increased attention from regulators to determine the impact of such trading techniques on financial stability (Foster, 2012). Furthermore, short selling presents its own set of risks to the investor. Wrongful predictions of the movement of the ETF share price while employing the short-selling technique could prove very costly and create substantial losses (Lydon & Wasik, 2008:129).

2.9.2 Options trading

An advantage to trading an ETF in comparison to a close-ended or open-ended unit trust is that many ETFs offer the opportunity to trade options (Mullaney, 2009:354).

Options traded on ETFs function in exactly the same way as options traded on regular shares. Both put[34] and call[35] options can be employed to profit from the anticipated price movements of the ETF share. A long ETF call position is taken when prices are expected to increase, and a long ETF put position is used when ETF prices are expected to decrease (Van Wyk *et al*., 2012:397). Conversely, the short ETF call profits from a decline or sideways movement of the share price, while the short ETF put will gain from a rise or sideways movement of the underlying ETF.

Some option trading strategies that are applicable to regular shares can also be employed to ETFs. Mullaney (2009:358) provides the full spectrum of ETF option strategies as follows:

- long or short call or put;
- long or short vertical spread;
- long or short iron condor;
- ratio spread;
- back spread;
- long or short straddle;
- long or short strangle;
- long or short butterfly;
- long or short condor;
- long or short calendar spread;
- long or short diagonal spread;
- covered call or put;
- long or short combination; and
- long or short covered combination.

The exact functioning of each of the above strategies falls beyond the scope of this research, but it can be stated that the use of the correct strategy will depend on the view of the market. Through the ability to use strategies as listed above, ETF investors are provided with another method in which to profit during market

[34] The right to sell an asset at a specified exercise price on or before a specified expiration date (Bodie *et al*., 2010:46)
[35] The right to buy an asset at a specified price on or before a specified expiration date (Bodie *et al*., 2010:46)

downturns. This can be used to substitute leveraged, or more specifically inverse ETFs that also offer investors the ability to profit from negative markets.

The covered call strategy as listed above should, however, be highlighted. This is considered one of the most popular ETF option strategies as it one of the safest strategies to follow (Anon., 2013b). Hull (2008:525) describes the covered call as a strategy that involves taking a short position in the ETF option and combining this with a long position in the ETF share (trader owns the ETF share). The trader using such a strategy profits when the option is not exercised by collecting the premium from the call option. However, should the call option be exercised, the trader already owns the underlying ETF share and does not run the risk of acquiring the ETF at an unreasonable price when delivering the share to the holder of the option.

2.9.3 Hedged investment

A long-term hedge strategy can be followed by taking a short-term or long-term investment position in a liquid ETF. Such a position provides diversification by exposing the portfolio to industries and economic sectors represented in the underlying index. The diversification benefits that ETFs offer have been pointed out in Section 2.4 by indicating the vast amount of sectors or niche market segments in which can be invested with ETFs. Diversification itself can be regarded as a hedge strategy, though the dollar-for-dollar correspondence of a classical hedge investment may be lacking (Anon., 2013b).

2.9.4 Buy-and-hold

The comparison between an ETF and its actively managed unit trust counterpart highlights the distinctly different approaches followed by both investment companies. The actively traded fund manager will make continuous changes in the composition of assets in the fund, whereas the ETF manager will try to replicate the index to the best of its ability with minimal changes occurring due to the static nature of the index. The simplest investment strategy for ETF investors, therefore, is to buy and hold the ETF over a long time period. Brinson *et al*. (1995) noted that the long-term asset allocation strategy accounted for almost 90 percent of the return and risk in a fund, whereas stock picking and short-term tactical changes had a negligible impact on the portfolio. Stevenson (2012:278) strengthens the case for a simple buy and hold strategy by indicating that asset allocation, and not active stock picking, is the main driver of portfolio performance.

2.10 SUMMARY

This chapter provided the fundamentals of ETFs. It was shown that advocates of the EMH believe that markets are fairly priced and as such provide no opportunity to make abnormal profits. The origin of passive index tracking investing follows from this notion; whereby, investors do not aim to outperform the market, but instead seek to obtain the returns delivered by the broader market. Traditional ETFs are perfectly suited to achieve these index-tracking goals of investors. ETFs hold unique features like greatly reduced transaction costs, improved liquidity and transparency, and the ability to trade like a listed stock on a registered stock exchange. The creation and redemption process used to create or redeem new ETF shares adds to the liquidity and ensures that any arbitrage positions between the underlying security prices and the ETF share prices are eliminated. An ETF share, therefore, always trades very close to its NAV.

The wide variety of ETFs on offer allows for application in numerous market segments. Index, sector, commodity, bond, style, property and currency ETFs are some of the types of ETFs that allow investors exposure to a desired niche market. The historical developments of ETFs showed the rapid advance within the ETF market since its inception. The popularity of ETFs continues to grow as more investors move away from more well-known investment vehicles such as unit trusts, index funds and hedge funds to ETFs. Lower TERs, ease of access, intra-day price availability and daily publication of fund holdings are a few of the characteristics that make ETFs so attractive, relative to the competing investment classes.

As the ETF aims to replicate the return of a benchmark index, it creates the risk that actual returns of an ETF may be significantly different to the underlying index. A noteworthy point of comparison between ETFs, therefore, is the tracking errors relative to the benchmark index. As leveraged ETFs form an important part of the study, some of the features and major risks relating to this relatively new product were emphasised. The synthetic position created by leveraged ETFs was shown to add greater amounts of counterparty risk for the investor utilising such products.

South African regulations recognise the risk of leveraged ETFs, and as such prohibit the creation and use of such products within the market. Traditionally ETFs have been favoured for their use as buy-and-hold investment products; however, some other strategies such as short selling, options trading, and hedged investments can also be used when dealing with ETFs.

With the necessary literature and background relating to exchange traded funds discussed in this chapter, subsequent chapters will focus on the performance measurement, risk measurement and diversification measurement of ETFs. The literature relating to performance measurement, risk and volatility measurement and diversification measurement will aid in the clarification of the methods used during the empirical section of this study.

CHAPTER 3
DIVERSIFICATION, RETURN PERFORMANCE MEASURES AND VOLATILITY

3.1 INTRODUCTION

This chapter presents the theoretical foundation of the study and provides a full analysis of the three major components used during the evaluation of ETFs. The measurements used to determine diversification, performance and volatility are explained in detail. Each of the three components is explained and their characteristics presented, as they will be used in the empirical study as comparative analysis tools.

Firstly, modern portfolio theory and its implications for diversification are presented within the Markowitz efficient frontier analysis. The single index model is presented as an alternative method to determine the effects of systematic and unsystematic risk on a portfolio, and subsequently, how this model can be used to enhance diversification. Whereas the Markowitz analysis and single index model provides a description of the optimal allocation of assets within a portfolio, the capital asset pricing model (CAPM) and arbitrage pricing theory (APT) models can be used to evaluate the pricing of such assets. Both of these asset-pricing models are discussed in depth.

During the evaluation of ETFs in the empirical section of the study, a wide variety of risk-adjusted performance measures are applied. This chapter provides a clear explanation of each performance measure and describes the purpose of each measurement within the study. The following risk-adjusted performance measures are included: Sharpe ratio, Treynor ratio, Jensen's alpha, Sortino ratio, Calmar ratio, Information ratio and the Omega ratio.

The final section of the chapter discusses volatility and the various approaches that can be followed to measure this market phenomenon. The standard deviation, autoregressive conditional heteroscedasticity (ARCH) models, and exponentially weighted moving average (EWMA) are presented and compared in terms of their use for ETF volatility measurement.

3.2 DIVERSIFICATION

Exchange traded funds have been widely promoted for the diversification benefits that they hold. When attempting to illustrate the differences in the diversification potential between various ETF indexation methods, it is vitally important to comprehend the diversification principle fully. As highlighted in Chapter 2, diversification refers to the act of spreading investments across multiple assets and/or asset classes in order to reduce the overall risk of such an investment portfolio (Wuite, 2009:136). This section will establish the exact working of the diversification principle and the effects that this has on a portfolio by exploring modern portfolio theory, the single index model, the capital asset pricing model, and the arbitrage-pricing model.

3.2.1 Modern portfolio theory – Markowitz efficient frontier

Modern portfolio theory (MPT) was first established in 1952 following the work published by Markowitz. His work laid the foundation on which the basic principle of diversification stands. The basic assumption was that investors are naturally risk averse, and will seek to obtain the highest possible returns for a given level of risk. Markowitz (1952) introduced the notion that in order to build the optimal portfolio or "efficient portfolio" as it is also know as, one needs to take into consideration the interaction between the assets in a portfolio. Markowitz showed that in order to determine the risk of the portfolio, the variance of returns needs to be considered with the correlation (or covariance) of the individual assets in the portfolio. MPT not only considered the risk involved with the investment portfolio, but also established a method to estimate the returns of a portfolio. This two-parameter model is known as the mean-variance model (Jones, 2010:196).

The expected return for a portfolio was shown by MPT to be the weighted average return of all the individual securities in the portfolio. The contribution to the overall return of the portfolio, therefore, depends on the weight that each individual asset carries in the portfolio. This relationship can be expressed mathematically as in Equation 3.1 (Reilly & Brown, 2009:10):

$$E(R)_{Port} = \sum_{i=1}^{n} w_i R_i \qquad (3.1)$$

where:

- $E(R)_{Port}$ represents the expected return of the portfolio;
- w_i shows the weighting of each individual asset in the portfolio; and
- R_i is the expected return for asset *i*.

The portfolio risk measurement, as presented by MPT, best describes the benefits that diversification holds for a portfolio. Marx *et al*. (2008:34) state that Markowitz regarded portfolio risk as not only the weighted average of the individual variances, but also included the weighted covariance between the pairs of individual assets. Mathematically, Equation 3.2 can show the standard deviation (measure of risk) of the portfolio (Hull, 2000:424):

$$\sigma_{Port} = \sqrt{\sum_{i=1}^{n} w_i^2 \sigma_i^2 + \sum_{i=1}^{n} \sum_{j=1}^{n} w_i w_j Cov_{ij}} \qquad (3.2)$$

where:

- $i \neq j$;
- w_i is the weight that each individual asset holds in the portfolio;
- σ_{Port} represents the portfolio volatility;
- σ_i is the standard deviation of asset i; and
- Cov_{ij} represents the covariance between asset i and j.

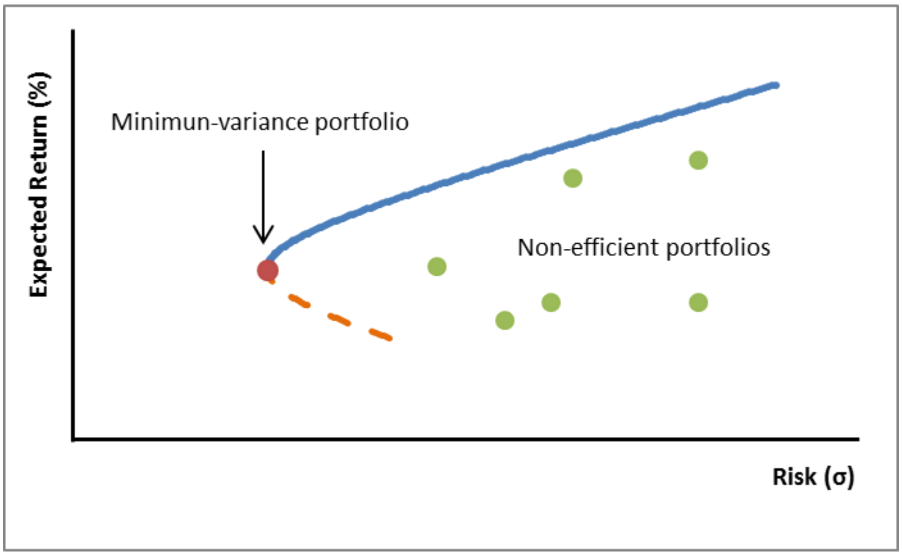
This measure of portfolio risk emphasises the importance of the interaction between assets in the portfolio. When adding an additional asset into the portfolio it becomes necessary to consider not only the individual assets variance, but also the covariance of this asset with the other investments in the portfolio (Reilly & Brown, 2009:181). Small or even negative correlations between the assets in a portfolio could have the effect that variability in returns from one asset could be offset by that of another, thereby reducing the overall risk in the portfolio (Bodie *et al*., 2010:154).

Therefore, the maximum benefits of diversification can be seen when combining perfectly negatively correlated (correlation = -1) assets into a portfolio. Reilly and Brown (2009:182) describe a portfolio consisting of perfectly negatively correlated assets as a risk-free portfolio. In such a risk-free portfolio, the negative covariance term exactly offsets the individual variance terms, leaving the overall standard deviation of the portfolio to be zero (Reilly & Brown, 2009:182). However, this exceptional case of zero portfolio risk is only attainable when the individual standard deviations of the assets are equal.

The essence of diversification is contained in the Markowitz portfolio risk measure as it can be shown that by varying the weights of low, zero or negatively correlated assets within a portfolio the overall risk of the portfolio could be lower than any of the single assets. Investors need to consider all combinations of assets (investment opportunity set) to include in their portfolio in order to establish the composition which will deliver the highest possible expected return, given the level of risk. This trade-off between expected return and risk in the portfolio can be illustrated graphically by Markowitz's efficient frontier. The efficient frontier is represented in Figure 3.1, which indicates those sets of portfolios that have the highest level of expected return given a specific level of risk. The efficient frontier similarly displays those portfolios that exhibit the lowest risk for a given level of expected return (Jones, 2010:192).

The efficient frontier represents those portfolios that have been effectively diversified (Hudson-Wilson, 1990:35). As such, no other portfolio or individual asset can offer a higher return than the efficient portfolios for a particular level of risk. The solid line as shown in Figure 3.1 meets this criterion and can be regarded as the efficient frontier. Individual assets and non-efficient portfolios fall below the frontier, indicating that by altering the composition of such a portfolio, the investor can obtain a higher level of expected return without incurring additional risk. The minimum-variance portfolio represents the portfolio that holds the lowest level of risk of all the efficient portfolios. Any other portfolio that falls below the minimum-variance portfolio (dotted line included) is dominated by a portfolio on the efficient frontier, and therefore, considered as non-efficient.

Figure 3.1: Markowitz efficient frontier

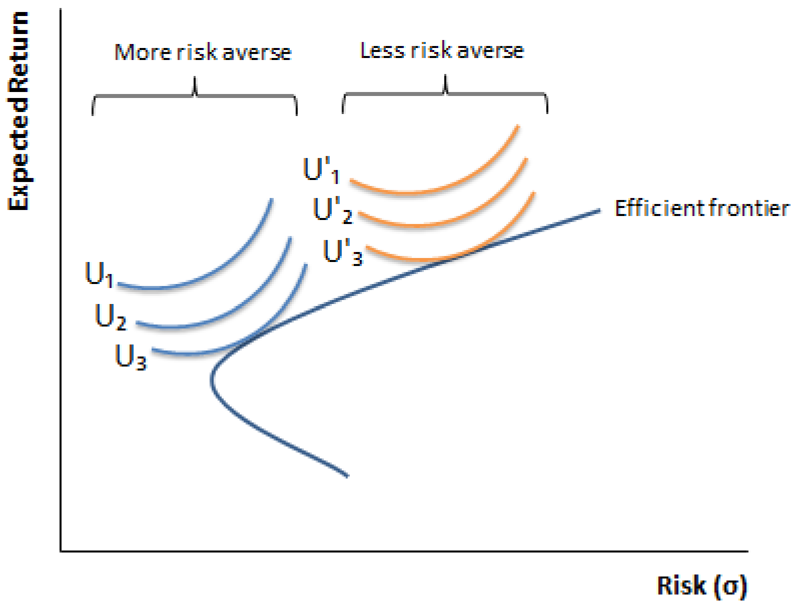


Source: Bodie *et al*. (2010:156)

Reilly and Brown (2009:189) state that a portfolio cannot dominate any other portfolio on the efficient frontier. Therefore, investors will base their decision of where to position themselves on the frontier according to their utility functions. Jones (2010:193) classifies the investor utility function according to the individual indifference curves. The indifference curve describes the investor's preferences for risk and return. Figure 3.2 shows the indifference curves of both a risk-averse investor as well as a less risk-averse investor superimposed on the efficient frontier.

Investors who are willing to accept more risk will position themselves further up and to the right on the efficient frontier. Higher utility functions such as U_1, U_2, U'_1 and U'_2 are more desirable to investors but are unattainable. The Markowitz portfolio selection model can be expanded through the introduction of a risk free asset into the portfolio. This will be discussed in the following section.

Figure 3.2: Efficient frontier with indifference curves



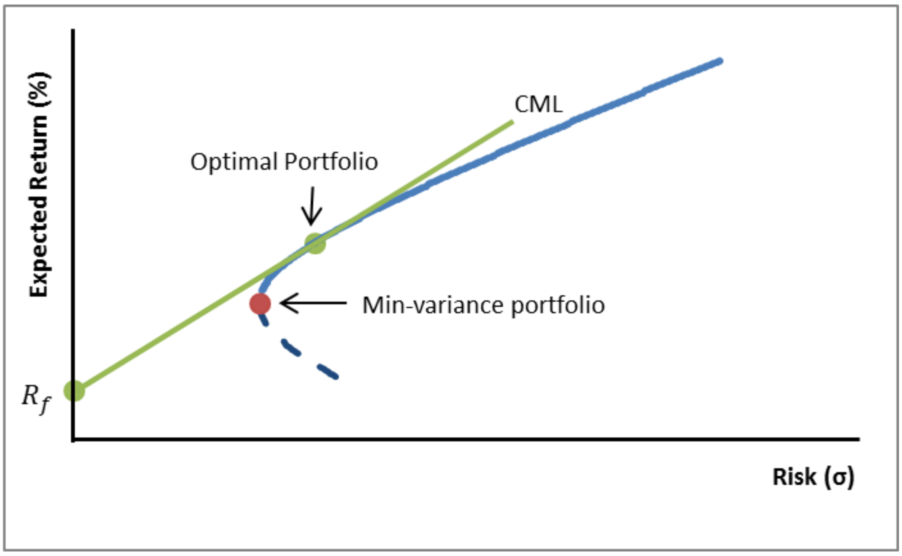
Source: Adapted from Ghosh (2010)

3.2.2 Portfolio selection with a risk-free asset

The Markowitz model presented in the previous section looked at how a portfolio consisting of risky assets could be structured to ensure an optimal mix between the risky assets to obtain the highest expected return for a given level of risk. The asset allocation decisions facing investors change significantly when a risk free asset gets introduced into the model.

Theoretically, no asset can hold zero risk; however, with the support of the government and its insensitivity to interest rate changes due to its short-term maturity, a treasury bill can be regarded as a possible risk-free asset (Bodie *et al*., 2010:132). The rate of return that an investor receives from such a risk-free asset can be considered as a guarantee because a very low probability exists that the issuer will not honor the payment (Wuite, 2009:337). Combining both risky assets and a risk-free asset into the overall investment portfolio alters the expected return and risk trade-off. Figure 3.3 shows a graphical illustration of this modified trade-off.

Figure 3.3: Risk and return



Source: Bodie *et al*. (2010:159)

Including a risk-free asset into the asset mix allows for the creation of an optimal portfolio. The optimal risky portfolio embodies a portfolio that consists of the best combination between the risk-free asset and the risky assets (Bodie *et al*., 2010:159). Investors can subsequently decide to invest in either the optimal portfolio or the risk-free asset. The asset allocation decision to include more/less of the risk-free assets, compared to the optimal portfolio, moves the investor along a straight line, which is known as the capital market line (CML). The CML is the line from the intercept point that represents the risk-free rate tangent to the original efficient frontier (Reilly & Brown, 2009:1041). The CML forms the new most efficient set of portfolios that the investor can obtain, as all portfolios on the CML dominate portfolios on the original Markowitz efficient frontier.

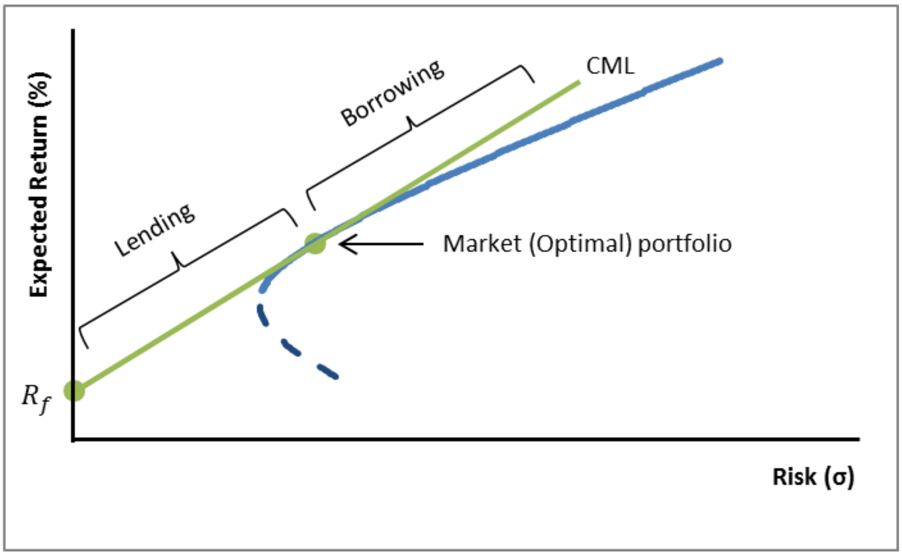
Investors who are more risk-averse will invest more in the risk-free asset and less in the optimal portfolio. Conversely, a less risk-averse investor will include a larger weight towards the optimal portfolio and less in the risk-free asset (Bodie *et al,* 2010:163). Considering that the theoretical optimal portfolio considers all possible risky assets, it can be stated that the optimal portfolio will be the same for all investors.

Tobin (1958) used this principle to formulate his separation theorem. Tobin's separation theorem stated that portfolio selection can be considered as a two-step process:

- Firstly, decisions are made in determining the optimal risky portfolio.
- Second, the degree of risk aversion is taken into consideration as personal choice is accounted for when determining the best mix of the optimal risky portfolio and the risk free asset.

Tobin's work illustrated how leverage can be added to the portfolio to obtain the desired return-risk profile. By lending more at the risk-free rate and holding fewer funds in the optimal portfolio, the investor moves down the CML line. Similarly, by using leverage, the investor can borrow more funds at the risk-free rate and invest these funds in the optimal portfolio. In doing so an expected return (and risk), which is higher than the optimal portfolio, can be achieved – essentially moving the investor up the CML line. Figure 3.4 illustrates the decision process of when to borrow or lend funds at the risk-free rate.

Figure 3.4: Capital market line assuming lending and borrowing at risk-free rate



Source: Marx *et al*. (2008:38)

Diversification, as presented by the Markowitz efficient frontier and the expansion of this model with the inclusion of the risk-free asset, presented the view of how asset allocation decisions can alter the expected return and risk for an investment portfolio. By including assets with a low correlation, the overall portfolio risk could even be lower than the risk associated with the individual assets. One of the shortcomings of modern portfolio theory, as presented here, is the simplifying assumption that probability distributions for portfolio returns are assumed to be normal (Haugen, 1986:180). Although this assumption ensures the probability distributions are fully described by their expected returns and standard deviations, such an assumption might not hold in practice. MPT does however still provide a good explanation of how different asset classes perform over time and assist in establishing reasonable estimates of returns.

The importance of the correlation between assets in the portfolio has been shown to be the most significant contributor to diversification in a portfolio. A second issue with MPT is that it makes no assumptions regarding the source of the covariance (correlation) between the assets (Haugen, 1986:122). Portfolio variance is accounted for accurately by including all covariances (obtained from the covariance matrix) into the calculations. When dealing with large portfolios, the covariance matrix can become extremely big, creating a challenge for determining the portfolio variance. To overcome this problem a simplified model, in the form of the single-index model, was developed.

3.2.3 Single-index model

The difficulty involved with the computation of covariances between assets in large portfolios created the need for a simplified model to estimate the expected return and risk of a portfolio. The single-index model overcomes the problem of multiple covariance calculations by making the simplifying assumption that security returns in the portfolio are correlated with each other only by means of their individual correlation with a market portfolio or index (Haugen, 1986:122). That is, all co-movement of individual assets in the portfolio can be accounted for by the variability of return in the market portfolio. Any deviation of actual return from the expected return under this model, therefore, can be attributed to a factor that is unique to that individual security rather than the behavior of the market portfolio. The single index model subsequently makes a distinction between the systematic risk (market risk) and unsystematic risk (firm-specific risk) associated with a security. Both components of risk will be discussed as part of the single-index model.

3.2.3.1 Systematic risk

Systematic risk, also called market risk, is defined as that risk component that is common to the whole economy and affects all securities in the market (Bodie *et al*., 2010:166). Unexpected changes in macroeconomic factors such as the interest rate, exchange rate, commodity prices, inflation, gross domestic production or political regimes can be seen as examples of systematic risk, which impact all securities in the market to some extent (Reilly & Brown, 2009:200). Systematic risk, for an individual security, is not unique to the asset's specific characteristics, industry, operations or management, but is rather associated with its sensitivity to overall market fluctuations. The sensitivity to the overall market changes can be measured by means of the beta (β) value of the individual security.

Beta measures the extent to which the value of a stock (or financial asset) will vary in reaction to the movement in the overall market (Gitman & Joehnk, 1990:197). Assets that exhibit a greater sensitivity to market changes will have a higher beta value. Similarly, should a stock show less sensitivity to general market movements, it will hold a low, or even negative, beta. Haugen (1986:128) sets the equation for beta as follows:

$$\beta_i = \frac{Cov\,(R_{i,}R_M)}{\sigma^2(R_M)} \tag{3.3}$$

where:

- β_i = the beta factor for asset i;
- $Cov(R_{i,}R_m)$ = the covariance between the returns of asset i and the returns of the market portfolio; and
- $\sigma^2(R_M)$ = the variance of the market returns.

Equation 3.3 shows that the beta factor for an individual security is equal to the covariance of the security with the market, divided by the variance of the return of the market. Stocks with a beta close to one have systematic risk approximately equal to the market, while stocks with a beta greater than or less than one have systematic risk greater than or less than the market (Bernstein & Damodaran, 1998:88). Stocks with a beta greater than one can be regarded as cyclical stocks, while stocks with a beta lower than one can be seen as defensive stocks (Bodie *et al*., 2010:167). Traditional passively managed ETFs have also been classified as beta funds because these funds have beta factors very close to one when compared to the benchmark index that such funds aim to replicate.

3.2.3.2 Unsystematic risk

Unsystematic risk can be described as that component of risk inherent in the value of a stock that can be ascribed to company- or industry specific factors. This can be seen as the unique risk associated with the individual security. Reilly and Brown (2009:18) provide some examples of unsystematic risks as business risk (nature of the business activities), financial risk (high debt-to-equity ratios), liquidity risk (amount of liquid assets employed), and operational risk (systems, people and processes risk). The decision to diversify an investment portfolio aims to reduce the unsystematic risk in the portfolio. The effect of diversification on both systematic and unsystematic risk will be discussed in the following section.

3.2.3.3 Single index model and diversification

Modern portfolio theory showed how the diversification benefits for a portfolio could be maximised by adding low to negatively correlated assets into the portfolio. The single index model does not consider the correlation among each individual security, but rather the correlation of a security with the market portfolio (index). The variability of returns of a security can be explained by its co-movement with the market portfolio, by making the simplifying assumption that a security responds in some way to the pull of the market portfolio. The single-index model can be described by means of Equation 3.4 (Bodie *et al*., 2010:167):

$$R_i = \beta_i R_m + \varepsilon_i + \alpha_i \qquad (3.4)$$

where:

- R_i = excess return of an individual security. This represents the return that an individual security will earn in excess of the risk-free rate ($r_i - r_f$);
- β_i = beta factor which represents the sensitivity of the individual security to changes in the market movement (R_m);
- ε_i = firm-specific risk or residual term; and
- α_i = alpha. Alpha represents the return that the stock will show beyond that induced by the broad market (inter alia the expected return when the market's excess is zero).

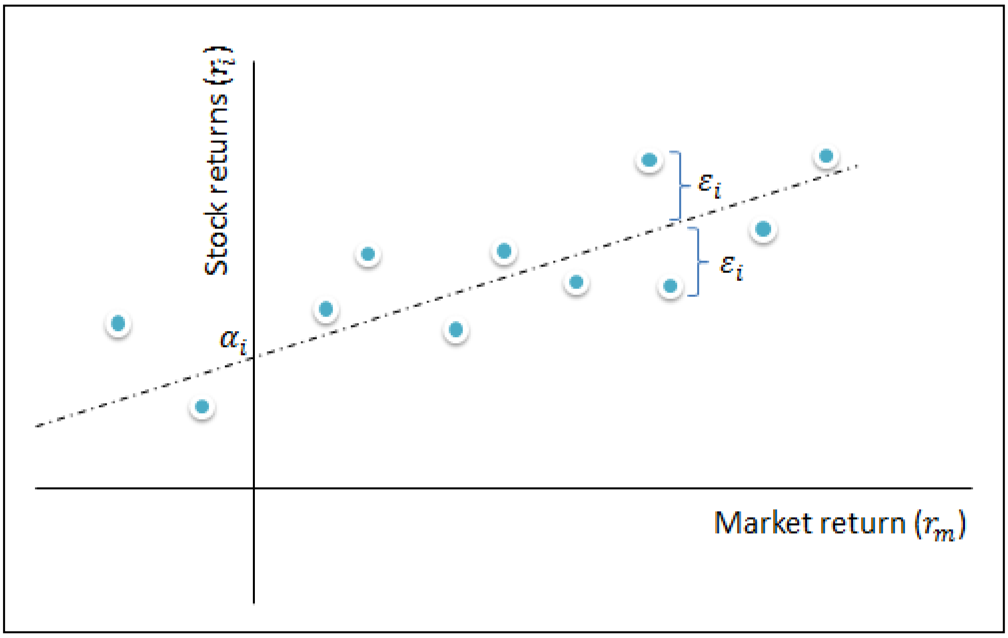
The single index model can also be illustrated graphically as in Figure 3.5. The single index model uses regression to compare the returns of the individual asset with that of the market return. Beta (β) represents the slope of the regression line.

From the preceding discussions it can be seen that two sources of security risk can be identified: systematic risk ($\beta_i R_m$) and unsystematic risk (ε_i). As such, Bodie *et al*. (2010:168) show that Equation 3.5 represents the variance in the return of a security:

$$\begin{aligned} Variance\ (R_i) &= Variance\ (\alpha_i + \beta_i R_m + \varepsilon_i) \\ &= Variance\ (\beta_i R_m) + Variance\ (\varepsilon_i) \\ &= \beta_i^2 \sigma_m^2 + \sigma^2(\varepsilon_i) \\ &= Systematic\ risk + Firm\ spesific\ (unsystematic)\ risk \end{aligned} \tag{3.5}$$

Therefore, systematic risk is determined by the variance in the return of the market portfolio (σ_m^2) and the sensitivity of the individual asset to the market variance (β_i). This implies that the systematic component of each security's return ($\beta_i R_m$) depends only on the market factor. As such, diversification has no effects on systematic risk (Bodie *et al*., 2010:168). Systematic risk depends on the beta and not on the number of securities in the portfolio. Therefore, the systematic risk in a portfolio can be controlled only by manipulating the average beta of the component securities and not by increasing the number of securities in the portfolio (Haugen, 1986:129).

Figure 3.5: Relationship between the returns on an individual asset and the market return

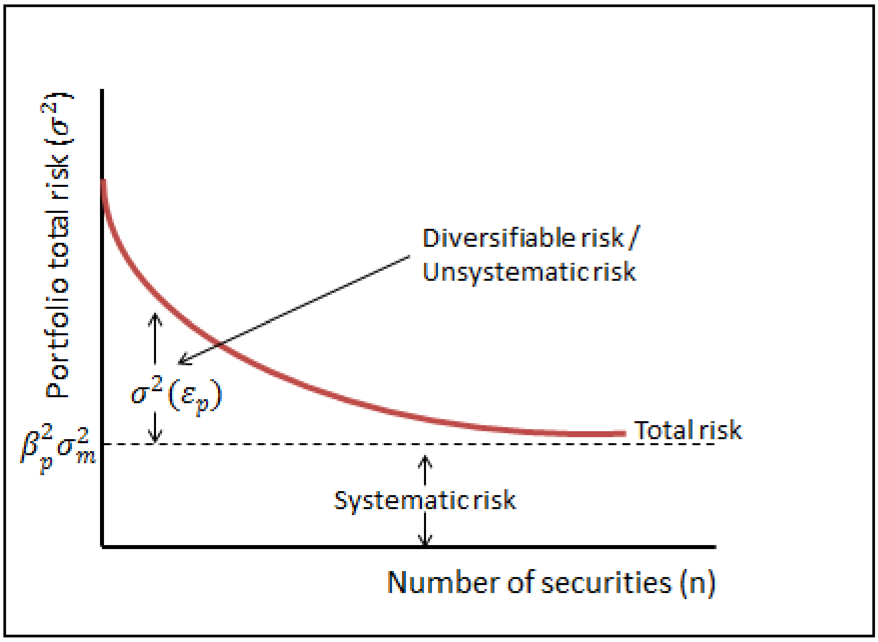


Source: Haugen (1986:123)

On the contrary, the firm-specific risk of individual securities (ε_i) are assumed to be uncorrelated with each other (Cov($\varepsilon_i, \varepsilon_j$) = 0) when dealing with multiple assets in one portfolio. Even when individual securities carry a large residual variance (specific risk), benefit can still be gained from adding more securities into the portfolio. For unsystematic risk, the number of securities, are therefore, more important than the firm-specific variance of securities (Bodie *et al*., 2010:172). A portfolio obtains a negligible level of unsystematic risk when more securities are added to it. Treynor (1965) contends that the unique (unsystematic) risk can theoretically be zero in a completely diversified portfolio.

Evans and Archer (as cited by Marx *et al*., 2008:34) specify that an investor need to include roughly 12 diverse securities into the portfolio to reduce most of the unsystematic risk. Figure 3.6 shows how the total risk in the portfolio is reduced as the inclusion of more securities diminishes the unsystematic risk, leaving only systematic risk in the portfolio. As the number of securities increase, the variance of the unique risk or residual value of the overall portfolio ($\sigma^2(\varepsilon_p)$) reduces and the portfolio risk that remains can said to be the market risk ($\beta_p^2\sigma_m^2$).

Figure 3.6: Systematic and unsystematic risk



Source: Bodie *et al*. (2011:282)

The single index model greatly reduces the number of calculations required to estimate the expected return and risk trade-off for a portfolio. However, the single index model holds some shortcomings due to the simplifying assumption that all securities are only assumed to be correlated to each other by means of their individual correlation with the market. Haugen (1986:124) states that the assumption that there is no correlation between the individual residuals of securities (Cov($\varepsilon_i, \varepsilon_j$) = 0) will yield incorrect estimates of the portfolio residual variance ($\sigma^2(\varepsilon_p)$). Stocks in a specific industry may have residual terms that are correlated to some extent, and as a result, the single-index model fails to account for the impact of industry-wide events on a portfolio.

The preceding sections looked at portfolio models that can be used to illustrate how diversification can be achieved in an investment portfolio. Both the single-index model and Markowitz's portfolio theory aim to determine the minimum variance set that will provide maximum diversification benefit. Apart from this similarity, the models do differ in their approach in selecting the minimum variance set. Table 3.1 summarises some of the key differences between Markowitz's portfolio theory and the single-index model.

Table 3.1: Markowitz vs Single-index model

Markowitz model	Single-index model
Portfolio variance is perfectly accurate (given accuracy of covariances).	Assumes residuals are uncorrelated. Thus only provides an approximation of the true portfolio variance.
Makes no assumptions regarding the sources of covariances between stocks.	Assumes that all the covariances can be accounted for by the relative responses of each stock to the market.

Source: Haugen (1986:136)

Whereas the portfolio models that were discussed act as tools to select the efficient set in the expected return and standard deviation space, such models still do not provide a description of how securities should be priced. The CAPM and APT extend capital market theory by providing a framework for pricing all risky assets. This will be discussed in the next section.

3.2.4 Capital asset pricing model

Lintner (1965), Mossin (1966), and Sharpe (1966) simultaneously and independently developed the capital asset pricing model (CAPM). Historically, the CAPM was developed prior to the single-index model, as described in the previous section. The single index model was widely adopted as a natural description of the stock market immediately on the heels of the CAPM, because the CAPMs implications match the intuition underlying the single index model (Bodie *et al.*, 2010:194). However, the CAPM not only provides a portfolio selection tool, but also provides a framework for pricing the risky assets in a portfolio. Therefore, essentially the CAPM can be used to determine the required rate of return for a particular asset given the current level of risk (Reilly & Brown, 2009:195).

Similar to the single-index model, the CAPM assumes the only driver of risk to be the systematic risk of an asset, and as a result the required rate of return for the asset will be proportional to its beta. The CAPM considers the required expected return and risk relationship that exists when a risk-free asset and a collection of all risky assets in the market place (market portfolio) are combined. The model as such views the systematic risk (beta factor) as a key determinant of how a security should be priced in the market, given its associated risk (Saunders & Cornet, 2006:54).

3.2.4.1 Assumptions of the CAPM

In constructing the CAPM, various assumptions are required to describe how the world is expected to function in order for the model be fully effective. Megginson (1996:13) states that the following assumptions form the basis of the CAPM:

- The investors are risk-averse individuals who have the aim of maximising their expected utility.
- The investors are also price-takers who have homogeneous expectations – inter alia they estimate identical probability distributions for future rates of return.
- Investors can borrow and lend any amount of money at the risk-free rate of return (RFR).
- The assets are perfectly divisible and easily marketable, so it is possible to buy and sell fractional shares.
- Capital markets are in equilibrium. The markets do not have any friction and market information is freely available to all investors at the same time.
- Taxes and restrictions do not exist in the market because they are considered imperfections that affect the regular functioning.

Even though these assumptions are not all representative of the real-world complexities, the CAPM still leads to powerful insights into the nature of equilibrium in security markets (Bodie *et al.,* 2010:195). For this equilibrium to exist, all investors in the market should use the model and position themselves on the efficient frontier. Haugen (1986:180) states that for the investors to take a position on the efficient frontier, either one of the following two conditions need to be fulfilled:

- the probability distributions for portfolio returns need to be normal; and
- the relationship between the investor utility and portfolio wealth should be quadratic in form.

All investors will assume a position on the efficient frontier, according to their individual risk appetite, if either one of these conditions are met. As such, Bodie *et al.* (2010:191) show that the risk premium on the market portfolio will be proportional to its variance. The individual risk preferences of the investor is accounted for by adding a scale factor (A*) into the equation that represents the degree of risk aversion undertaken by the investor. Equation 3.6 expresses this relationship (Bodie *et al.*, 2010:191):

$$E(r_m) - r_f = A^* \sigma_m^2 \tag{3.6}$$

where:

- $E(r_m) - r_f$ = the risk premium on the market portfolio;
- A^* = the scale factor representing the degree of risk aversion taken by the average investor; and
- σ_m^2 = the variance of the market portfolio.

This relationship highlights that the equilibrium risk premium of the market portfolio $(E(r_m) - r_f)$, will be proportional to the degree of risk aversion by the investor (A*) and the risk inherent in the market portfolio (σ_m^2) (Bodie *et al.*, 2010:191). This relationship implies that the higher the degree of risk aversion, the higher the expected rate of return should be to maintain a state of equilibrium. A higher degree of risk aversion will also cause the CML to have a steeper slope (Haugen, 1986:181).

3.2.4.2 CAPM and security valuation

Taking into account that investors can diversify away all unsystematic risk in the portfolio, the relationship stated in Equation 3.6 further implies that the investor will require a risk premium such that they are compensated for the systematic risk in the portfolio. As such, investors will price securities according to the contribution that each makes to the systematic risk of the overall portfolio (Haugen, 1986:204). The systematic risk, as measured by beta, needs to be accounted for, as it is the only source of concern for the well-diversified investor.

The CAPM's usefulness in pricing individual securities can now be introduced. To determine the expected return for each individual security in the portfolio, the ratio of the risk premium to beta for each security needs to be considered. Bodie *et al*. (2010:193) state that the ratio of the risk premium to beta should be the same for any two securities or portfolio. Equation 3.7 sets out this condition:

$$\frac{E(r_m) - r_f}{1} = \frac{E(r_i) - r_f}{\beta_i} \tag{3.7}$$

where:

- $E(r_m) - r_f$ = the risk premium of the market portfolio;
- $E(r_i) - r_f$ = the risk premium of the individual security;
- β_i = the beta of the individual asset; and
- r_f = the rate of return for the risk-free asset.

The ratio of the risk premium of the market portfolio to the beta of the market portfolio[36] is assumed equal to the ratio of the risk premium for an individual security to the beta of that security (β_i). By rearranging the components in Equation 3.7, the formula for the CAPM can be deduced. Equation 3.8 sets out the CAPM (Sharpe, 2000:81):

$$E(r_i) = r_f + \beta_i[E(r_m) - r_f] \tag{3.8}$$

where:

- $E(r_m) - r_f$ = the risk premium of the market portfolio;
- $E(r_i) - r_f$ = the risk premium of the individual security;
- β_i = the beta of the individual asset; and
- r_f = the rate of return for the risk-free asset.

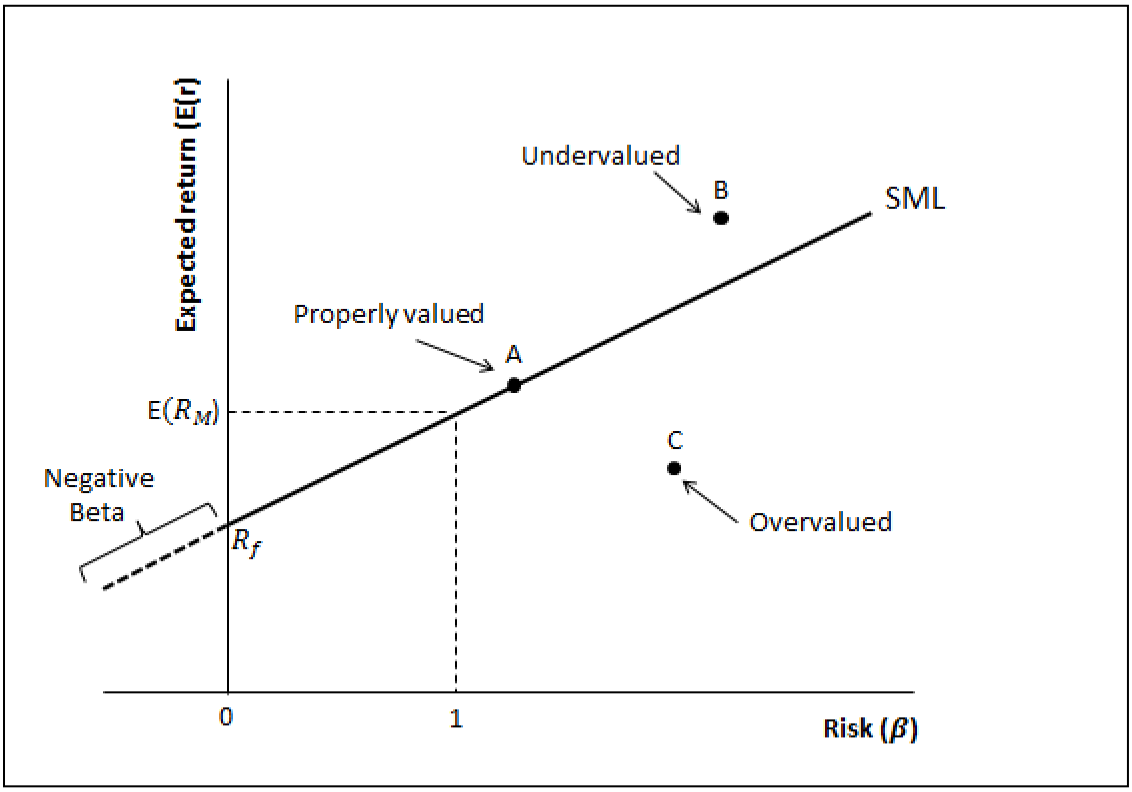
[36] The beta of the market portfolio is equal to a value of 1 (Bodie *et al*., 2010).

Therefore, the CAPM shows that an investor can expect a return equal to the risk-free rate, plus compensation for the number of risk units they accept (as measured by beta). The CAPM uses only the market risk premium ($E(r_m) - r_f$) and risk-free rate in estimating the expected return for a security by adjusting the market risk premium upwards or downwards according to the asset's sensitivity to market fluctuations (β_i) (Reilly & Brown, 2009:203). Similar to the single index model, this single risk factor greatly reduces the number of calculations required to estimate the expected returns for individual securities.

The security market line (SML) can also graphically illustrate the CAPM. Whereas the CML is depicted in the expected return – standard deviation space, the SML uses beta as the risk measure and plots the relationship between risk and return in the expected return – beta space. This implies that the SML only considers the systematic risk component of an investment's volatility (Reilly & Brown, 2009:206). Figure 3.7 shows the SML with the expected return of the market portfolio indicated along with its beta value (equal to 1).

Furthermore, Figure 3.7 can be used to show whether a security is over or undervalued by comparing the actual rate of return to the fair price of the security. A security that is fairly priced will fall on the SML, as the expected rate of return will be consistent with the level of systematic risk that it carries (Reilly & Brown, 2009:207). The difference between the fair price and the actual rates of return is called alpha. Reilly and Brown (2009:207) describe alpha as the abnormal rate of return on a security in excess of what would be predicted by the CAPM equilibrium model. Alpha values can be zero, negative or positive, depending on the difference in rates of return. An example of a fairly priced security with zero alpha can be denoted by security A. Security B is considered to be undervalued as it plots above the SML line. Security B, therefore, carries a positive alpha as it delivers a higher rate of return than predicted by the CAPM. Conversely, security C plots below the SML and holds a negative alpha. Therefore, security C's rate of return is lower than what is expected of a similar security with the given level of risk.

Figure 3.7: Security market line – Over and undervaluation of security



Source: Marx *et al*., (2008:39)

3.2.4.3 Criticism of the capital asset pricing model

The assumptions that form the foundation of the CAPM as set out previously, have attracted a great deal of criticism for its effectiveness in real world application (Megginson, 1996:15). Some assumptions have come under scrutiny for being too theoretical in nature and not being representative of the real world. The CAPM have been questioned in several areas including the ability to lend and borrow at a risk-free rate, the homogeneity of investor expectations of return and risk, the absence of taxes on profits, the absence of costs and availability of free market information for all investors, and the existence of a theoretical market portfolio (Bon & Sinusi, 2011).

Another one of the major limitations of the CAPM is the use of a single risk factor (beta) when determining the expected rate of return on a security (Paavola, 2006:15). Initial empirical tests conducted by Black *et al.* (1972) and Fama and MacBeth (1974) only partially supported the CAPM, which indicated that high-beta portfolios carried greater returns. Such high-beta exhibited lower rewards than predicted by the CAPM model. Further empirical studies by Roll (1977), and Fama and French (1992), brought the CAPM's practicality into question by examining the true existence of the market portfolio and predictive effectiveness of beta respectively. With the shortcoming of having only one systematic risk factor, the CAPM fails to give an accurate prediction of expected rates of return. This lead to the inclusion of multiple risk factors, which will be discussed under the APT model. Despite the criticisms directed at the CAPM, the method of this model and the assumptions underlying it still make it a powerful tool for analysis (Bon & Sinusi, 2011).

3.2.5 Arbitrage pricing theory

The criticisms of the CAPM, as discussed above, led to the development of the arbitrage pricing theory by Ross (1976; 1977). The APTs most significant difference against the CAPM is that the systematic risk is not assumed to be a function of only one risk source, but instead gets impacted by many variables (Bodie *et al*., 2010:213). The APT does not specify precisely which risk factors need to be considered, and the selection thereof is thus based on the issue at hand (Chamberlain, 1983:28). Various researchers have as such used a host of different risk factors.

Fama and French (1996, 2004) propose that the single risk factor model needed to be expanded further, by combining the size of the firm and book-to-market ratio with the existing market index, and then to use the three-factor model to determine expected returns. Others such as Chen *et al.* (1986) used multiple economic variables as the risk factors to capture the systematic risk, for example the change in industrial production, the change in expected inflation, unanticipated inflation, excess returns of long-term government bonds over short term government bonds, and excess returns of long-term corporate bonds over long-term government bonds. While the APT and CAPM differ in terms of the risk factor, the assumptions underlying both models are also significantly different.

The strict assumptions as stipulated by the CAPM are greatly relaxed, leaving only three main assumptions that govern the APT (Reilly & Brown, 2009:230):

- Capital markets are assumed to be perfectly competitive;

- Investors always prefer more wealth to less wealth with certainty.
- The process of generating asset returns can be expressed as a linear function of a set of *k* risk factors[37] and all unsystematic risk is diversified away.

The implications of the relaxed assumptions aid in the development of a model that is based on far less assumptions about the investor and the market in which they function. Unlike the CAPM, the APT does not assume the following (Bodie *et al*., 2010):

- that investors possess quadratic utility functions;
- that security returns are normally distributed; and
- the existence of a market portfolio that contains all risky assets and is mean-variance efficient.

The APT subsequently uses a set of *k* risk factors, and the sensitivity of a security to that risk factor (factor betas), to estimate the expected returns for a particular security. Equation 3.9 (Reilly & Brown, 2009:231) illustrates the APT model:

$$E(R_i) = \lambda_0 + \lambda_1 b_{i1} + \lambda_2 b_{i2} + \cdots + \lambda_k b_{ik} \tag{3.9}$$

where:

- $E(R_i)$ is the expected return on an asset;
- λ_0 is the expected return on an asset with zero systematic risk;
- λ_i is the risk premium related to the j^{th} common risk factor; and
- b_{ij} is the responsiveness of the price of the asset to the j^{th} common factor risk premium.

To summarise, both the APT and CAPM have shortcomings. Whereas the CAPM is limited to a single risk factor and makes numerous assumptions about the market, the APT relaxes some of the assumptions and allows the investor to customise the set of risk factors. Furthermore, while the CAPM is based on the assumption that an efficient market portfolio exists, the APT operates on an arbitrage-free assumption,

[37] The choice of which risk factors to include into the APT model is dependent upon the issue at hand.

which could even exclude the market portfolio completely (Goldenberg & Robin, 1991:194).

Diversification, and the benefits that it holds, was illustrated in Section 3.2. The Markowitz theory and the single-index model have illustrated the basic principle of diversification, and how the overall portfolio risk can be lower than the individual risks of each asset in the portfolio. Systematic risk has been shown to remain in a portfolio; however, the unsystematic risk within a portfolio can be eliminated through effective diversification. Given the systematic risk within a portfolio, the CAPM and APT models use either a single factor or a set of factors respectively to estimate the expected returns of securities.

After determining the performance of the complete portfolio, an investor can determine the growth experienced over a certain time period. The portfolio performance measures that can be used for this purpose will subsequently be discussed.

3.3 PORTFOLIO PERFORMANCE MEASURES

3.3.1 Introduction to performance measures

The process of measuring the performance of a fund or investment portfolio can be described under two broad categories (Marx *et al.*, 2008:260):

- Performance relative to risk. This element to the performance of a portfolio refers to the ability of the portfolio manager to create diversification in the portfolio by eliminating unsystematic risk. It is also referred to as performance measurement.
- Performance relative to time and other portfolios. This element to portfolio performance looks at the comparison to a selected benchmark portfolio and the over or under performance in relation to it due to market timing and security selection. This component of performance is also known as performance attribution analysis.

Due to the passive nature of ETFs, this study will only focus on the performance measurement component, as market timing and security selection are not at work with a single ETF portfolio. As such, a wide variety[38] of risk-adjusted performance measures will be considered in the performance comparison between various ETFs.

To compare the returns on an investment effectively, an investor needs to standardise the returns for the differences in risk contained within each investment (Mayo, 2000:249). Comparing portfolios solely on the historical performance does not produce a thorough evaluation of the portfolio, as risk is not controlled explicitly in such an analysis (Reilly & Brown, 2009:933). Risk-adjusted performance measures are subsequently used to ascertain if the risk averse investor has been sufficiently compensated for the amount of risk that he/she assumes in the portfolio.

Performance measures encompass a whole set of techniques, many of which originate from modern portfolio theory (Le Sourd, 2007). Recent developments in the measurement of performance take a step away from modern portfolio theory and consider cases beyond the mean-variance theory (Le Sourd, 2007). The existence of such a wide array of performance measures is testament that no single universally accepted risk adjusting performance measure could be found. The following section will discuss a host of risk-adjusted performance measures ranging from the more traditional and simple evaluation of portfolio returns to the more sophisticated approaches that evaluate risk in its various acceptations.

3.3.2 Sharpe performance ratio

Developed by Sharpe (1966), the Sharpe ratio measures the performance of a portfolio per unit of total risk. The relationship between the risk premium and the standard deviation of returns is taken into consideration to evaluate the risk-adjusted performance of the portfolio (Eling & Schuhmacher, 2007:2634). A higher Sharpe ratio is indicative of a higher return for a given level of risk. Conversely, a lower Sharpe ratio represents that less return was obtained for the risk inherent in the portfolio. Mathematically, the Sharpe ratio for a portfolio p, can be illustrated as in Equation 3.10 (Sharpe, 1966):

[38] These measures include; The Sharpe ratio, Treynor ratio, Jensen's alpha, Sortino ratio, Calmar ratio, Information ratio and Omega ratio.

$$S_p = \frac{E(R_p) - R_f}{\sigma(R_p)} \quad (3.10)$$

where:

- $E(R_p)$ denotes the expected return of the portfolio;
- R_f denotes the return on a risk-free asset; and
- $\sigma(R_p)$ denotes the standard deviation of the portfolio returns.

Total risk is accounted for in the Sharpe ratio through the use of the standard deviation of the returns. Therefore, the Sharpe ratio also sometimes is referred to as the reward-to-variability ratio (Le Sourd, 2007). The ratio shows the return an investor can expect for every 1 percent increase in the standard deviation (Bodie *et al*., 2010:600). When standard deviation is used as the risk measurement, the total risk inherent in the portfolio is considered. As such, the Sharpe ratio makes no distinction between systematic and unsystematic risk (Marx *et al*., 2008:262).

Positive and negative elements can be identified when analysing performance with the use of a total risk measurement. Advantageously, it is possible to evaluate the performance of less-diversified portfolios (Le Sourd, 2007). This allows the Sharpe ratio to evaluate a portfolio manager on the basis of performance and the ability to bring about diversification in the portfolio (Marx *et al*., 2008:262). However, from a negative perspective the Sharpe ratio does not distinguish between upside or downside risk. All variabilities in the return series are taken into consideration. As such, the upside volatility is penalised when using standard deviation as the risk measurement.

Other shortcomings of the Sharpe ratio can be found when considering the distribution of returns and asset allocation characteristics of the fund under review. The Sharpe ratio only provides appropriate performance rankings when the returns are distributed normally (Eling & Schuhmacher, 2007:2633). When returns are normally distributed a performance measure that relies on the mean return and standard deviation (*inter alia* the first two moments of the distribution), such as the Sharpe ratio, provides a meaningful analysis. Furthermore, the Sharpe ratio is most suitable when the portfolio represents the investor's total investment (Le Sourd, 2007). A ratio that takes into account the correlation between a market index and an investment fund would be more suitable should the investor divide the risky assets between both (Eling & Schuhmacher, 2007:2633). Such measures include the Treynor and Jensen's alpha measures.

3.3.3 Treynor performance ratio

The Treynor ratio was first introduced by Treynor (1965) and builds on the foundational work of the CAPM. In contrast to the Sharpe ratio, the Treynor ratio indicates the portfolio's return per unit of systematic risk (Treynor, 1965). The Treynor ratio measures the relationship between the risk premium of the investment fund and its systematic risk (Le Sourd, 2007). Treynor thus focused on the systematic risk in the portfolio, rather than the total risk, because all unsystematic (unique risk) should be diversified completely away in a fully diversified portfolio, leaving only the market risk (Marx *et al*., 2008:261). The Treynor ratio subsequently considers only the systematic risk (measured by beta) in adjusting the returns for its risk characteristics. The mathematical representation of this ratio can be stated as in Equation 3.11 (Treynor, 1965):

$$T_p = \frac{E(R_p) - R_f}{\beta_p} \tag{3.11}$$

where:

- $E(R_p)$ denotes the expected return of the portfolio;
- R_f denotes the return on a risk-free asset; and
- β_p denotes the beta of the portfolio or the systematic risk inherent in the portfolio.

Similar to the Sharpe ratio, a higher value for the Treynor ratio indicates that a higher rate of return was obtained for a given level of risk (Marx *et al*., 2008:261). As a result, the risk-averse investor will prefer a higher value for the Treynor ratio. Bacon (2004) states that although the Treynor ratio is a well-known performance measure, it is used less frequently in practice because it ignores unsystematic risk. Since specific risk is disregarded in the risk measurement, the diversification in the portfolio cannot be captured through the use of the Treynor ratio. An appropriate representation of performance of a portfolio is attained when the portfolio is well diversified and only systematic risk applies (Le Sourd, 2007).

One of the drawbacks of the Treynor ratio is its dependence on a market index used in the estimation of the investment fund's beta (Le Sourd, 2007). The effectiveness of the Treynor ratio is questioned through Roll's (1977) critique that theoretically the market index is unobservable. The Treynor ratio has received further criticism pertaining to its reaction to negative beta portfolios, which could falsely show a portfolio to have underperformed (Reilly & Brown, 2009:939). Comparing the actual returns to the expected returns as predicted by the CAPM provides a view of the SML that will better compare a negative beta portfolio to a positive beta portfolio.

In comparison to the Sharpe ratio, which is better suited towards a portfolio that represents the investor's total investment, the Treynor ratio is designed specifically to benefit from situations when the portfolio only comprises a part of the investor's wealth allocation towards the fund (Eling & Schuhmacher, 2007:2633). The Jensen alpha performance measure is also geared towards dealing with partial allocation of assets towards an individual fund.

3.3.4 Jensen's alpha performance measure

Jensen (1968) formulated the alpha performance measure based on the CAPM as introduced in Section 3.2.4. The Jensen's measurement of performance focuses on the excess actual return that a portfolio produced over the expected return, as predicted by the CAPM (Marx *et al*., 2008:262). The Jensen performance measure provides an alpha value to illustrate the ability of the portfolio manager to obtain above-expected returns. Mathematically, the Jensen performance ratio can be illustrated as follows (Marx *et al*., 2008:262):

$$\alpha = R_p - [R_f + \beta_p(R_m - R_f)] \tag{3.12}$$

where:

- R_p represents the actual historical returns of the portfolio;
- R_f denotes the return on a risk-free asset;
- β_p denotes the beta of the portfolio or the systematic risk inherent in the portfolio; and
- R_m represents the return of the market portfolio.

The term$[R_f + \beta_p(R_m - R_f)]$, measures the return estimated by the CAPM, and as such the Jensen alpha provides a way to quantify the additional return that a portfolio manager achieved in the portfolio (Le Sourd, 2007). The Jensen measure is based on the assumption that the rate of return of a portfolio will have a linear relationship with the risk-free rate and the risk-premium $(R_m - R_f)$ (Marx *et al*., 2008:262). The regression function used to obtain the linear relationship can be stated as follows (Le Sourd, 2007):

$$R_p - R_f = \alpha_p + \beta_p(R_m - R_f) + \varepsilon_p \quad (3.13)$$

where:

- R_p represents the actual historical returns of the portfolio;
- R_f denotes the return on a risk-free asset;
- β_p denotes the beta of the portfolio or the systematic risk inherent in the portfolio;
- R_m represents the return of the market portfolio; and
- ε_p represents the random error term of the regression analysis.

The random error term represents the differences between the actual returns and expected returns during the regression analysis. The alpha value highlights the manager's ability to derive above-average returns, and showcases his/her achievement in selecting undervalued assets for inclusion into the portfolio, with the goal of outperforming other managers. A portfolio that performed exactly as expected will hold an alpha value of zero, showing the portfolio manager's inability to outperform a simple buy-and-hold strategy (Reilly & Brown, 2009:941). Therefore, superior performance is indicated by positive alpha values, whereas negative alpha values are indicative of an inferior portfolio performance (Marx *et al*., 2008:263).

The Jensen measure is subjected to some criticisms. Reilly and Brown (2009:942) state that in order for the Jensen alpha to provide accurate results, the risk-free rate must be varied according to the different time periods under review. This stands in contrast to the Treynor and Sharpe ratios, which use the average returns for the total period. The Jensen alpha is limited in that it captures only the systematic risk within the portfolio due to the use of beta as the risk measure (Reilly & Brown, 2009:942). As with the Treynor ratio, the ability of the fund manager to bring about diversification is not measured by the Jensen alpha. Le Sourd (2007) furthermore state that due to the market timing actions of portfolio managers, the beta of the portfolio can vary and even become negative, which then does not reflect the real performance of the manager. Some variations on the Jensen performance measure have been proposed to be used with the APT to incorporate multiple risk factors instead of just beta (Reilly & Brown, 2009:942).

Whereas the Sharpe, Treynor and Jensen alpha performance measures were all based on the first two moments (mean and variance) of the distribution of returns, additional advanced ratios will be discussed subsequently. The Sortino-, Calmar-, Information- and Omega ratios all take into consideration the distribution characteristics of returns, and will be discussed in the following sections.

3.3.5 Sortino ratio

Through the analysis of MPT, the standard deviation and symmetrical normal distributions have formed the foundational assumptions for the study of investment returns. Post-modern theory, however, recognises that the upside risk (variability of positive returns) is greatly preferred to downside risk (variability of negative returns) (Bacon, 2004). Due to this progression in the analysis of performance measurement, alternative measures such as the Sortino ratio consider the skewness of distributions and do not require symmetry between upside and downside potential (Kanellakos, 2005:76).

Sortino and Van der Meer (1991) highlight the importance of considering downside risk and subsequently measuring risk on the basis of semi-standard deviation rather than standard deviation. The Sortino ratio, therefore, relies on downside volatility of returns rather than standard deviation. The Sortino ratio is perfectly suited to an asymmetrical return distribution as the use of semi-standard deviation prevents one from making assumptions about the shape of the return distributions (Amenc *et al*., 2004:21). The use of lower partial moments (LPMs)[39] ensures that the Sortino ratio measures the negative variations of return (Eling & Schuhmacher, 2004:2635).

The Sortino ratio measures the portfolio's average return in excess of a user defined minimum accepted level of return (τ), which is also known as the hurdle rate, divided by the downside risk (Reilly & Brown, 2009:934). Mathematically, the Sortino ratio can be represented as in Equation 3.14 (adapted from Eling & Schuhmacher, 2007):

$$Sortino\ ratio = \frac{R_p - \tau}{\sqrt[n]{LPM_{ni}(\tau)}} \tag{3.14}$$

where:

- R_p denotes the average return of the portfolio;
- τ represents the minimum acceptable return threshold which could be zero, the risk-free rate of return or the average return;
- LPM shows the use of lower partial moments; and
- *n* represents the order chosen to represent the degree of risk aversion by the investor.

The LPM for the Sortino ratio is set at an order of two to represent the risk-averse behavior of investors (Alam, 2013). The downside risk, as expressed by the lower partial moments in the Sortino ratio, can be detailed as in Equation 3.15 (Eling & Schuhmacher, 2007):

$$LPM_{ni}(\tau) = \frac{1}{T}\sum_{t=1}^{T} \max[\tau - r_{it}, 0]^2 \tag{3.15}$$

[39] Lower partial moments (LPMs) measure the risk by the negative deviations of actual returns away from a minimum threshold level. The minimum acceptable level of return could be the average return, zero or risk-free rate of retun (Eling & Schuhmacher, 2004:2635).

where:

- r_{it} = return of the individual asset *i* at time *t*;
- max = the mathematical maximum equation; and
- τ represents the minimum acceptable return threshold which could be zero, the risk-free rate of return or the average return.

The use of a downside risk measurement puts the Sortino ratio at an advantage to other measures utilising total risk measurements, which negatively accounts for upside volatility. The Sortino ratio, however, still holds its own set of drawbacks. The choice of the minimum accepted level of return (τ) is dependent on an estimation of a location point, which if under- or overestimated can provide incorrect measurements of the downside risk (Amenc *et al.*, 2004:21). Another measure that follows an alternative approach to the measurement of risk can be found in the form of the Calmar ratio.

3.3.6 Calmar ratio

Young (1991) developed the Calmar ratio, with the name for this ratio following from the name of his company - California Managed Accounts Reports. Similar to the Sortino ratio, the Calmar ratio uses an alternative measure of risk rather than the standard deviation. The Calmar ratio recognises the risk measurement needs to account for extreme risk events when returns are not distributed normally. The Calmar ratio uses the maximum drawdown (maximum loss) to capture the risk contained within a portfolio (Eling & Schuhmacher, 2007). The maximum drawdown reflects the investor’s level of risk (Young, 1991). The maximum drawdown is represented by the biggest loss or lowest return recorded in comparison with the highest level reached by the fund during the period (Amenc *et al.*, 2004:23). Mathematically, Equation 3.15 can represent the Calmar ratio (Eling & Schuhmacher, 2007):

$$Calmar\ ratio = \frac{R_p - R_f}{-MD_i} \qquad (3.15)$$

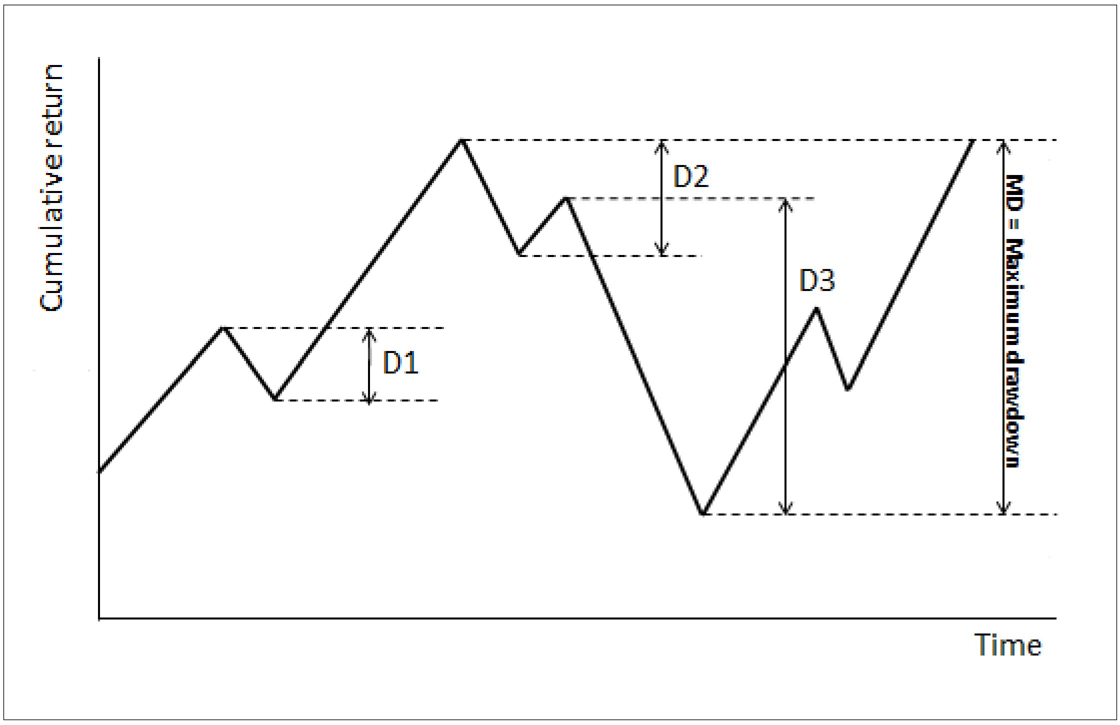
where:

- R_p = the return of the portfolio;

- R_f = the risk-free rate of return; and
- $-MD_i$ = the maximum drawdown experienced during the period under review.

The term $R_p - R_f$ represents the return that the portfolio achieved in excess of the risk-free rate of return. Dividing the excess return by the maximum drawdown provides a comparison between the opportunities for gains, to the possibilities for losses. The use of the maximum drawdown as the risk measure ensures that a comparison is drawn between funds based upon their largest possible loss experienced over the time period under review. This ensures that extreme risk events are captured by the calculation of the Calmar ratio. The maximum drawdown can be represented graphically as the vertical distance between the peak and valley of the cumulative returns, as illustrated in Figure 3.8.

Figure 3.8: Maximum drawdown



Source: Bacon (2004)

An investor would sustain such a maximum drawdown when buying into the fund at its highest level and selling at the lowest level (Bacon, 2004). For this reason the original Calmar ratio did not include the risk-free rate in the calculation, as futures and commodity funds aimed to instead use the Calmar ratio to measure their ability to buy at the lowest and sell at the highest possible levels.

The Calmar ratio provides the investor with a tool to compare risk beyond the traditional total risk measurement. The use of the Calmar ratio in the measurement of the risk-adjusted performance for ETFs would be of particular importance to capture the ability of the ETF to withstand periods of extreme market volatility. Another useful risk-adjusted performance measure suitable to ETFs can be found in the form of the Information ratio.

3.3.7 Information ratio

The information ratio holds some of the characteristics of the Sharpe ratio, but instead substitutes the use of absolute returns with excess returns. In addition, the information ratio does not use absolute risk, but instead makes use of the tracking error, which is a form of relative risk (Bacon, 2004:4). To obtain the information ratio, the portfolio's average return in excess of that of a benchmark portfolio is divided by the standard deviation of the excess return (Reilly & Brown, 2009:942). Expressed in mathematical form, the information ratio can be stated as in Equation 3.16 (Reilly & Brown, 2009:942):

$$IR = \frac{\bar{R}_j - \bar{R}_b}{\sigma_{ER}} = \frac{\overline{ER}_j}{\sigma_{ER}} \qquad (3.16)$$

where:

- $\overline{ER}_j$ represents the excess return that the portfolio *j* achieved beyond that of the benchmark portfolio. The excess return shows the managers' ability to generate return higher than that of the benchmark; and
- σ_{ER}, also known as the tracking error, shows the amount of unsystematic risk incurred to reach the excess returns. By taking the standard deviation of the excess return instead of the absolute returns, a relative risk measure is created.

The information ratio can be regarded as a benefit-to-cost ratio, as it gauges the ability of the portfolio manager to use information to his/her availability to derive excess returns and overcome the unsystematic risk within the portfolio. The use of the tracking error in the calculation of the information ratio holds significant benefit for its application in evaluating ETF performance. Traditional ETFs seek to deliver the return of a predetermined benchmark index. As such, by evaluating the deviations of ETF returns away from the benchmark index provides the investor with a view of its effectiveness to track the benchmark.

Higher information ratios are indicative of a better performing portfolio manager, as this illustrates the skill of the manager to obtain alpha in the portfolio, while not consistently deviating from the benchmark. Grinold and Kahn (cited by Reilly & Brown, 2009:942) state that the level of the information ratio will range from 0,5 for a well performing manager to 1,0 for an excellent portfolio performance. Le Sourd (2007:29) points out that an exception arises when portfolios exhibit negative excess return. Under this condition, the higher information ratio may not highlight the better performing portfolio. Funds with a lower negative excess return and smaller tracking error are preferable to those with larger negative excess returns and high tracking errors (Le Sourd, 2007:29). To overcome this problem with the information ratio Israelsen (2005) proposed to add an exponent into the denominator of the information ratio in order to adjust for negative excess returns. The modified version of the information ratio can be illustrated as in Equation 3.17 (Israelsen, 2005):

$$IR_{modified} = \frac{\bar{R}_j - \bar{R}_b}{\sigma(ER)^{(ER)/abs(ER)}} \tag{3.17}$$

where:

- $\bar{R}_j - \bar{R}_b = ER$ = the excess return that the portfolio j achieved beyond that of the benchmark portfolio; and
- σ_{ER} indicates the tracking error.
- abs represents the absolute number mathematical operator.

The adjustment made in the modified version of the information ratio allows portfolios containing negative or positive excess returns to be ranked consistently (Le Sourd, 2007:30). Care needs to be taken with the modified information, as the absolute value of the ratio holds no significance, but instead provides only a means to rank funds.

The performance ratios as described thus far have, to some extent, either simplified the distribution characteristics of the returns by considering only the mean and variance (as with the Sharpe-, Treynor- and Jensen's alpha), or only included a slightly more advanced risk measurement in the form of downside risk (Sortino ratio), maximum drawdown (Calmar ratio), or the tracking error (Information ratio). The higher order moments of the distribution of the returns (inter alia skewness and kurtosis) are not accounted for by any of the aforementioned ratios. In order to allow for the analysis of non-normally distributed returns, the Omega ratio was developed by Keating and Shadwick (2002), which takes into consideration the higher moments of distribution.

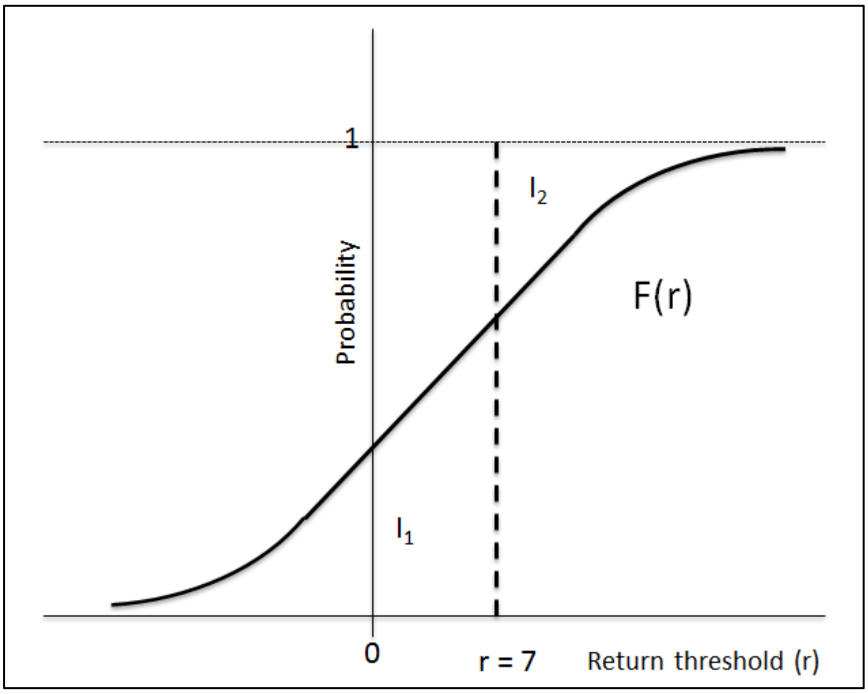
3.3.8 Omega ratio

The Omega ratio was developed to allow the investor to consider all the information in the return series, and as such rank portfolios unequivocally (Keating & Shadwick, 2002). This is achieved with a measurement that incorporates all the moments of the distribution into the calculation of the ratio (Bacmann & Scholtz, 2003). Whereas the mean and standard deviation represent the first two moments of the return distribution, all other moments are labeled as higher order moments. Two of the most significant higher order moments that need to be considered in the analysis of return distributions can be found in the form of skewness and kurtosis.

Skewness describes how asymmetric the return distribution is (Bacmann & Scholtz, 2003). The likelihood for returns to fall within the right tail of the distribution is captured by this measurement, and helps explain the shift away from the mean. Positively skewed distributions are preferred to negatively skewed distributions (Bergh & Van Rensburg, 2008:104, Kraus & Litzenberger, 1976). Kurtosis, on the other hand, explains the occurrence of extreme events (Bacmann & Scholtz, 2003) through a measure of the relative sharpness or flatness of the tails of a distribution (Bergh & Van Rensburg, 2008:104). The higher the kurtosis, the more likely extreme events are. The Omega ratio provides an intuitive way to incorporate both of these higher order moments, distancing it from the assumptions and complexities from which other ratios suffer (Keating & Shadwick, 2002).

Omega is defined as the ratio between the expected gains and the expected losses, with respect to a return threshold (Kanellakos, 2005:83). Obtaining the information ratio involves dividing returns into losses and gains above and below a threshold and then considering the probability weighted ratio of returns above and below that separation (Keating & Shadwick, 2002). Partitioning of returns is performed through the use of the cumulative distribution function of the returns. Figure 3.9 illustrates how the cumulative distribution function is used in this regard.

Figure 3.9: Cumulative distribution function for Omega ratio



Source: Keating and Shadwick (2002)

For the example shown above, the threshold level has been set at 7 percent. Using the cumulative distribution F for the asset, the area above F and to the right of seven, $I_{2,}$ (gains relative to the threshold) can be divided by the area below and to the left of seven, $I_{1,}$ (losses relative to the threshold) to obtain the Omega ratio. By calculating the probability-adjusted ratio of gains to losses for various threshold levels, the Omega function can be obtained (Bacmann & Scholtz, 2003). Calculating the Omega ratio at all the values from the lowest observed return (a) to the highest observed return (b), and calculating the integral from *a* to *b*, will provide the Omega function. The Omega function ($\Omega[r]$) provides a means to acquire the probability-weighted ratio of gains to losses for any level of return *r*, relative to that return threshold level (Keating & Shadwick, 2002). The Omega function has the unique characteristic that it takes on a value of one when *r* is the mean return. The mathematical definition of Omega can be stated as in Equation 3.18 (Keating & Shadwick, 2002):

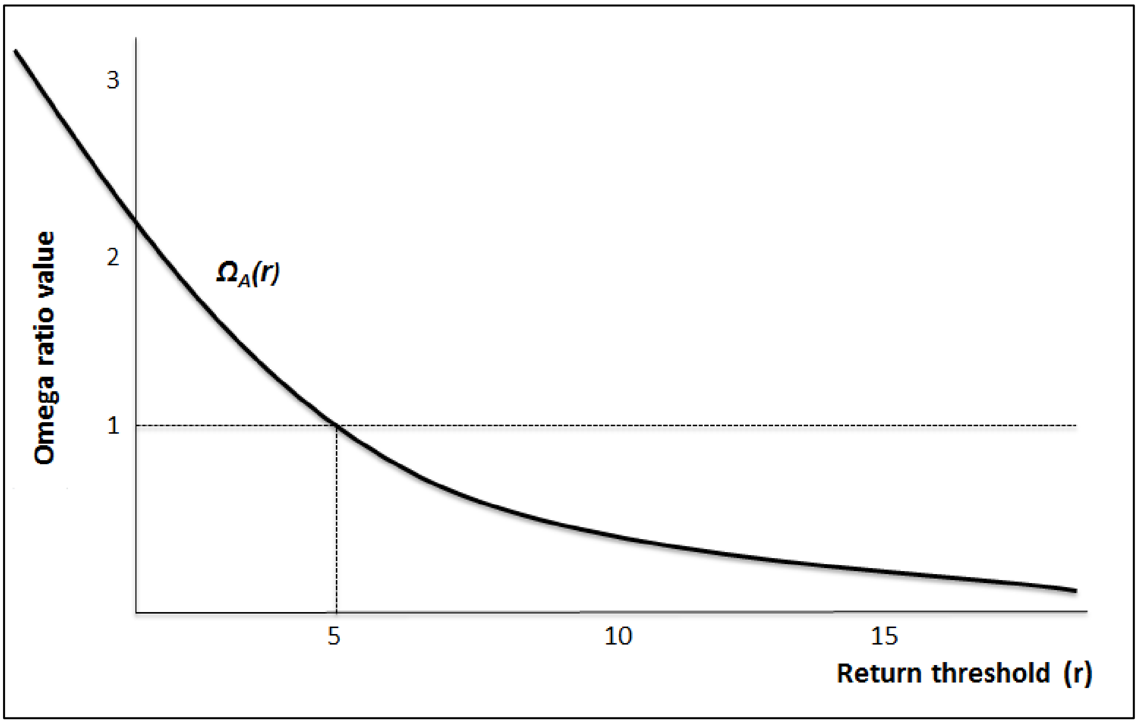
$$\Omega(r) = \frac{\int_r^b (1-F(x))dx}{\int_a^r F(x)dx} \quad (3.18)$$

where:

- $F(x)$ = the cumulative distribution function of the return series;
- *a* = the lowest observed return; and
- *b* = the highest observed return in the return series.

Graphically the Omega function can be shown as in Figure 3.10.

Figure 3.10: Omega function



Source: Keating and Shadwick (2002)

The ability to customise the Omega by setting the specific return threshold (*r*) to any desirable level makes it modifiable to the individual risk preferences of an investor (Kanellakos, 2005:83). However, this flexibility with Omega can also be a significant disadvantage with the use of the Omega, as each investor will set different threshold values. Fixed-point comparisons performed by an investment professional will subsequently be impractical, as using such a specific risk threshold only represents a small portion of the investor base (Kanellakos, 2005:88). A further disadvantage of Omega is its sensitivity to the sample size. Amenc *et al*. (2004) reports that to provide meaningful results, at least 40-50 data observations are required. Favre-Bull and Pache (2003) found that sample sizes below 100 observations showed significant variations, but sample sizes above 200 held no meaningful improvement to Omega calculations.

Despite some shortcomings found in the Omega ratio, numerous advantages make it a very suitable ratio for which to analyse the performance of ETFs. Omega omits none of the information in the distribution, which makes it equivalent to the return series itself (Keating & Shadwick, 2002). By incorporating the higher order moments in this way, the Omega can measure the combined effect of all the moments, rather than the individual impact of any one of the moments of the distribution. Ranking of portfolios via the use of the Omega is always possible, unlike as with the Sharpe ratio where ranking of negative ratios become almost impossible (Bacmann & Scholtz, 2003). Keating and Shadwick (2002:5) makes the application benefit of Omega clear for alternative investments, leveraged investments or derivatives by stating that “Omega, when applied to benchmark relative portfolios, provides a framework in which truly meaningful tracking error analysis can be carried out”. As mentioned with the Information ratio, the tracking error in traditional ETFs forms a vital part of the performance analysis of ETFs.

Therefore, the Omega ratio will form the basis of this study and provides the ideal analysis of non-normally distributed return. The risk-adjusted performance ratios, as highlighted in Section 3.3 of this chapter, have provided the theoretical foundation on which the various indexation methods used with ETF portfolios will be evaluated. Chapter 4 of this study highlights the use of Omega as the performance ratio of choice, and its comparison to other ratios. Furthermore, in order to make a clear comparison between the ETFs on the basis of fluctuations in their returns, the concept of volatility needs to be explored in greater depth.

3.4 VOLATILITY

3.4.1 Introduction to volatility

Volatility can be defined in the most general terms as change or variability of an alterable entity (Daly, 2008:2378). The greater the fluctuation that the variable exhibits over a period of time, the more volatile it is classified to be. Applying this concept to finance sees volatility referring to the variability of returns on an asset over a specific period (Wuite, 2009:401). Volatility is often associated with unpredictability, uncertainty or risk (Daly, 2008:2378). Due to the trade-off between risk and expected return, as highlighted in Section 3.1, a comprehensive review of volatility as a source of risk is warranted.

The importance of volatility within the financial industry cannot be overstated. The impact of volatility on the markets and investor behavior can be disseminated into numerous forms. Daly (2008:2378) states six reasons why clearly understanding volatility is vital:

- Fundamental economic analysis fails to explain the short-term price fluctuations that cause asset prices to move sharply on an intraday basis.
- Volatility is an important factor to consider in determining the probability of bankruptcy for individual firms.
- Volatility drives the bid-ask spread for asset prices. The higher the volatility, the wider the spreads between buy and sell prices for assets.
- The prices to implement portfolio-hedging techniques are impacted by volatility. Increased volatility demands higher rates to protect the value of the portfolio due to increased uncertainty.
- If investors are assumed to be risk averse, an increase in volatility could see a reduction in the number of participants in the market.
- Increased volatility pushes regulators to enforce greater liquid capital holdings upon market participants.

Volatility within financial markets need not only be considered as a negative aspect to the market participant as volatility creates the opportunity to take advantage of market inefficiencies when short-term price deviations of asset prices from its true value arise. The primary source of changes in market prices is the arrival of news about an asset's fundamental value (Daly, 2008:2379). In addition to this primary source, various other key driving factors of volatility can be identified.

3.4.2 Driving forces of market volatility

Daly (2008:2379) separates the factors that influence volatility into long-term and short-term causes. Corporate leverage ratios (*inter alia* the debt to equity ratio) are regarded as a major determinant to the level of volatility in the long-run (Schwert, 1989). The long-term nature of this phenomenon is associated with the response to financial risk[40] that sees share prices move down as a result of the higher expectations about return to equity. The fundamental characteristics of the economy also influence volatility over the long-term. Market innovation or structural changes in the economy, such as deregulation, can lead to financial bubbles, which can create volatility when these bubbles do eventually burst (IMF, 2003:74). Historically, the Great Depression of the 1930s, the OPEC oil crisis of 1974, the stock market crash of October 1987, and recently the financial credit crisis of 2007–2008 have all produced major volatility peaks in the market (Daly, 2008:2379).

In the short-term, volatility is driven by factors such as trading volume, contrarian trading[41], and the introduction of futures and options (Daly, 2008:2379). Most of the short-term volatility induced by trading can be seen as noise and holds no long-term impact on asset prices. The introduction of leveraged products, such as synthetic ETFs that use swaps and other derivative products to achieve the required return, have also been a cause of concern for regulators who believe that their existence is adding to market volatility (Foster, 2012). The volatility characteristics of traditional ETFs will be measured to that of leveraged ETFs during the analysis in Chapter 4, to see if such concerns are valid.

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[40] An increased debt-to-equity ratio.

[41] Contrarians go against the market signals by buying in negative markets and selling in positive markets (Daly, 2008:2379).

In addition to the breakdown between short- and long-term sources of volatility, Nelson (1996) provides a list of additional factors to consider with regard to volatility:

- Positive serial correlation of volatility. This refers to the momentum effects that volatility displays, where positive/negative movements in the market get followed up by further positive/negative movements.
- Trading and nontrading days contribute differently to market volatility. This refers to the findings of Fama (1965) and French and Roll (1986) that Mondays exhibit much greater volatility than other weekdays due to the arrival of excessive amounts of information to which the market has not yet reacted.
- High nominal interest rates have also been shown to be associated with high market volatility.

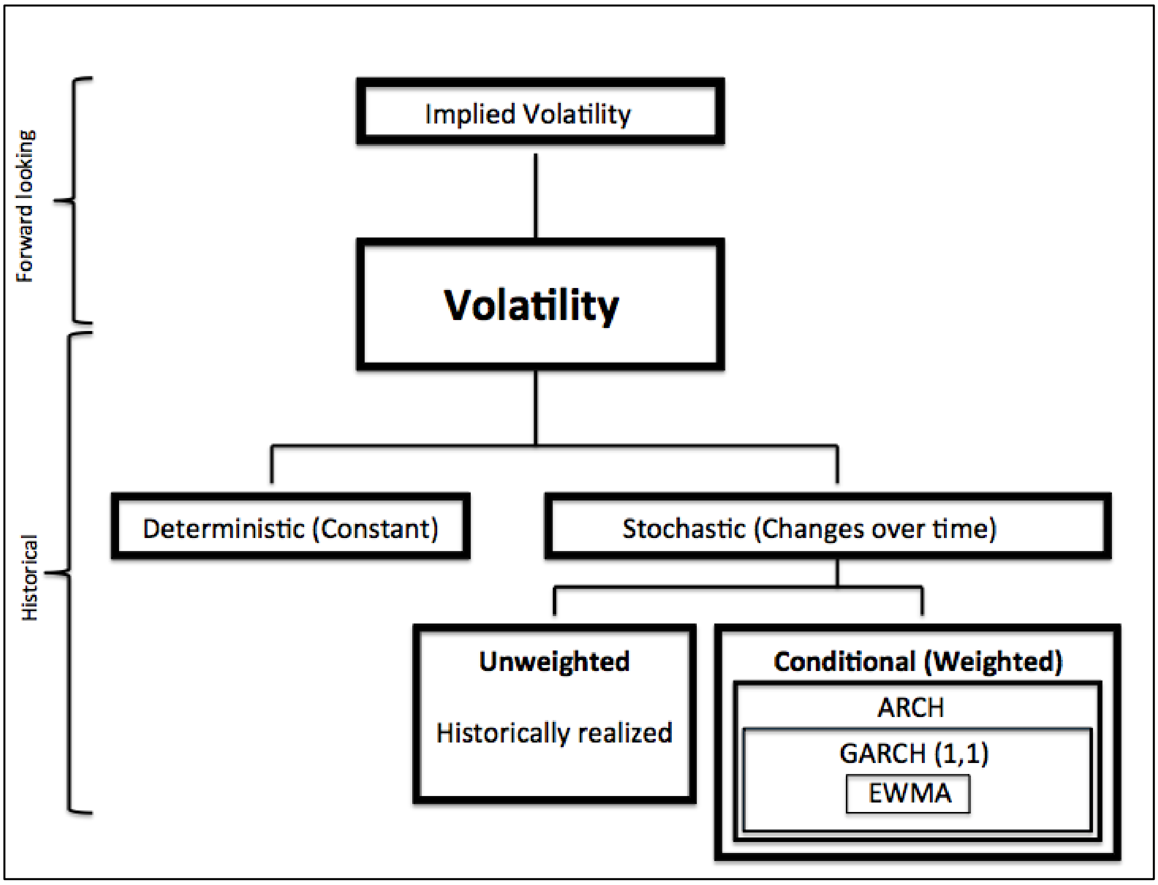
Quantification of volatility forms the next step in understanding this characteristic of a financial market. The measurement of volatility has evolved tremendously to incorporate much more than just the historical fluctuations of prices away from a mean value. Improved volatility measurements incorporate the stochastic nature of data into the calculations by placing additional emphasis on recent observations. The next section describes the various approaches to volatility measurement.

3.4.3 Volatility measurement

An overview of the approaches towards volatility measurement is reflected in Figure 3.11. The distinction between implied volatility and historical volatility is regarded as the separation between volatility that is forward looking and volatility that is based on realised observations of returns. Implied volatility refers to the standard deviation of returns that has to be provided as an input for the Black-Scholes option pricing formula in order for it to match the current market price of the stock option (Bodie *et al*., 2011:537). Implied volatility provides a forward-looking view of what the market implicitly perceives the volatility to be, by setting the market price at current levels. However, this study will only be concerned with historical risk-adjusted performance measures of ETFs and as such, the volatility forecasting as stated here will not be utilised.

The second sub-set of volatility measures deal with historical observations of returns. Within this category, a further distinction can be made between deterministic and stochastic techniques used with the measurement of volatility. Daly (2008:2377) refers to these sub-categories as time invariant and time variant measures. Whereas time invariant measures are based on the assumption that volatility is constant over time (deterministic), the time variant measures use the assumption that volatility does change over a period of time (Daly, 2008:2377). Non-constant variance measurements can also be described as heteroscedastic, whereas constant variance is also referred to as homoscedastic. ETFs trade on stock exchanges and as such are exposed to the same volatility with which regular stocks are faced. The deterministic approach to volatility, therefore, does not apply to ETFs.

Figure 3.11: Approaches to volatility



Source: Harper (2008)

The stochastic approach to determine volatility includes a further breakdown between those measures dealing with an unweighted approach towards volatility and those that place conditionality requirements to the way in which return observations are handled. The standard deviation of returns, the autoregressive conditional heteroscedasticity (ARCH) family of models, and the exponentially weighted moving average (EWMA) will each be discussed separately before concluding volatility measurements with a view of indices that are used to exhibit the volatility within such markets.

3.4.3.1 Standard deviation

The foundational definition of volatility measurement can be obtained from the square root of the variance of returns (Sinclair, 2008:16). This square root calculation, known as the standard deviation, represents the most basic method in which volatility can be measured (Poon, 2005:1). Standard deviation provides a statistic that measures the dispersion of returns away from the mean/expected value (Daly, 2008:2380). Such movement away from the expected value is what infuses the notion of risk into the metric[42]. Statistically, the standard deviation can be represented as in Equation 3.19 (Daly, 2008:2380):

$$\sigma = \sqrt{\frac{1}{T-1}\sum_{t=1}^{T}(R_t - \bar{R})^2} \qquad (3.19)$$

where:

- R_t = the logarithmic returns;
- $\bar{R}$ = the average return of the sample; and
- T = the sample size.

Standard deviation as a measurement of volatility can be categorised within the unweighted section of Figure 3.11. Each observation of the returns (R_t) carries the same weighting as all other observations in the sample. By measuring volatility in this manner, both upside and downside fluctuations of returns are treated equally. Assigning the same weight to the most recent price variations as to observations made in the distant past, limits the standard deviation measurement to be no more

[42] Larger deviations away from the mean and more frequent deviations away from the mean, results in more uncertainty about the future direction of prices. Increased uncertainty of future price movements is a source of risk.

than a simple moving average over the time period under review (Harper, 2008). A large standard deviation indicates the possibility of large positive or negative price movements (Daly, 2008:2380).

Although the standard deviation provides a clear view of total risk, its measurement of dispersion fails to account for the shape of the distribution of such returns (Poon, 2005:2). Despite its shortcomings, the standard deviation of returns has been shown to be a widely used measurement of risk, as incorporated into the Sharpe ratio.

3.4.3.2 Autoregressive conditional heteroscedasticity (ARCH) models

The standard deviation measurement of volatility as described in Section 3.4.3.1 provides a starting point to estimate the volatility of a return series. However, when such return series are not normally distributed and exhibit non-constant variance or heteroscedasticity, alternative methods should be applied (Nyamongo & Misati, 2010:188). The autoregressive conditional heteroskedasticity (ARCH) models are designed specifically to model and forecast variance (Agung, 2009:419). The ARCH models accomplish such a volatility forecast by utilising past information to obtain a future estimation of the variance, also known as the conditional variance (Nyamongo & Misati, 2010:188). It is furthermore possible to determine whether recent information is more important than old information, and how fast information decays (Daly, 2008:2381). In contrast to historical volatility models, ARCH models do not make use of past standard deviations, but express the conditional variance of asset returns through maximum probability approximation (Poon, 2005:37).

Subsequently, numerous extensions to the original ARCH have been developed. Some of the models forming part of the ARCH volatility simulations include the GARCH (generalised ARCH), EGARCH (exponential GARCH), TGARCH (general/threshold ARCH), CGARCH (component ARCH) and MARCH (modified ARCH) (Nyamongo & Misati, 2010:188). The focus for this study will center on the ARCH models in general.

The growth of the ARCH models stems from its versatility in capturing important stylised facts about many economic and financial data (Daly, 2008:2381). The shape of the unconditional distributions, the change of variance over time and consistency of volatility persistence are some of the characteristics that the ARCH models incorporate into the predictions about future volatility (Daly, 2008:2381). The interest in the ARCH model is generated from the evidence that time series realisations of returns often exhibit time-dependent volatility, and the ARCH is based on the specification of conditional densities at successive periods of time (JP Morgan/Reuters, 1996:88). ARCH models have been used to capture the volatility spillover effects when considering how information flows across countries, markets and assets (Daly, 2008:2381). The usefulness of ARCH models extends to asset pricing models such as the CAPM and APT, where it captures the time-varying systematic risk used within such models (Daly, 2008:2381). The basic foundation that a conditional volatility model such as the ARCH model stands on is the predictability component of volatility, which is key to determining the risk premium, as found in models such as the CAPM and APT (Pagan & Schwert, 1990:267).

In order to present an ARCH model, two distinct equations or specifications need to be highlighted. Firstly, the conditional mean, and second, the conditional variance, need to be considered (Agung, 2009:419). ARCH models make the conditional variance prediction error a function of time, system parameters, exogenous and lagged exogenous variables, and past prediction errors (Nelson, 1991:347). The conditional mean, on the other hand, is obtained by utilising information from the previous period and can generally be seen as a random variable (Daly, 2008:2382).

According to Pagan and Schwert (1990) a time series y_t that can be modeled by $y_t = x_t'\beta + \mu_t$ where y_t is the conditional mean of the time series and x_t is the set of variables that affects the conditional mean, with μ_t being an error term with a distribution such that the mean is zero and conditional variance $\epsilon(\mu_t^2|F_t) = \sigma_t^2$. The ARCH(q) model developed by Engle (1982) follows from the time series description and can be stated as follow:

$$\sigma_t^2 = \sigma^2 + \sum_{k=1}^{q} \alpha_k \mu_{t-k}^2 \tag{3.20}$$

where:

- μ_{t-k}^2 represents the ARCH term which indicates the lagged squared residual from the previous periods (volatility from previous periods); and
- α_k is the reaction parameter or GARCH error coefficient, where larger values indicate a more intense reaction to market movements.

Bollerslev (1986) extended upon the original ARCH model by incorporating lagged conditional variance terms as autoregressive terms, which became known as the generalised ARCH model (GARCH) (Asteriou & Hall, 2007:260). Pagan and Schwert (1990) set the mathematical equation for GARCH (*p*,*q*) as in Equation 3.21:

$$\sigma_t^2 = \sigma^2 + \sum_{j=1}^{p} \beta_j \sigma_{t-j}^2 + \sum_{k=1}^{q} \alpha_k \mu_{t-k}^2 \qquad (3.21)$$

where:

- μ_{t-k}^2 represents the ARCH term, which indicates the lagged squared residual from the previous periods (volatility from previous periods);
- σ_{t-j}^2 represents the GARCH term and indicates the forecasted variance from previous periods;
- α_k is the reaction parameter or GARCH error coefficient, where larger values indicate a more intense reaction to market movements; and
- β_j is the persistence parameter or GARCH lag coefficient, where larger values are indicative of very persistent volatility (Nyamongo & Misati, 2010:188).

Hence, the tendency of volatility to revert to a long run average, as well as the persistence of the variance with the last observed data, is incorporated into the GARCH model. Nyamongo & Misati (2010:188) states that a simple GARCH model provides significant results in forecasting the *j*-period[43] future volatility. However, the model is not free of its shortcomings. In the first instance, the future variances as predicted by the standard GARCH model are linear in current and past variances, allowing for the model to only react to additional market news in a symmetrical manner (Nyamongo & Misati, 2010:188). Furthermore, the application of the GARCH

[43] With the volatility known for period *i*, the GARCH model provides the ability to predict volatility for the subsequent period, *inter alia* period j.

to asset pricing models is reduced greatly due to the following limitations stated by Nelson (1991:347):

- GARCH models impose parameter constraints that may limit the dynamics of the conditional variance process, which is often infringed upon by projected coefficients.
- Evidence of negative correlation between future returns and current returns volatility has been found, standing in contrast with the basic assumptions of the GARCH model.
- Interpretation of the persistence of shocks to the conditional variance is difficult to translate.

The exponential GARCH (EGARCH) model attempts to overcome the shortcomings of the GARCH model by considering the impact of shocks on volatility in an asymmetric fashion (Nelson, 1991:350). Restrictions to the parameters avoiding negative variances are also reduced with the EGARCH as compared to the ARCH and GARCH models (Pagan & Schwert, 1990:268). Other extensions and variations to the ARCH models fall outside the scope of this study and will not be included in the analysis of volatility approaches. A special case of the GARCH can, however, be found in the exponentially weighted moving average and will be discussed in the next section.

3.4.3.3 Exponentially weighted moving average (EWMA)

The exponentially weighted moving average (EWMA) is a statistic used for measuring the average volatility by assigning less and less weight to past data points the further it stretches into the past (Čisar & Čisar, 2011:73). As such, the EWMA and GARCH volatility models share the similarity that they improve on the simple moving average volatility measurement by assigning a greater weight to more recent return observations. The EWMA achieves this decreasing allocation of weight by assigning a decay factor, λ, to the most recent observation, and then exponentially declining the weight for each subsequent past return observation (JP Morgan/Reuters, 1996).

The parameter λ, also known as the smoothing or persistence parameter, determines the rate at which older data enter into the calculation of the EWMA (Čisar & Čisar, 2011:73). Exponential smoothing places higher weight on the most recent observations and mimics better the most recent changes (Bessis, 2006:375). Consistent with probability weightings the λ parameter can take a value between zero and one (Gil, 2012). Higher values (λ=1) are indicative of more weight being allocated towards the most recent data, while smaller values of close to zero place greater weight on past data (Čisar & Čisar, 2011:73). The decay factor forms part of the EWMA as presented in Equation 3.22 (Harper, 2008):

$$\sigma_n^2 = (1-\lambda)\mu_{n-1}^2 + \lambda\sigma_{n-1}^2 \tag{3.22}$$

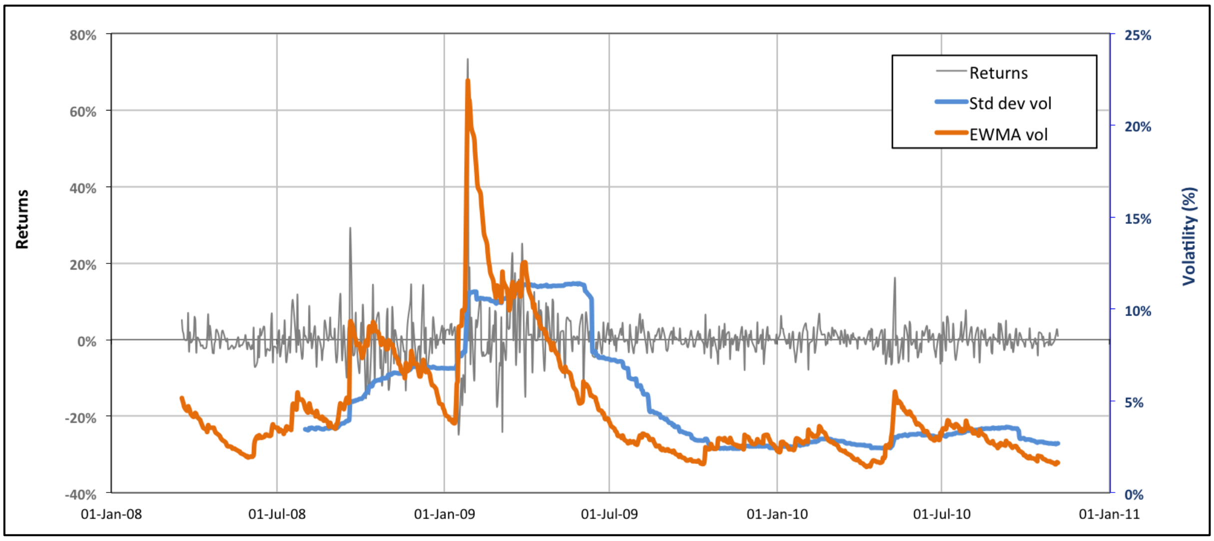
where:

- λ represents the exponential smoothing factor, lambda;
- μ_{n-1}^2 = the squared returns from the previous observation period; and
- σ_{n-1}^2 = the squared variance from the previous period.

Equation 3.22 highlights how both the squared lagged returns (μ_{n-1}^2) as well as the squared lagged variance (σ_{n-1}^2) form part of the calculation of the variance for the next observation period (σ_n^2). The EWMA can be seen as a special case of the GARCH when considering that the difference between both models lies in the assimilation of mean-reversion into the GARCH model, whereas this is not the case with the EWMA (Harper, 2008). The omission of mean-reversion from the EWMA, however, does not significantly alter its ability to estimate out-of-sample forecasts, as compared to results found by the GARCH model, except in the case of very short time horisons (West & Cho, 1995). JP Morgan/Reuters (1996) further reiterate this close similarity between the models through their research which indicated that the exponential model gives very similar results to the integrated GARCH (IGARCH) model.

When compared to the standard historical volatility measurement, the exponential volatility measurement has the advantage that the effect of a shock to the volatility fades much more gradually using the EWMA (Gil, 2012:5). Exponentially weighted volatility will react sharply to the initial shock on volatility and then gradually decline to lower levels as less weight is allocated towards older return observations (Gil, 2012:5). The effect of volatility shocks on both the standard deviation and EMWA measurements of volatility can be illustrated as in Figure 3.12, which shows how increased volatility from the financial crisis of 2008–2009 was absorbed into each of the metrics. The EWMA is shown to exhibit a much sharper reaction to the outset of the crisis, however, a much faster phase-out of the initial shock exists with the EWMA as the effect of the volatility is allocated an exponentially smaller weighting over time.

Figure 3.12: EWMA vs standard deviation



Source: Complied by author

The different reactions to volatility shocks as illustrated in Figure 3.12 are due to the integration of the persistence factor into the EWMA. Finding the optimal λ parameter involves selecting the decay factor that produces the best forecasts (JP Morgan/Reuters, 1996). The optimal decay factor can be considered as the λ* value that yields the smallest root-mean-squared-prediction-error (RMSE) over various values of λ (JP Morgan/Reuters, 1996). The choice of the RMSE as a forecast error measurement rests on the more severe penalisation of large errors. The RMSE applied to a daily forecast of variance can be obtained as follow (J.P. Morgan/Reuters, 1996):

$$RMSE_v = \sqrt{\frac{1}{T}\sum_{t=1}^{T}\left(r_{t+1}^2 - \hat{\sigma}_{t+1|t}^2(\lambda)\right)^2} \tag{3.23}$$

where:

- $r_{t+1}^2 - \hat{\sigma}_{t+1|t}^2$ represents the variance forecast error ($\varepsilon_{t+1|t}$); and
- the optimal parameter λ* is set such that average squared errors are minimised $\therefore \epsilon_t[r_{t+1}^2] - \sigma_{t+1|t}^2 = \epsilon\left[\varepsilon_{t+1|t}^2\right] = 0$ (JP Morgan/Reuters, 1996).

When dealing with multiple time series in the data set, one optimal decay factor needs to be acquired. With $\hat{\lambda}_i$ denoting the i^{th} optimal decay factor; N(*i* = 1,2,…N) showing the number of time series in the data set and τ_i being the minimum i^{th} RMSE associated with $\hat{\lambda}_i$, the optimal decay factor can be obtained as follows (JP Morgan/Reuters, 1996):

The first step involves obtaining Π; calculated as the sum of N minimal RMSE's (τ_i):

$$\Pi = \sum_{i=1}^{N}\tau_i \tag{3.24}$$

Next, the relative error measure is defined as:

$$\theta_i = \frac{\tau_i}{\Pi} \tag{3.25}$$

The weight associated with each τ_i is calculated as:

$$\Phi_i = \frac{\theta_i^{-1}}{\sum_{i=1}^{N}\theta_i^{-1}} \tag{3.26}$$

Weightings for all Φ_i values should summate to one. Finally, the optimal decay factor ($\tilde{\lambda}$) for all time series in the data set can be calculated as the weighted average of the individual optimal decay factors where the weights are a measure of individual forecast accuracy (JP Morgan/Reuters, 1996). Mathematically, Equation 3.27 shows the final step in setting the optimal smoothing factor:

$$\tilde{\lambda} = \sum_{i=1}^{N} \Phi_i \hat{\lambda}_i \qquad (3.27)$$

The EMWA measurement has the shortcoming that some volatility driving factors such as earning reports are not dealt with as effectively since the release of earnings will create a high volatility, which will persist in the EWMA metric into the future when volatility should be lower (Gil, 2012:5). The use of the EWMA as a volatility measurement has much greater application benefits when used with indices as the diversification effects reduce the net effect of individual stock volatility (Gil, 2012:5). The use of the EWMA in establishing ETF volatility, which exhibits the same diversification characteristics, thus becomes valuable.

3.5 SUMMARY

This chapter presented the theory relating to the concepts used during the empirical section of the study. Diversification, performance measurement and volatility (risk) measurement were all covered in detail.

The Markowitz portfolio theory showed that the greatest amount of diversification can be obtained in a portfolio of risky assets when low or negatively correlated securities are added into the portfolio. An analysis of the risk-return tradeoff revealed that a minimum-variance portfolio can be obtained that offers the lowest amount of risk. By combining a risk-free asset with a portfolio of risky assets, an optimal market portfolio could be obtained that offered the highest risk-adjusted returns. The single index model extended upon the Markowitz theory by separating the risk of an investment into a systematic (market) risk and unsystematic (specific) risk component. The single index model subsequently showed that diversification has the effect that unsystematic risk is reduced within a portfolio as more securities are added. It was furthermore indicated that the unsystematic risk can be measured by the residual errors when performing a regression analysis between the security returns and the market returns.

The evaluation of ETFs based upon the risk-adjusted returns warranted a complete analysis of the various performance measures. It was indicated that the performance ratios differ in most part by the manipulation of risk; the Sharpe ratio uses a total risk measurement; the Treynor ratio considers only systematic risk; the Sortino ratio incorporates only downside risk; the Calmar ratio uses the maximum drawdown as the risk measure; and the Information ratio explains risk by means of the tracking error. The Omega ratio was shown to improve on a number of shortcomings that other performance ratios hold by including the higher order moments (skewness and kurtosis) of the distribution into the performance calculation. The Omega ratio, therefore, holds the advantage that no assumption needs to be made about the shape of the distribution of returns and can subsequently provide a more consistent risk-adjusted performance evaluation.

The discussion surrounding volatility revealed that methods to determine volatility could consist of either forward looking (implied) measures or historical measures. The use of historical price data for this study created the need to evaluate the historical measures. The traditional standard deviation of return measure was shown to hold some limiting characteristics, which called for a more advanced approach to be followed in this study. The ARCH family of models was described for its value to determine a future volatility (condition variance). Finally, the EWMA was indicated to be a special case of the GARCH model and a valuable volatility measurement as it treats older volatility differently from more recent volatility.

The evaluation of ETFs based on risk, performance and diversification are presented in Chapter 4 by making use of techniques presented in this chapter.

CHAPTER 4
METHODOLOGY AND FINDINGS

4.1 INTRODUCTION

This chapter presents the results of the empirical research conducted for this study. Various ETFs are compared on the basis of risk and performance in order to establish which ETF indexation category offers the greatest diversification benefits. The results of the empirical comparisons are presented in this chapter. To allow for the best possible comparison between the selected indexation methodologies a detailed explanation of each method is provided. The complete description of the various indexation methods includes a review of previous studies conducted.

The subsequent sections of this chapter describe the data collection and analysis process in detail. The method followed during the data collection phase and the frequency of the data is explained fully. The methodology applied during this study is presented by reviewing the main comparisons between the various performance measures. Furthermore, the decision to include each of the risk-adjusted performance measures is provided. Similarly, a full discussion is provided about the methods used to determine the volatility, risk and diversification of the ETFs under review.

The final part of this chapter conveys the findings of the study. Market capitalisation weighted, fundamentally weighted, equally weighted and leveraged ETFs are compared and ranked on the basis of performance, risk and diversification.

4.2 INDEXATION METHODS

Chapter 1 introduced the four indexation methods that were selected as part of this study. Market capitalisation weighted (market cap), also referred to as traditional indexation, was shown to be a technique, which aims to track a broad market index as closely as possible with the goal to replicate the return of the market benchmark. Fundamental indexation was described as the indexation methodology, which attempts to improve on the shortcomings of the traditional methodology by including only those securities that show favorable valuations based on a key set of fundamental indicators. Another alternative to the traditional market cap approach was shown to be an equally weighted indexation approach, which assigns an identical weight to each security in the index. Finally, the leveraged indexation method was described as an alternative alpha-seeking strategy, which aims to deliver a multiple magnification of the returns experienced by the market index.

A more detailed discussion about each of the four indexation methods is subsequently provided to allow some comparison about the arguments for and against each of the techniques. The results of this study and its comparison between the various ETF indexation methodologies follow thereafter.

4.2.1 Market capitalisation-weighted (traditional) indexation

The market capitalisation weighted method for index construction assigns a weight to each security in the index in line with the size of the company as measured by its market capitalisation.[44] The market capitalization is used capture the total market value of the company. Traditionally, the idea to base passive investment funds on a market cap based index followed from the EMH, as it reflected the underlying notion that the market value of the company will be representative of all the information currently available for that particular company. According to this methodology, the market cap is believed to be a reasonable representation of the true fair value[45] of each company comprising the index. However, the existence of an efficient market is questionable and some studies have subsequently proposed that alternative indexation strategies are preferable (Siegel, 1994).

Choueifaty and Coignard (2008) state that there are increased claims that the market capitalisation-weighted indices are not an efficient way to obtain optimal risk-adjusted returns. Studies have proven that the high concentration of the market capitalisation indices towards specific sectors create a bias towards highly correlated stocks, which do not provide ideal levels of diversification (Stevenson, 2012:59). In

[44] Market capitalisation refers to the size of the company as expressed by the multiplication of the market price of the share with the current number of outstanding shares in the market (Wuite, 2009:246).
[45] The true fair value of a company should be based on the discounted future cash flows expected from the company (Arnott *et al*., 2005).

Section 3.2, it was indicated that mean-variance diversification can only be achieved when low or negatively correlated securities are added into the portfolio.

Market cap indices, furthermore, have the characteristic that these indices (by design) are heavily weighted towards the large cap stocks in the market (Clare *et al.,* 2013). An added benefit of market cap indices that follows closely with this characteristic is the high liquidity associated with large (and frequently traded) stocks (Arnott *et al*., 2005). The bias toward large stocks has the disadvantage that stocks with higher market prices (inter alia popular stocks) are given a greater weight in the index. The market cap indexation method can be said to be flawed as it overweighs expensive companies (Arnott *et al*., 2005). By definition, companies that are overvalued will have an extra weight in the index at the expense of undervalued companies (Hsu & Campollo, 2006).

The construction of the index using the market cap indexation technique, furthermore, creates a momentum bias. As popular stocks increase in value at a relatively fast rate, the share price and subsequently market value will increase. A passive fund manager with an index tracker based on market cap will as a result have to increase the weightings of "hot stocks" on a continuous basis (Stevenson, 2012). The negative consequence is that an investor always is invested largely in the sectors that are popular and conversely have reduced exposure to the unpopular sectors, regardless of the valuations of the sectors. The momentum bias of market cap indices were proven during the extended bull run of the markets in the 1990s, when the market cap based index method outperformed all the other indexation methodologies (Clare *et al.,* 2013).

In reaction to the drawbacks of the traditional indexation methodology, a few alternatives were developed. Fundamentally weighted indexing represents one such substitute method.

4.2.2 Fundamentally weighted indexation

In order to overcome the bias of the market cap weighted index towards the more popular stock in the market, an alternative indexation method was developed. The fundamentally weighted indices assign larger weightings to stocks that are expected to offer the best value in terms of a set of selected fundamental characteristics, rather than using the market value of stocks as the selection criteria. It can also be said that fundamental indexation aims to deliver not only beta (market risk), but instead provide an alternative or smart beta (Chow *et al*., 2011).

Fundamentals of companies form the selection criteria, which are used in the construction of a fundamentally weighted index. Variables such as the book value, revenues (cash flows), gross sales, dividends and employment are some of the factors that are considered the drivers of the future expectations for returns. The fundamentally weighted methodology seeks to create a value bias, which can produce extra returns over a long time frame by including securities that display favorable fundamental ratios (Stevenson, 2012).

Fama (2000) provides the underlying argument for the use of fundamental indexation, as opposed to a market cap weighted methodology. According to Fama (2000), the single risk factor (beta) that is used by the market cap methodology cannot be considered the only source of risk for all stocks. A three factor risk model that includes the size of the company, book-to-market value, as well as the market index, was proposed by Fama and French (1996). Small company stocks expose an investor to a different form of volatility and exhibit unique risk-return characteristics when compared to larger sized companies. “In the presence of more than one risk factor, the goal of indexing switches from diversification across the available stocks to diversification across the available risk-return dimensions” (Fama, 2000:1).

Constructing an index based on fundamentals holds a particular challenge when trying to retain the advantages of the market cap methodology. The two main advantages of market cap weightings, liquidity and low turnover, need to be compared to fundamentally weighted indices. Firstly, the increased market value of large capitalised stocks provides an inherent liquidity benefit. Smaller stocks with favourable fundamentals might not necessary be as liquid. Arnott *et al.* (2005) found that a strong correlation exists between liquidity and other company fundamentals such as book value, cash flow, sales, revenue and dividends. Subsequently liquidity is not compromised due to fundamental indexing because the size of the firm is in large part determined by these fundamental variables.

Second, fundamental indexation cannot provide the same low turnover[46] benefits as market cap weighted indices. Fundamental indices do have higher turnovers and need to be rebalanced on an annual basis to reassign weights according to changes in fundamental valuations (Arnott *et al.,* 2005). Davies (cited by Stevenson, 2012) states that the danger with this technique is that the data can become very stale as the annual rebalancing approaches. Rebalancing of fundamental indices only occurs on an annual basis due to frequency of the available annual reports from the companies. Arnott *et al*. (2005) oppose Davies' view and found no meaningful return advantage when rebalancing of the fundamental indices was done on a more frequent basis. Higher turnovers than market cap indices are noticeable.

Arguments both for and against the use of fundamental indexation have been put forward by critics. On the downside, the fundamental indices tend to under-represent fast-growing or young companies relative to their weighting on traditional indices. Fundamental valuations of such companies might not be in line with current market pricing. The negative effects of this bias towards fundamental value instead of market value are the missed opportunities of capturing sudden upward movements in the market. Hsu and Campollo (2006) confirm that fundamental indices will underperform relative to other methodologies in a bubble environment when rapid and irrational expansions in market prices provide better results for large market capitalised companies. The momentum bias of market cap weighted indices is apparent in markets with extreme momentum, which will hurt the performance of fundamental indexation (Hsu & Campollo, 2006).

Fundamental indexation also provides the opportunity to gain returns above that shown by the traditional indexation method. Arnott *et al*. (2005) state that the fundamental (non-capitalisation-based indices) consistently provide higher returns than the traditional cap-weighted equity market indices. The explanation for superior returns from fundamental indexation can be found in the validity of the EMH. In an inefficient market, the market cap weighted indices will experience a return drag as

[46] The low turnover in market cap weighted indices is a result of the slow change in the rankings of the largest companies in the market. Very little movement in these rankings results in fewer rebalances of the index.

rebalancing occurs at a slower rate, which provides a better opportunity for a fundamental index. However, in an efficient market an investor will be indifferent about which risky portfolio he invests in, as such the fundamental index will perform on par with the market cap weighted index (Hsu & Campollo, 2006).

It has also been suggested that a portfolio should, if the market is efficient, be "mean-variance efficient", but there is no reason why on an *ex ante*[47] basis this should be the case (Clare *et al.,* 2013). Arnott *et al.* (2005:97) concurs by stating that, "the fundamental indices are materially more mean-variance efficient than standard cap weighted indices". It can be said that fundamental indexation is a viable alternative to the traditional market cap weighted indices. One other alternative indexation method is the equally weighted index method.

4.2.3 Equally weighted indexation

Equal weighted indices assign the same weight to each of the *N* stocks comprising the index. Unlike market cap and fundamental indexation methodologies, no bias is created towards any stocks in the index as each carries an identical weight. The construction methodology followed by equally weighted indices creates unique characteristics, which are different from the underlying headline indices. Concentration risk that might arise with the market cap approach will not be present in equally weighted indices, as larger sectors are not over-represented by this methodology (Zeng & Luo, 2013).

Three drawbacks of equally weighted indices can be identified when compared to traditional market cap indices. Firstly, equally weighted indices will have reduced liquidity due to the larger proportion of the index that comprises smaller (and possibly less traded) stocks. When the fund rebalances and acquisitions of smaller stocks are required, a lack of supply in the market could affect the ultimate weightings. Second, an equally weighted index will not provide the return characteristics that are representative of the aggregate equity market (Arnott *et al*., 2005). Greater allocation towards smaller stocks in the market will deliver significantly altered returns, as opposed to those of the traditional market cap indices. A final drawback can be

[47] *Ex ante* refers to the detection of an outcome before the event occurrence.

found in the higher turnover rate of equally weighted indices (Zeng & Luo, 2013). This is the result of a quarterly rebalance schedule followed by equally weighted indices.

Despite the theoretical limitations of equally weighted indices, it has been shown empirically that equally weighted indices have outperformed market cap weighted indices over longer periods (Zeng & Luo, 2013). However, these results have varied considerably over different market conditions. Burgess (cited by Stevenson, 2012:59) states, “in bull markets, the equal weight index does seem to produce better returns than the standard index, if only because of its relative weight towards smaller stock”. Fernholz and Shay (1982) also found that an equally weighted portfolio has the potential to earn returns that are greater than buy-and-hold portfolios.[48] Outperformance of equally weighted indices over traditional market cap indices is clearly visible, given the correct market conditions. Differing weightings and rebalancing practices can be seen to be the major contributors to such out performances.

4.2.4 Leveraged indexation

Section 2.4.9 described leveraged ETFs in detail and indicated that such ETFs are linked largely to an underlying market cap weighted index. However, instead of seeking to mimic the exact return of the underlying index, leveraged ETFs will aim to deliver a multiple of the index value. An inverse ETF ties in closely with leveraged ETFs as it seeks to deliver a negative multiple of the index. The leveraged factor, which leveraged ETFs aim to deliver, ranges from two times (2x) or three times (3x) the index (for a long position on the market), to negative two times (-2x) or negative three times (-3x) the index (for a short position on the market) (Stevenson, 2012:128). Leveraged ETFs can be considered as a magnified variation on the market cap weighted index. Any increases in the market cap weighted indices will result in an amplified increase in the leveraged ETF.

The differences between daily, monthly and life-time leveraged ETFs were clearly indicated in Section 2.4.9. A critical area to note is that most leveraged ETFs in

[48] Buy-and-hold strategies are in most cases synonymous with traditional passive investing, which is associated with market cap weighted indices (Stevenson, 2012).

existence are daily leveraged ETFs (Johnston, 2010a). Daily leveraged ETFs as such seek to deliver the stated leveraged factor on a daily basis. The compound returns of daily leveraged ETFs will over a longer time period differ significantly from expected levels.[49] Daily leveraged ETFs are by design structured to deliver superior returns to that of the market on a daily basis. However, longer term results of such products will deviate from the underlying market index, depending on the volatility of the market index. Leveraged ETFs require that both the direction and magnitude of market movements be predicted correctly in order to gain over the longer term (Johnston, 2010a).

Very little literature (and in the case of South Africa none at all)[50] exists that compares the performance of a leveraged indexation approach to others such as fundamentally weighted and equally weighted on a risk-adjusted basis. This study seeks to fill precisely this gap. The data used and methodology that was followed to complete this study will be described in more detail in the following sub-section.

4.3 DATA AND METHODOLOGY

4.3.1 Data selection

Data collection for this study was limited to selected equity ETFs in South Africa (SA) and the United States of America (US). Equity funds were selected over bond or commodity funds due to the largest part of the ETF market comprising of equity ETFs. Equity ETFs provided the benefit that a comparable market index could be used as a benchmark in which to relate return performance. For the South African market, the JSE Top 40 index was selected as the market index, whereas in the US, the S&P 500 index served as a similar benchmark index. The utilisation of market capitalisation weighted ETFs during this study, necessitated the use of benchmark indices with close resemblance to the selected market capitalization ETFs. The S&P 500 index and the JSE Top 40 index were best suited for this purpose due to their inclusion of the largest market capitulation stocks in the respective markets. The US

[49] The compounded value of the leveraged ETF is expected mistakenly to be the underlying index value multiplied by the leveraged factor.

[50] This is a result of the regulation prohibiting leveraged ETFs in the South African market.

was selected as the country of comparison due to the vast amount of ETFs traded in the US market and because it is the birthplace of the ETF product.[51]

Traditional market capitalisation ETFs were selected from funds that aim to replicate the performance of these benchmark indices as closely as possible. For both the SA and US market, three traditional market capitalisation ETFs were selected. For SA, this was the complete list of ETFs available in the market, which aim to replicate the JSE Top 40 index. The same sample size from the US ensured consistency in comparisons. The selection of fundamentally weighted ETFs in SA was based on the availability of historical data. Only two SA equity ETFs, with a close relation to the benchmark index, fulfilled the criteria for sufficient historical information.[52] A similar sample size was selected for the US market. Only one equally weighted ETF is traded in the SA market, and subsequently one equally weighted ETF was selected from the US market. Due to regulations imposed on the SA ETF industry,[53] no leveraged ETFs are in existence in the SA market. A comparison of the three abovementioned indexation methods to leveraged ETFs was as a result restricted to the US ETF market. Both leveraged and inverse ETFs were included as part of the analysis. One two times and one three times leveraged ETF were randomly selected. Similarly, one negative two times and one negative three times inverse (short) leveraged ETF was included into the analysis.

Section 2.4.1 discussed the key differences between ETFs and ETNs, and as such only ETPs that follow an ETF structure were included into the analysis. Care was taken to ensure that all funds included in the analysis use an ETF structure, which reduced the available sample, especially in SA.

Returns for all abovementioned ETF categories were calculated from the EFTs' daily closing prices. The creation and redemption process as explained in Section 2.3.1 highlighted how any arbitrage between the NAV and market prices for an ETF will be eliminated through the buying and selling of creation units containing the underlying securities. As a result, the market prices of ETFs will not differ dramatically from the

[51] The historical developments of ETFs and the importance of the US in these developments can be seen from Section 2.5.
[52] See Section 4.3.2 for a description about the data observation period.
[53] See Section 2.8.

net value of the underlying assets (Pennathur *et al*., 2002), hence the decision to use market prices instead of the NAV for each ETF. Market prices for SA ETFs were obtained from the McGregor BFA (2014) database, while the Yahoo Finance (2014) database provided the historical prices for US ETFs. The risk-free rate of return (as used in many performance measures) was based on the 91 day treasury bill rates for SA and the US. Risk-free rates were obtained for the same observation period as the price data. South African treasury rates were obtained from the South African Reserve Bank (SARB, 2014), while US treasury rates were obtained from the Board of Governors of the Federal Reserve System's (2014) website.

4.3.2 Data frequency and observation period

The sample period under review included the most recent three-year period of data. Fundamental ETFs have not been in existence within the SA market for an extended period of time. To allow as many ETFs to be analysed as possible, a period from December 2010 to January 2014 was selected.

Daily closing prices were used to obtain the returns exhibited by the various ETFs. Daily analysis of prices allowed for a better comparison with leveraged ETFs. Section 2.4.9 highlighted the ways in which the daily rebalancing of leveraged ETFs could have significant effects on the compound returns of such products. The use of daily data allowed for a more consistent comparison with other categories of ETFs.

4.3.3 Methodology - performance measurement

An evaluation of the performance of each ETF was not only conducted on an absolute return basis, but also on a risk-adjusted basis. An analysis of the compound annual returns for the various ETF categories was conducted to compare the indexation methods in terms of its return generation ability. However, to determine truly the performance of each ETF in relation to other ETFs, a cross-category analysis needed to be performed on a risk-adjusted basis. Risk-adjusted performance measures provide a view of the risk-return characteristics of an investment by incorporating the amount of risk that has to be incurred to achieve the level of return (Bacon, 2004).

Section 3.3 provided a detailed description of each of the various performance ratios that were considered for this study. The major difference among all the performance ratios rests primarily with the adjustment for risk (Mayo, 2000:249). The Sharpe ratio considers total risk; the Treynor ratio considers only the systematic risk; the Sortino ratio accounts for the downside risk below a specified threshold rate; the Calmar ratio considers risk as the maximum downturn that an investment exhibited; and the Information ratio incorporates the tracking error as its risk measurement.

Various characteristics of each of these measurements validated its use in the study. In addition, however, some shortcomings with each of the above-mentioned measurements created the need for results to be compared to other measures of portfolio performance. The total risk[54] measurement used by the Sharpe ratio ensured that less-diversified ETFs could be evaluated (Le Sourd, 2007). However, using the standard deviation of returns as risk measure essentially penalises upside variation in the return series (De Wet *et al*., 2008). The Sharpe ratio relies on the assumption that returns are normally distributed (Eling & Schuhmacher, 2007:2633), which is not the case for the sample of ETFs as will be indicated in Section 4.4.1. The Treynor ratio can be considered a closely related portfolio performance ratio, which uses the beta of the portfolio as the risk measurement (Bacon, 2004). The Treynor and Sharpe ratios can also be viewed in comparison to each other to determine the level of diversification in the portfolio. For a fully-diversified[55] portfolio, the Sharpe and Treynor ratios should essentially provide the same measurements, as any difference in rankings comes directly from a difference in portfolio diversification levels (Reilly & Brown, 2009:945). Adding both measures into the study allowed a supplemental technique to measure the diversification of each ETF.

Both the Sortino and Calmar ratios hold the benefit that upside risk does not get penalised, as adjusted measures of risk are incorporated into each of these ratios. The use of downside risk in the Sortino ratio ensures that a specified minimum level of return could be selected to determine the deviation of returns away from such a level. The Sortino ratio allows for a user defined minimum level of return to be set,

[54] Measured as the standard deviation of returns.
[55] A fully diversified portfolio contains no unsystematic risk and as such, the total risk of the portfolio will be equal to its systematic risk.

which if chosen incorrectly, could over- or understate the downside risk (Amenc *et al.*, 2004:21). Due to the use of daily data for the study, the minimum level of return was set at zero. The limited data for this study allowed for only a three-year bull-market to be included. As such, no extreme downturns were observed in the period under review. However, incorporating the Calmar ratio into the analysis provided some manner to observe the performance of each ETF in reaction to its most extreme event (maximum downturn).

The information ratio holds particular importance for its application to ETF performance measurement. The use of the tracking error as the risk measurement has been indicated in Section 2.7.1 to be of great importance with passively managed investment products such as ETFs. The inclusion of the tracking error in the calculation of the information ratio provided a good comparison of how well each ETF performed relative to the benchmark market index. The information ratio as a technique to evaluate the performance of various indexation methodologies has also been applied in numerous other studies (Arnott *et al*., 2005; Arnott *et al*., 2010).

Eling & Schuhmacher (2007:2633) stated that a primary argument for the selection of a performance measure rests on the fund's return distribution. Investment funds exhibiting non-normal return distributions cannot be evaluated sufficiently with the use of performance ratios such as the Sharpe and Treynor ratios (Sharma, 2004). The use of only the first two moments[56] of the return distribution in the Sharpe and Treynor measurements can provide inconsistent results when returns are not normally distributed. The Sortino ratio improves on this drawback of the Sharpe and Treynor measures by allowing asymmetrical return to be evaluated (Kanellakos, 2005:76). Utilising downside risk allows for the skewness[57] of the distribution to be incorporated into the calculation (Amenc *et al*., 2004:21). Similarly, the Calmar ratio is not only concerned with the mean and variance, but applies to the maximum downturn experienced over the period under review. However, the Calmar and Sortino ratios only consider the lower partial moments, which considers upside and downside variability differently.

[56] The first and second moments of a distribution were shown in Section 3.3.8 to be the mean and variance.
[57] Skewness can be considered as the third moment of the distribution. See Section 3.3.8.

The final performance measure introduced in Section 3.3, the Omega ratio, overcomes all the limitations experienced by the other performance measures. The Omega ratio incorporates all four moments of the distribution of returns; *inter alia* the mean, variance, skewness and kurtosis (Togher & Barsbay, 2007). The Omega performance measure considers both the upside potential (higher partial moments) and downside potential (lower partial moments) of a portfolio for the entire distribution of return (Kazemi *et al.,* 2003). By using the entire cumulative distribution function, the Omega ratio needs to make no assumptions about the shape of the distributions (Keating and Shadwick, 2002). Subsequently, fund rankings obtained using the Omega ratio will be noticeably different from those obtained by other performance measures. Keating and Shadwick (2002) state that when the higher moments of the distribution are important,[58] the Omega will provide a correction for the simplifying assumptions made in other performance measures. The Omega also differs from other measures of performance as the ratio is expressed as gains to losses, rather than in the form of (expected) return and risk (Van Dyk *et al.,* 2012). Botha (2006:1) summarises the supremacy of the Omega ratio by stating that the Omega is superior to both the Sharpe and Sortino ratio.

The above-mentioned comparison between the different performance measures highlights the importance of each ratio as part of the overall analysis. The Omega ratio exhibits some distinct characteristics, and subsequently, the findings obtained with the use of the Omega ratio will carry a greater weighting in the conclusion.

4.3.4 Methodology - volatility and risk measurement

One of the main objectives of this study is to compare the returns of various ETF indexation methods on the basis of volatility and risk. Volatility and the measurement thereof were discussed in detail in Section 3.4.3.

However, the risk of variability of returns is not the only cause of concern for ETF investors. The index-tracking nature of ETFs creates the need to compare the returns on the basis of relative performance to its set benchmark indices. Tracking

[58] The importance of the higher moments is dependent upon the existence of normality in the return distribution.

errors and their importance in this study have been discussed in Section 2.7.1. The inclusion of the information ratio as part of the performance measures further underlines the need to consider tracking errors as a source of risk for index-tracking investment products such as ETFs. This study subsequently compares the tracking errors for each of the various ETFs.

The volatility measurement of choice for this study is the exponentially weighted moving average (EWMA). Comparisons between the EWMA and other measurements of volatility such as the ARCH models and standard moving average have been provided in Section 3.4.3.3. While the ARCH models deliver its own set of unique benefits, the EWMA has been shown to be a special case of the GARCH model, which achieves very similar results (JP Morgan/Reuters, 1996). Similar to the GARCH model, the EWMA improves on the simple moving average volatility measurement by assigning a greater weight to recent return observations.

The use of the EWMA as a volatility measurement has much greater application benefits when used with indices, as the diversification effects reduce the net effect of individual stock volatility (Gil, 2012:5). The use of the EWMA in establishing ETF volatility, which exhibit the same diversification characteristics, thus becomes very useful.

4.3.5 Methodology - diversification measurement

The measurement used to determine the level of diversification that each ETF exhibit follows from the single index model as explained in Section 3.2.3. The single index model discussed the risk associated with a particular asset, which can be estimated through the interaction that the asset has with the market portfolio. The variability of return for an individual asset can be explained by its co-movement with the market portfolio.[59] For the purposes of this study, the assumption needed to be made that the two respective benchmark indices for SA and the US are representative of the true market portfolio.[60] A portfolio, which shows a high degree of covariance with the market portfolio, will exhibit actual returns that are much closer to the expected returns predicted by the single index model (Haugen, 1986:133).

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[59] The market portfolio refers to a completely diversified portfolio (Van Dyk *et al*., 2012).
[60] Haugen (1986:136) states that obtaining the true market portfolio is nearly impossible.

Determining the degree of diversification that each ETF holds subsequently involves a regression analysis to be performed between the actual returns of the ETF and the returns of the market portfolio (Gopi *et al*., 2006:4). An ETF with a high degree of unsystematic risk[61] will show much larger deviations between the estimated values of the regression and the actual returns of the ETF. These deviations are known as the estimate residuals (ε_i). The variance of the residual values ($\sigma^2(\varepsilon_i)$) were shown in Section 3.2.3 to be the source of unsystematic risk in a portfolio. Subsequently, the extent of diversification still attainable in the portfolio will be denoted by the variance of the residuals (Van Dyk *et al.,* 2012).

This study considers the standard error of the residual values to determine the amount of diversification contained in each ETF. The standard error of estimate (SEE) can be considered as a measure of accuracy that evaluates the exactness of the estimated return values compared to the actual returns of the dependant[62] ETF. The regression analysis delivers the regression line, which aims to minimise the sum of the squared residuals (Lane, 2007). The standard error of estimate follows from the sum of squared residuals and can be stated by Equation 4.1 (Lane, 2007):

$$SEE = \sqrt{\frac{\sum(R_i - R_i')}{N}} \tag{4.1}$$

where:

- SEE represents the standard error of estimate;
- R_i denotes the actual return value of the ETF; and
- R'_i represents the predicted (estimated) value following from the regression analysis. (Lane, 2007).

A regression analysis was performed between each of the individual ETFs and their respective benchmark indices. The standard error of estimate (SEE) was obtained

[61] Higher levels of unsystematic risk in a portfolio are indicative of a poorly diversified portfolio.
[62] During each regression analysis, an ETF is considered as the dependent variable and the market index as the independent variable.

and ETFs were ranked according to their diversification characteristics. The methodology as stated in Sections 4.3 delivered the following findings.

4.4 FINDINGS

4.4.1 Distribution statistics

The return distribution characteristics for the ETFs included in this study are presented in Table 4.1 (South Africa) and Table 4.2 (United States). It is important to evaluate the descriptive statistics associated with each ETF and the market index to determine to what extent the return distributions compare with a normal distribution.

Table 4.1: Return distribution characteristics (%) for SA market and ETFs

	Mean	Median	Max.	Min.	Std. Dev.	Skewness	Excess kurtosis
JSE Top 40 Index	0.0006	0.0010	0.0414	-0.0338	0.0104	-0.1541	1.2421
ETF U	0.0006	0.0010	0.0416	-0.0341	0.0105	-0.1662	1.2491
ETF V	0.0006	0.0013	0.0387	-0.0385	0.0107	-0.2383	1.0594
ETF W	0.0006	0.0000	0.2454	-0.1846	0.0178	1.8515	76.2768
ETF X	0.0006	0.0012	0.0471	-0.0481	0.0096	-0.1833	2.0936
ETF Y	0.0006	0.0012	0.0349	-0.0326	0.0105	-0.0510	0.6980
ETF Z	0.0004	0.0000	0.0991	-0.1119	0.0139	-0.3860	14.8989

Source: Compiled by the author

Table 4.2: Return distribution characteristics (%) for US market and ETFs

	Mean	Median	Max.	Min.	Std. Dev.	Skewness	Excess kurtosis
S&P 500 Index	0.0005	0.0007	0.0474	-0.0666	0.0103	-0.4768	5.2160
ETF A	0.0006	0.0008	0.0465	-0.0652	0.0102	-0.5000	4.9624
ETF B	0.0006	0.0009	0.0448	-0.0641	0.0102	-0.4710	4.6956
ETF C	0.0006	0.0009	0.0516	-0.0648	0.0103	-0.4742	5.3082
ETF D	0.0006	0.0013	0.0507	-0.0709	0.0105	-0.5241	5.3333
ETF E	0.0006	0.0010	0.0513	-0.0732	0.0114	-0.5021	5.0418
ETF F	0.0006	0.0008	0.0364	-0.0553	0.0094	-0.5087	3.8237
ETF G	0.0011	0.0015	0.0934	-0.1287	0.0205	-0.4973	5.0574
ETF H	-0.0012	-0.0016	0.1290	-0.0948	0.0205	0.4718	5.0142
ETF I	0.0017	0.0025	0.1430	-0.1970	0.0310	-0.5027	5.1318
ETF J	-0.0019	-0.0027	0.2021	-0.1507	0.0311	0.5109	5.3641

Source: Compiled by the author

The comparison between the various performance measures in Section 4.3.3 emphasised the importance of normality in the return distribution. To allow meaningful conclusions to be drawn from the performance measures, it first needs to be established if the assumption of normality in the data is valid. The observations for both the South African market and the United States market clearly indicate that significant deviations from normality exist.

The daily return distributions were evaluated and the descriptive statistics were obtained. Both the SA and US ETFs display a dominant left sided skewness (negative skewness). Distributions that contain a negative skewness indicate that the possibility of downside returns is greatly increased. The use of daily data shows that on average the returns for both markets and the ETFs listed as part of this study will tend to show a negative return distribution on a daily basis. Normal distributions will have a skewness value of zero. A few exceptions were noted. Two ETFs from the US sample showed a strong positive skewness, whereas one ETF for the SA sample displayed a substantial deviation away from a normal distribution. The inclusion of leveraged (and specifically inverse) ETFs into the US sample explains the two US outliers. Both positively skewed ETFs in the US sample are inverse ETFs. These ETFs, therefore, function exactly as intended by delivering the opposite of the market return. The outlier for the SA sample requires further analysis as this could be as a result of the asset allocation or tracking error of this particular ETF.

Concerning the fourth moment of the distribution, kurtosis, it can be seen that all observations from both the SA and US sample exhibit positive excess kurtosis values. The excess kurtosis measurement provides a view of the kurtosis for that particular ETF or index in excess of the normal distributions' kurtosis. A normal distribution will have a kurtosis value of three, and subsequently an excess kurtosis of zero. The higher the kurtosis the more likely extreme events are. Both SA and US samples are indicative of sharper tails in the distributions.

The negative skewness and high kurtosis values will cause any performance measures that rely heavily on the first two moments[63] of the distribution to misrepresent the overall level of risk. Traditional performance measures such as the Sharpe ratio and Treynor ratio, therefore, need to be interpreted with caution. Results obtained by performance ratios (such as the Omega) that do incorporate higher order moments[64] will deliver more consistent rankings (Eling & Schuhmacher, 2007:2633).

[63] Mean and variance.
[64] Skewness and kurtosis.

4.4.2 Performance

The performance potential for the various ETFs and the indexation methodology on which they are based was evaluated by its annual compound performance as well as by the various risk-adjusted performance measures that were identified. The findings obtained from each of these are presented in the following sections.

4.4.2.1 Annual compound return performance

The compound returns provide an indication of capital growth over the three-year period (December 2010 to January 2014) studied. Table 4.3 and Table 4.4 present the compounded performance of the ETFs for the SA and US samples respectively. The market index with which the ETFs are linked is supplied as a comparable benchmark.

Table 4.3: SA ETFs – Annual compound return rankings for period - December 2010 to January 2014

Name:		*Return:*	*Indexation Method:*
ETF Y	Best	14.65%	Fundamental
ETF X	↓	14.17%	Fundamental
Index		13.81%	Index
ETF U		13.74%	Market Cap
ETF V		13.63%	Market Cap
ETF W		12.70%	Market Cap
ETF Z	Worst	7.29%	Equally Weighted

Source: Compiled by the author

Table 4.3 presents the SA ETF results for the compound returns, and indicates that fundamentally weighted ETFs outperformed the traditional market cap weighted and equally weighted ETFs. Fundamentally weighted ETFs furthermore outperformed the JSE Top 40 index. Equally weighted indexation showed to deliver substantial underperformance when compared to other indexation methods.

Table 4.4 indicates contrasting results delivered by the US equally weighted ETF. The equally weighted indexation proved to be the more rewarding strategy to follow when compared to the market cap weighted and fundamentally weighted indexation methods. Long leveraged ETFs proved to deliver far superior absolute returns than all other ETFs in the sample. Market cap weighted ETFs also proved to deliver slightly better compound returns than the fundamentally weighted ETFs, which again stand in contrast to results from the SA market.

Table 4.4: US ETFs – Annual compound return rankings for period - December 2010 to January 2014

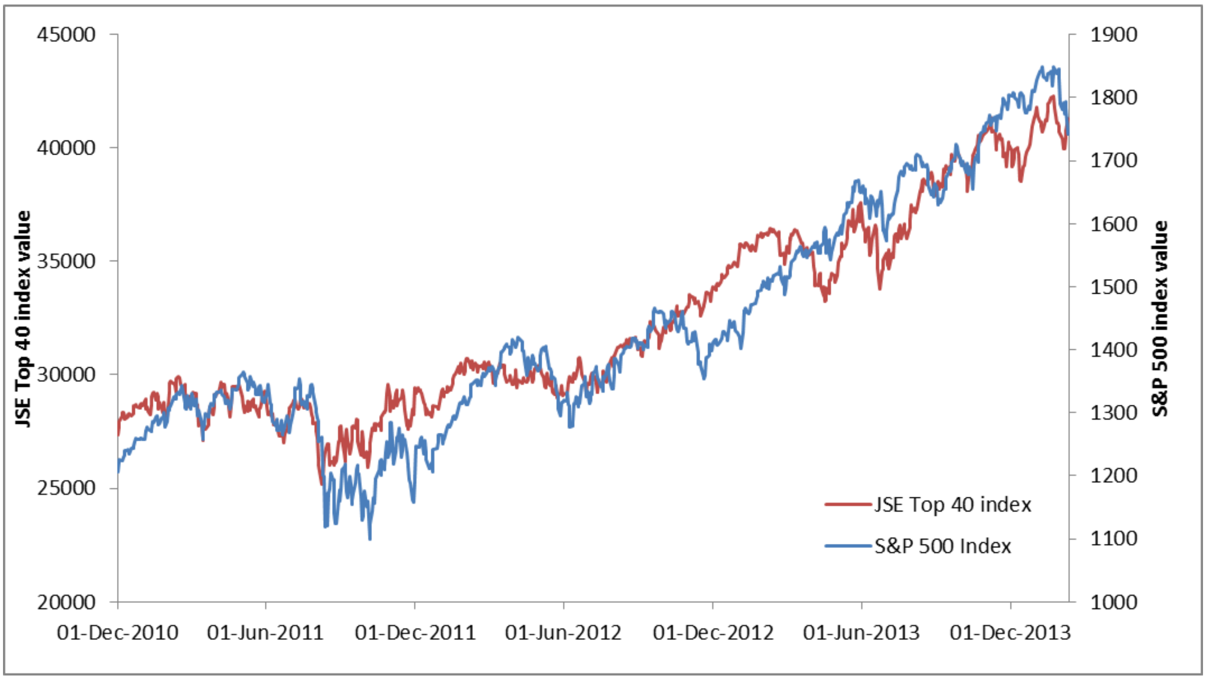
Name:		*Return:*	*Indexation Method:*
ETF I	Best	33.98%	3x Long Leveraged
ETF G	↓	26.03%	2x Long Leveraged
ETF E		15.10%	Equally Weighted
ETF B		14.59%	Market Cap
ETF C		14.56%	Market Cap
ETF A		14.52%	Market Cap
ETF D		14.46%	Fundamental
ETF F		14.17%	Fundamental
Index		12.22%	Index
ETF H		-30.15%	-2x Short Leveraged
ETF J	Worst	-44.22%	-3x Short Leveraged

Source: Compiled by the author

The stated results do have to be interpreted with care. Although the long leveraged ETFs proved to deliver good results, it has to be considered that the period under review was one of strong upward movements in both the SA and US markets. Figure 4.1 shows that since December 2011, the global economic recovery has pushed stock markets to record highs. This strong upward trend favours the long leveraged indexation methodology, but impacts negatively on a short leveraged (inverse) position. Table 4.4 clearly shows the significant underperformance of both short leveraged ETFs to the rest of the sample.

Another noticeable feature with the leveraged and inverse ETFs is the inconsistency between the stated daily leveraged factor and the compounded leverage factor. With the index moving up 12,22 percent, it would be expected to see the two times long leveraged ETF deliver a return of 24,44 percent, and the three times long leveraged ETF deliver a return of 36,66 percent. Actual returns differ from the expected value due to the daily rebalancing of the stated ETFs. The use of such products should subsequently be limited to investors who can monitor and trade them on a daily basis. Buy-and-hold strategies might have proven favorable under the sample review period, but more sideways movement of markets will result in significantly different rankings.

Figure 4.1: Overall market movements for SA and US stock indices



Source: Compiled by the author

The differences between the SA and US rankings for both fundamentally weighted ETFs and equally weighted ETFs require some further explanation. The size of the market and the number of shares that comprise the index need to be considered. The US index selected (S&P500) as part of this study holds the largest 500 companies by market value. On the contrary, the SA index only consists of the top 40 shares valued by market capitalisation. When considering an equally weighted indexation method for both markets, the weights given to each security on the index will differ substantially. A weight of 2,5 percent is allocated to each stock on the SA equally weighted index, whereas only 0,2 percent is allocated towards each stock on the US equally weighted index. Poor performance by smaller companies will impact the SA equally weighted index much more severely than the US equally weighted index.

Fundamentally weighted indexation similarly stands to benefit (or suffer) as a result of differences between the number of stocks comprising the index. The SA fundamentally weighted ETFs were all based on an underlying index of 40 shares. This stands in contrast to the US where 1000 equities with the highest fundamental strength are weighted by their fundamental scores. The smaller size in this instance favoured the SA market as greater weighting could be assigned to the shares with ideal fundamental characteristics.

Due to the sample size differences between the SA and US market, the findings for both markets cannot be viewed in comparison to each other. This study, therefore, considers the SA and US market separately. For the SA market only market cap, fundamentally weighted, and an equally weighted ETF is used, while the US study incorporated the additional leveraged indexation category. Any conclusions with regards to leveraged ETFs should only be considered valid for the US market.

4.4.2.2 Sharpe performance measure

The compound annual returns provided a view of the pure return performance of each of the various ETF categories and the ETFs of which they are comprised. Incorporation of a risk measure into the performance analysis allows for risk-adjusted performance rankings to be done. The Sharpe ratio (Section 3.3.2) is the first performance ratio to be considered. The Sharpe ratio includes the standard deviations of returns as the risk measure and subsequently calculates the performance value as the excess return (return above the risk-free rate) divided by the standard deviation of returns over the period under review. Higher Sharpe ratios are indicative of better risk-adjusted performance by the ETF. Table 4.5 and Table 4.6 provide the Sharpe rankings for the SA and US respectively.

Sharpe performance rankings for SA fully concur with the rankings based on compound returns alone. Fundamentally weighted ETFs deliver the highest risk-adjusted performance followed by the market cap weighted ETFs and finally the equally weighted ETF.

Table 4.5: SA ETFs – Sharpe rankings for period - December 2010 to January 2014

Name:		*Ratio Value:*	*Indexation Method:*
ETF X	Best	0.585	Fundamental
ETF Y	↓	0.566	Fundamental
Index		0.516	Index
ETF U		0.508	Market Cap
ETF V		0.494	Market Cap
ETF W		0.263	Market Cap
ETF Z	Worst	0.091	Equally Weighted

Source: Compiled by the author

Sharpe rankings for the US differ significantly from that obtained by a pure return analysis. By incorporating the risk with the return, the fundamentally weighted ETFs perform much better. Although the literature showed that strong trending markets (which is the case with this study) are more favourable towards market cap weighted indices (Hsu & Campollo, 2006), these results show that on a risk-adjusted basis, fundamentally weighted indices deliver better results. The risks involved with leveraged ETFs are also clearly evident from the much lower rankings obtained by the Sharpe ratio. The large standard deviations of such products over the time period greatly reduce the Sharpe rankings.

Table 4.6: US ETFs – Sharpe rankings for period - December 2010 to January 2014

Name:		*Ratio Value:*	*Indexation Method:*
ETF F	Best	0.941	Fundamental
ETF B	↓	0.892	Market Cap
ETF A		0.886	Market Cap
ETF C		0.883	Market Cap
ETF D		0.856	Fundamental
ETF E		0.831	Equally Weighted
ETF G		0.799	2x Long Leveraged
Index		0.738	Index
ETF I		0.689	3x Long Leveraged
ETF J		-0.902	-3x Short Leveraged
ETF H	Worst	-0.938	-2x Short Leveraged

Source: Compiled by the author

The diversification benefits for each of the indexation categories are considered as the final objective of this study. The comparison of ETFs, based on their Sharpe ratios, provide the viewpoint where a higher Sharpe ratio can be seen as indication that the ETF contains less risk. More diversified ETFs should therefore theoretically show higher Sharpe ratios. However, the total risk[65] measure used with the Sharpe ratio does not distinguish between systematic and unsystematic risk. The Treynor ratio was used to overcome this shortcoming in the Sharpe measure.

4.4.2.3 Treynor performance measure

The Treynor ratio (see Section 3.3.3) considers the systematic risk (beta) of each of the ETFs instead of the standard deviation of returns. Traditional market cap weighted ETFs have been referred to as beta funds due to their objective to deliver returns equal to the market return (Brown, 2013b). A performance ranking that integrates the beta of the ETFs will subsequently deliver results that adjust for the index-tracking nature of the product. The inclusion of the Treynor ratio into the study, furthermore, allows a comparison to be made with the Sharpe ratio for diversification purposes. Sharpe and Treynor rankings should be identical when the portfolio is completely diversified as all unsystematic risk is eliminated leaving only systematic risk (Reilly & Brown, 2009:94). Table 4.7 and Table 4.8 present the rankings obtained with the Treynor performance measure for SA and the US respectively.

Table 4.7: SA ETFs – Treynor rankings for period - December 2010 to January 2014

Name:		*Ratio Value:*	*Indexation Method:*
ETF W	Best	0.1847	Market Cap
ETF X	↓	0.1325	Fundamental
ETF Y		0.1203	Fundamental
ETF V		0.0865	Market Cap
Index		0.0853	Index
ETF U		0.0848	Market Cap
ETF Z	Worst	0.0327	Equally Weighted

Source: Compiled by the author

[65] Standard deviation of returns is considered as a total risk measure as it considers both upside and downside risk equally (Bacon, 2004).

The Treynor rankings for South African ETFs deliver noticeably different rankings than the Sharpe rankings. Market cap weighted ETFs (due to their beta nature) showed the ability to deliver better risk-adjusted returns than fundamentally weighted ETFs. Equally weighted ETFs still ranked consistently below the other categories, due to their poor return performance over the period under review. The diversification implications of these rankings, furthermore, hold that a large amount of unsystematic (diversifiable) risk is contained within each of the ETFs. The standard error of estimate (SEE) measure used during the diversification analysis will supplement this finding obtained from the Treynor ratio.

Table 4.8: US ETFs – Treynor rankings for period - December 2010 to January 2014

Name:		*Ratio Value:*	*Indexation Method:*
ETF F	Best	0.1835	Fundamental
ETF H	↓	0.1534	-2x Short Leveraged
ETF J		0.1475	-3x Short Leveraged
ETF B		0.1459	Market Cap
ETF A		0.1447	Market Cap
ETF C		0.1445	Market Cap
ETF D		0.1409	Fundamental
ETF E		0.1370	Equally Weighted
ETF G		0.1306	2x Long Leveraged
Index		0.1205	Index
ETF I	Worst	0.1128	3x Long Leveraged

Source: Compiled by the author

The US Treynor rankings did not show a considerable difference from the Sharpe rankings. The rankings highlighted one of the drawbacks of the Treynor ratio namely: short leveraged ETFs by design carry a negative beta, which when combined with the negative excess returns experienced over this time period will skew its rankings. The higher Treynor rankings of short leveraged ETFs are misleading and cannot be used as a direct comparison to other categories. Excluding the short leveraged ETFs from the sample will show Treynor rankings much closer to the Sharpe rankings. This result shows that in general the diversification of US ETFs is much better (a result of the larger number of securities comprising the US ETFs). The standard error of estimate (SEE) used as part of the diversification analysis will offer a supplemental indication that US ETFs hold increased diversification benefits.

4.4.2.4 Sortino performance measure

The Sortino ratio as discussed in Section 3.3.5 extends upon the Sharpe and Treynor measures by assimilating the skewness of the distribution into the calculation (Kanellakos, 2005:76). The Sortino ratio achieves this by assessing the actual returns in excess of a specified target rate of return, per unit of downside risk (Reilly & Brown, 2009:934). For the purposes of this study, the specified target rate of return was set to a zero level. The lower partial moments or downside risk is considered as the daily returns that highlight a negative value. Therefore, a high Sortino ratio is an indication of a low probability of losses arising (Van Dyk *et al*., 2012). Table 4.9 shows the Sortino rankings for SA ETFs.

Table 4.9: SA ETFs – Sortino rankings for period - December 2010 to January 2014

Name:		*Ratio Value:*	*Indexation Method:*
ETF Y	Best	70.33	Fundamental
ETF X	↓	63.59	Fundamental
Index		59.09	Index
ETF U		57.86	Market Cap
ETF V		54.29	Market Cap
ETF Z		7.67	Equally Weighted
ETF W	Worst	5.22	Market Cap

Source: Compiled by the author

The Sortino rankings for the South African market show nearly identical rankings to the Sharpe rankings in Table 4.5. The ability of fundamentally weighted ETFs to outperform the benchmark index and subsequently other indexation techniques is visible from the results. Fundamentally weighted ETFs, therefore, show a superior ability to deliver positive daily returns when compared to alternatively indexed ETFs. The equally weighted ETF still ranks among the worst performing ETFs in the sample.

One market cap weighted ETF (ETF W) should be pointed out. The bad performance with the Sortino measure for ETF W highlights the importance of the distribution characteristics of the returns. A review of Table 4.1 shows that ETF W exhibited a significantly different distribution to other ETFs in the sample. Furthermore, ETF W highlighted an extremely high excess kurtosis value, which was indicative of extreme tail events. Although the Sortino ratio does not explicitly account for kurtosis, the deduction can be made that ETF W has extreme negative values in the return distribution, which impacted on the low Sortino value. Therefore, a fair comparison for ETF W can only be made through the use of the Omega ratio, which considers the kurtosis fully.

The US rankings are presented in Table 4.10 and show a close similarity with the Sharpe rankings. Fundamentally weighted ETFs have the ability to outperform alternatively indexed ETFs, but can also rank below them, as is the case with ETF D. Although the equally weighted ETF showed promising results when compared on a pure return basis, it can be seen from the Sortino results that the downside risk of this product reduces its risk-adjusted performance.

Table 4.10: US ETFs – Sortino rankings for period - December 2010 to January 2014

Name:		*Ratio Value:*	*Indexation Method:*
ETF F	Best	49.83	Fundamental
ETF B	↓	41.60	Market Cap
ETF A		40.33	Market Cap
ETF C		39.56	Market Cap
ETF D		36.64	Fundamental
ETF E		33.87	Equally Weighted
Index		32.96	Index
ETF G		18.02	2x Long Leveraged
ETF I		10.17	3x Long Leveraged
ETF J		-17.42	-3x Short Leveraged
ETF H	Worst	-27.71	-2x Short Leveraged

Source: Compiled by the author

The risky nature of leveraged ETFs is also clearly visible from the comparisons with other indexation methodologies. Both long and short leveraged ETFs rank well below other ETFs in the sample. Therefore, negative daily returns are more likely with the leveraged ETFs. The need for a daily rebalancing of a leveraged ETF position is re-emphasised with this finding as an incorrect prediction of the daily movement of the underlying index does result in a negative impact on the performance of the leveraged ETF.

4.4.2.5 Calmar performance measure

The Calmar ratio (Section 3.3.6) recognises that when returns are not distributed normally, the risk measurement needs to account for extreme risk events. The Calmar ratio uses the maximum drawdown as the risk measurement (Eling & Schuhmacher, 2007). The maximum drawdown is represented by the biggest loss recorded, in comparison with the highest level reached by the fund during the period (Amenc *et al.*, 2004:23). Figure 4.1 showed the strong upward market movement, which contained very few severe downturns. On a daily basis, however, moderate downturns were experienced by all ETFs in the sample. The inclusion of the Calmar ratio into the study was done to capture these downturns as best as possible. The rankings obtained from the Calmar analysis are presented in Table 4.11 and Table 4.12 for both SA and the US respectively.

Table 4.11: SA ETFs – Calmar rankings for period - December 2010 to January 2014

Name:		*Ratio Value:*	*Indexation Method:*
Index	Best	1.3520	Index
ETF X	↓	1.3421	Fundamental
ETF U		1.3253	Market Cap
ETF Y		0.9976	Fundamental
ETF V		0.8451	Market Cap
ETF W		0.1516	Market Cap
ETF Z	Worst	0.0796	Equally Weighted

Source: Compiled by the author

The Calmar rankings proved to have substantially different results than those obtained by other performance measures. For the South African market, it can be seen that the steady upward movement of the market index transcended the performance of all ETFs aiming to track and/or outperform that market. No clear distinction can be made about the relative success of either fundamentally weighted or market cap weighted ETFs. However, the equally weighted ETF showed a consistently low ranking. The findings for fundamentally weighted and market cap weighted ETFs are inconclusive.

Specific analysis revealed the continuous poor ranking for ETF W. The strong downside risk of ETF W is also confirmed using the Calmar ratio, as it ranks very low compared to other market cap weighted ETFs. By combining both the Sortino and Calmar ratio results, it becomes clear that ETF W does not provide ideal market tracking abilities, as would be expected from a market cap weighted ETF. The US Calmar rankings provided similarly mixed results as per Tbale 4.12.

Table 4.12: US ETFs – Calmar rankings for period - December 2010 to January 2014

Name:		*Ratio Value:*	*Indexation Method:*
ETF I	Best	1.7482	3x Long Leveraged
ETF F	↓	1.6721	Fundamental
ETF B		1.0837	Market Cap
ETF A		1.0444	Market Cap
ETF E		1.0354	Equally Weighted
ETF D		0.9684	Fundamental
ETF C		0.9431	Market Cap
ETF G		0.9263	2x Long Leveraged
Index		0.8661	Index
ETF J		-0.8002	-3x Short Leveraged
ETF H	Worst	-0.8602	-2x Short Leveraged

Source: Compiled by the author

In comparison to the market index, most ETFs sustained smaller maximum downturns and subsequently rank better on a risk-adjusted basis. The comparison between market cap weighted, fundamentally weighted, and equally weighted ETFs did not provide a sufficient indication of outperformance of one category above the others. It can, however, be noted that the equally weighted ETF in the US market for the first time shows an outperformance relative to the market cap weighted and fundamentally weighted ETFs in the sample. This was not the case with the Sharpe, Treynor or Sortino rankings. The finding concur with the literature, as it was indicated that in a bull-market the equally weighted indexation method possesses the ability to outperform other indexation methods due to the larger weight that is allocated to smaller stocks (Stevenson, 2012).

The long leveraged ETFs provided a surprisingly high ranking with the Calmar ratio. While ETF G outperformed the market index, ETF I showed an outperformance of all ETFs in the sample. When considering the components of the Calmar ratio (returns in numerator and maximum drawdown risk in the denominator), a better explanation can be obtained. The maximum drawdown of ETF I was very much in line with the market index's drawdown. However, the much higher return, as contained in the numerator, allowed for a better Calmar ranking.

4.4.2.6 Information performance ratio

The information ratio (Section 3.3.7) shows the return in excess of a benchmark portfolio (alpha) divided by the standard deviation of the excess return (Reilly & Brown, 2009:942). The standard deviation of the excess returns is considered the tracking error of the fund, as it measures how closely the returns match the benchmark index (Bacon, 2004:4). The information ratio, therefore, measures the abnormal return per unit of risk, where the risk is measured by the tracking error (Bodie *et al*., 2010).

The application of the information ratio to passively managed funds requires that a key distinction be made to an actively managed fund. The information ratio represents the ability of the active manager to generate portfolio return in excess of a set benchmark (Reilly & Brown, 2009:942). Traditional (market cap) passive funds do not aim to deliver such an outperformance, but seek to track the market instead. Negative excess return will be present in the numerator of the information ratio due to the underperformance of a market-tracking product to the benchmark index. This requires that a more detailed analysis be made. The breakdown of the information ratio excludes the ratio value for the benchmark index, as the index formed the comparable level for the tracking error measurements. The information ratio rankings of the South African market are presented in Table 4.13.

Table 4.13: SA ETFs – Information ratio rankings for period - December 2010 to January 2014

Name:		*Ratio Value:*	*Indexation Method:*
ETF Y	Best	0.076	Fundamental
ETF X	↓	0.030	Fundamental
ETF V		-0.032	Market Cap
ETF U		-0.033	Market Cap
ETF W		-0.038	Market Cap
ETF Z	Worst	-0.318	Equally Weighted

Source: Compiled by the author

The information rankings are very consistent with other performance rankings, as they indicate the ability of fundamentally weighted ETFs to deliver superior risk-adjusted performance rankings compared to alternatively indexed ETFs. The information ratio, furthermore, shows that only the fundamentally weighted ETFs in the South African sample were able to deliver positive excess return.[66] Both the market cap weighted ETFs and the equally weighted ETF underperformed the benchmark in this regard. The aim of fundamentally weighted ETF construction is to obtain a value bias, allowing it to deliver an outperformance of the market. For the period under review, the fundamentally weighted ETFs proved to be more mean-variance efficient.

The information ratio rankings for the US market presented in Table 4.14 provide surprising results. The market cap weighted ETFs clearly outperformed the fundamentally weighted and equally weighted ETFs. All market cap weighted ETFs outperformed relative to alternative indexation categories, which was not the case with previously mentioned performance measures. The positive value for the information ratio for nearly all ETFs (short leveraged ETFs did not conform) shows a positive excess return for these ETFs above the market index. A review of Table 4.4 proves that this is indeed the case. The strong upward momentum of the markets can be said to explain these rankings. This finding aligns perfectly with the literature, which indicates that the momentum bias of market cap weighted indices will hurt the

[66] The fundamentally weighted ETFs are the only ETFs that have a positive Information ratio. The negative value for other ETFs is a result of the negative excess returns.

performance of fundamental indexation in markets with extreme momentum (Hsu & Campollo, 2006).

Table 4.14: US ETFs – Information ratio rankings for period - December 2010 to January 2014

Name:		*Ratio Value:*	*Indexation Method:*
ETF G	Best	6.640	2x Long Leveraged
ETF I	↓	6.418	3x Long Leveraged
ETF A		2.739	Market Cap
ETF B		2.033	Market Cap
ETF C		1.976	Market Cap
ETF E		0.970	Equally Weighted
ETF D		0.969	Fundamental
ETF F		0.216	Fundamental
ETF J		-17.426	-3x Short Leveraged
ETF H	Worst	-22.676	-2x Short Leveraged

Source: Compiled by the author

A special note must be pointed out in regard to the adjustment that was made to the tracking errors for leveraged ETFs.[67] Tracking errors were calculated on the ability of such funds to deliver a multiple of the underlying index.[68] Therefore, only deviations away from the multiplied index value were considered as tracking errors. The adjustment allows a more reasonable comparison to be made with the tracking errors of other ETFs. The higher information ratio values for bull-market leveraged ETFs (long leveraged ETFs) reflect their ability to achieve excess return compared to the risk of not obtaining the index multiple.

4.4.2.7 Omega performance ratio

The Omega ratio as discussed in Section 3.3.8 forms the decisive performance ratio for this study. The mixed findings obtained using other performance ratios can be attributed to the distribution characteristics of the ETFs under review. The performance ratio comparison in Section 4.3.3 clearly showed how a non-normal distribution of returns calls for a performance measure that integrates the higher

[67] Tracking errors are presented in Section 4.4.3.2

[68] The tracking error was determined by the deviation away from a value of 2x, 3x, -2x or -3x the market index.

order moments of the distribution series. From the distribution statistics in Table 4.1 and Table 4.2, a non-normal distribution in the return was noticeably apparent. Performance findings obtained by the Omega ratio are, therefore, of particular importance to this study as it incorporates the entire return distribution.

The Omega ratio is able to capture the higher order moments as it utilises all information in the return series instead of using simple figures such as mean and variance (Keating & Shadwick, 2002). The Omega ratio achieves this feat by using a ratio of both gains and losses above and below a return threshold, and subsequently determines the probability-weighted ratio of return above and below that threshold (Botha, 2006:6). The Omega ratio is, therefore, the weighted gains or losses relative to a specified return threshold (Van Dyk *et al.,* 2012). A high value for the Omega ratio indicates that the return distribution towards the right-hand side of the threshold level is denser than the returns to the left side of the threshold.

Two key threshold levels were selected for this study. In order to obtain rankings based on positive returns, a threshold level equal to the risk-free rate (+ risk-free rate) was used. In order to capture the downside risk of each ETF, a negative threshold level was necessary for consideration. To keep comparisons consistent, a value equal to the negative of the risk-free rate (- risk-free rate) was used. Values of +0,187% and -0,187% were used for both of these respective threshold levels.

As the threshold level is selected lower and lower, fewer of the returns will account as losses. Once none of the return series losses is lower than the threshold level, the Omega ratio will tend to a value of infinity. The sooner the ratio heads for infinity (using a negative threshold), the less risky the portfolio is on the downside, as it means that there are less negative returns (Botha, 2006). The opposite applies for a positive threshold. As a larger threshold level is selected, less of the positive returns will exceed the specified threshold level, which means the numerator, and subsequently the Omega ratio value, will move to zero. The slower the Omega ratio tends to zero (using a positive threshold), the greater the potential for positive returns (Botha, 2006). Rankings for both positive and negative threshold levels varied considerably and are represented in Table 4.15 and Table 4.16 for SA and the US respectively.

Table 4.15: SA ETFs – Omega rankings for period - December 2010 to January 2014

Threshold = +Risk free rate			
Name:		*Ratio Value:*	*Indexation Method:*
ETF Y	Best	0.864	Fundamental
Index	↓	0.812	Index
ETF U		0.800	Market Cap
ETF V		0.790	Market Cap
ETF X		0.790	Fundamental
ETF W		0.613	Market Cap
ETF Z	Worst	0.258	Equally Weighted
Threshold = -Risk free rate			
Index	Best	2.606	Index
ETF U	↓	2.600	Market Cap
ETF V		2.492	Market Cap
ETF W		2.315	Market Cap
ETF Y		2.253	Fundamental
ETF X		2.212	Fundamental
ETF Z	Worst	0.868	Equally Weighted

Source: Compiled by the author

The breakdown between the positive and negative threshold levels for the South African sample of ETFs provides a view of how differently the ETFs react when positive and negative returns are considered. The Omega rankings for a positive threshold (+ risk-free rate) show great similarity with rankings obtained by other performance ratios. Fundamentally weighted ETFs displayed strongly against other indexation methods, while equally weighted ETFs retained their poor ranking. Thus, it is reconfirmed that fundamentally weighted ETFs have the ability to deliver an outperformance when returns are positive.

However, the most significant finding was gained from the negative threshold analysis. Market cap weighted ETFs proved to be superior, as they outperformed all other ETFs in the sample. Therefore, from a risk perspective it can be said that the market cap weighted ETFs contain less risk when returns tend to be negative. As the period under review was mostly a positive upswing of the market, other performance ratios echoed the results gained by a positive threshold level. However, using the Omega ratio, an indication is given that other categories of ETF indexation will not deliver favourable results should a great number of negative values arise in the return series.

Table 4.16: US ETFs – Omega rankings for period - December 2010 to January 2014

Threshold = +Risk free rate			
Name:		*Ratio Value:*	*Indexation Method:*
ETF I	Best	2.295	3x Long Leveraged
ETF G	↓	1.987	2x Long Leveraged
ETF B		1.099	Market Cap
ETF C		1.096	Market Cap
ETF A		1.089	Market Cap
Index		1.047	Index
ETF E		1.036	Equally Weighted
ETF D		1.021	Fundamentals
ETF F		0.778	Fundamentals
ETF J		0.172	-3x Short Leveraged
ETF H	Worst	0.146	-2x Short Leveraged
Threshold = -Risk free rate			
ETF A	Best	13.802	Market Cap
ETF C	↓	13.784	Market Cap
ETF B		13.695	Market Cap
Index		12.471	Index
ETF F		11.484	Fundamental
ETF D		9.129	Fundamental
ETF E		8.700	Equally Weighted
ETF G		7.686	2x Long Leveraged
ETF I		5.283	3x Long Leveraged
ETF H		0.516	-2x Short Leveraged
ETF J	Worst	0.421	-3x Short Leveraged

Source: Compiled by the author

US Omega rankings provided similarly noteworthy results. The use of a positive threshold level showed the dominance of the long leveraged ETFs and their ability to deliver substantial gains to the positive side. Long leveraged ETFs, therefore, delivered when the markets moved upwards, while short leveraged ETFs (by design) have very few positive returns on the upside during a bull-market. Market cap weighted, equally weighted and fundamentally weighted ETFs showed identical rankings compared to the rankings obtained by the Information ratio. The strong performance of the market cap weighted ETFs can again be attributed to the upward market momentum. The larger size of the US market favours stocks that have greater market capitalisation in a bull-market.

The negative threshold analysis showed that market cap weighted ETFs contain less risk when compared to all other indexation approaches. This is a similar finding to the SA market. The true riskiness of all leveraged ETFs clearly is apparent when considering the downside risk. Although on the upside, the long leveraged ETFs highlighted the ability to deliver substantially large returns, the negative threshold analysis shows that such large returns are accompanied by equally large deviations to the downside. Both long and short leveraged ETFs, therefore, rank poorly when a negative threshold level is selected.

The findings of the Omega ratio showed that market cap weighted ETFs contain less risk than all other categories of ETF indexation. This finding will be substantiated using risk measurements and diversification measurements.

4.4.3 Volatility and risk

4.4.3.1 EWMA

The exponentially weighted moving average (EWMA), as discussed in Section 3.4.3.3, measures the average volatility by assigning less and less weight to past data points the further it stretches into the past. The EWMA achieves this decreasing allocation of weight by assigning a decay factor, λ, to the most recent observation and then exponentially declining the weight for each subsequent past return observation (JP Morgan/Reuters, 1996). EMWA allows more recent observations to carry a greater weight in the calculation of volatility, which is in contrast to a standard deviation (simple moving average), which assigns an equal weight to all the price fluctuations.

Section 3.4.3.3 clearly indicates the method of selecting the optimal decay factor, λ^*, which provides the decay factor that delivers the best forecasts. When dealing with multiple time series in the data set, one optimal decay factor needs to be acquired. In order to obtain an accurate optimal lambda it is necessary to evaluate a large sample of time series. This was, however, not the case for this study. Smaller samples will provide inaccurate optimal decay factors. The optimal lambda gathered using several years of US data as reported in JP Morgan/Reuters (1996) was 0,94, and subsequently this value was used as the decay factor for this study. The annualised EWMA for both SA and the US are presented in Table 4.17 and Table 4.18 respectively.

Table 4.17: SA ETFs – EWMA rankings for period - December 2010 to January 2014

Name:		*Volatility:*	*Indexation Method:*
ETF X	Best	14.62%	Fundamental
Index	↓	15.94%	Index
ETF U		16.06%	Market Cap
ETF V		16.06%	Market Cap
ETF Y		16.45%	Fundamental
ETF W		21.99%	Market Cap
ETF Z	Worst	25.41%	Equally Weighted

Source: Compiled by the author

Table 4.18: US ETFs – EWMA rankings for period - December 2010 to January 2014

Name:		*Volatility:*	*Indexation Method:*
ETF F	Best	13.71%	Fundamental
ETF D	↓	14.76%	Fundamental
ETF A		14.79%	Market Cap
ETF B		14.80%	Market Cap
ETF C		14.83%	Market Cap
Index		14.85%	Index
ETF E		16.31%	Equally Weighted
ETF H		29.51%	-2x Short Leveraged
ETF G		29.53%	2x Long Leveraged
ETF I		44.62%	3x Long Leveraged
ETF J	Worst	44.74%	-3x Short Leveraged

Source: Compiled by the author

The EWMA analysis for both markets showed that fundamentally weighted ETFs exhibited lower volatilities over the sample period. This finding stands in contrast to the negative Omega threshold analysis and requires that other risk measures such as beta and tracking errors be considered in addition to the EWMA. The consistent poor rankings obtained by the performance measures for equally weighted ETFs are reinforced by the EWMA risk measurement. The poor risk-adjusted performances of the equally weighted ETFs are as a result of the greater amount of risk present in these products. A subsequent conclusion can be made that smaller (lower market cap weighted) stocks proved to be very volatile over the period under review, while the larger capitalised stocks contained in the market cap weighted and fundamentally weighted ETFs proved to exhibit a much more stable growth in returns.

The negative threshold analysis with the Omega ratio highlighted the risky nature of leveraged ETFs, and this is again noticeable with the EWMA. Within the US market comparison, the leveraged ETFs showed volatilities that were much greater than all other indexation methods. Leveraged ETFs have shown that when the market direction is accounted for correctly, it can be used to obtain significant gains. However, in order to achieve such results, great risk needs to be incurred.

4.4.3.2 Tracking errors

Tracking errors arise due to differences in the return experienced by the ETFs and the return shown by the reference benchmark index. Tracking errors are calculated as the annualised deviation of the daily differences between the ETF returns and the index returns (Stevenson, 2012:147). For the purposes of this analysis, the JSE Top 40 index and S&P500 index were used to determine the tracking errors. As mentioned with the Information ratio, the tracking errors for the US sample needed to be adjusted to reflect the nature of leveraged ETFs. The multiple of the index that each of the leveraged ETFs seek to deliver was factored into the calculation to ascertain to what degree the leveraged ETF is able to deliver that multiple of the index. Tracking error rankings for the South African sample as presented in Table 4.19 provided very similar results to the rankings of the negative threshold Omega analysis.

Table 4.19: SA ETFs – Tracking errors for period - December 2010 to January 2014

Name:		*Tracking Error:*	*Indexation Method:*
ETF U	Best	2.34%	Market Cap
ETF V	↓	5.62%	Market Cap
ETF Y		11.01%	Fundamental
ETF X		11.72%	Fundamental
ETF Z		20.50%	Equally Weighted
ETF W	Worst	29.10%	Market Cap

Source: Compiled by the author

According to the results, the market cap weighted ETFs contained the lowest risk levels when compared to the benchmark index. The beta value analysis in Section 4.4.3.3 provides a greater insight into such an occurrence. ETF W proved to be an outlier during the Sortino and Calmar analysis and show a similar position in the EWMA rankings. The EWMA risk measure helps to explain the poor performance by highlighting the great amount of volatility that is associated with ETF W. Both the downside risk (Sortino ratio) and maximum drawdown (Calmar ratio) are impacted due to the great amount of price fluctuations experienced by ETF W. However, this is an uncharacteristic observation for a market cap weighted ETF. The beta analysis was once more critical to evaluate the degree to which the ETF moves with the market index. The beta results are presented in the next section.

The US sample (tracking errors presented in Table 4.20) concurs with the SA results and reemphasises the less risky nature of the standard market cap weighted ETFs. The market cap weighted ETFs (also known as beta ETFs) perform as expected and show very little movement away from the set benchmark index. Fundamentally weighted and the equally weighted ETFs did show greater tracking errors as the set benchmark index contains a vastly different set of stocks. ETF F showed a significant deviation away from the set benchmark index. Closer analysis of ETF F revealed that the fund holds only 69 stocks, whereas ETF D (a rival fundamental ETF) holds 1000 stocks, while the market index holds 500 stocks. Therefore, the larger tracking error can be accredited directly to incorrect sample selection[69] by the fund.

Table 4.20: US ETFs – Tracking errors for period - December 2010 to January 2014 (with adjustment for leveraged ETFs)

Name:		*Tracking Error:*	*Indexation Method:*
ETF A	Best	0.84%	Market Cap
ETF B	↓	1.17%	Market Cap
ETF C		1.18%	Market Cap
ETF H		1.87%	-2x Short Leveraged
ETF G		2.08%	2x Long Leveraged
ETF D		2.31%	Fundamental
ETF E		2.97%	Equally Weighted
ETF J		3.24%	-3x Short Leveraged
ETF I		3.39%	3x Long Leveraged
ETF F	Worst	9.01%	Fundamental

Source: Compiled by the author

Long and short leveraged ETFs performed slightly better due to the adjustments made for the leveraged factors. The findings did however point out that the tracking errors were not necessarily tied to the leveraged factor or the direction of the leveraged ETF. Expectations are that the long leveraged ETFs would dominate the short leveraged ETFs in terms of the tracking error measurement. The tracking errors for two times (2x) and negative two times (-2x) leveraged ETFs, however, showed better results than the three times (3x) and negative three times (-3x) leveraged ETFs. A more detailed analysis revealed that the provider of the ETF and the practices used by the provider could be attributed to the alternative rankings. Both two times (2x) and negative two times (-2x) leveraged ETFs were selected from a different provider than the three times (3x) and negative three times (-3x) leveraged ETFs. This reveals that part of the risk contained in a leveraged ETF is indeed counterparty risk.

[69] Representative sampling was shown to be a technique employed by index tracking funds in order to achieve the returns of a specified index (see Section 2.4.2).

4.4.3.3 Beta

Beta (the systematic risk of an asset) was discussed in detail in Section 3.2.3.1. Beta measures the extent to which the value of a stock (or financial asset) will vary in reaction to the movement in the overall market (Gitman & Joehnk, 1990:197). Stocks with a beta close to one have systematic risk approximately equal to the market, while stocks with a beta greater than or less than one have systematic risk greater than or less than the market (Bernstein & Damodaran, 1998:88). The market index has a beta value of one. The tracking errors presented in the previous section have to be considered alongside the beta value for each ETF, as this describes how closely the returns of the ETFs match those of the market on a daily basis. Table 4.21 and Table 4.22 present the beta rankings for SA and the US respectively.

Table 4.21: SA ETFs – Beta rankings for period - December 2010 to January 2014

Name:		*Beta Value:*	*Indexation Method:*
Index	Market Beta	1.00	Index
ETF U	< Market Beta	0.996	Market Cap
ETF V		0.964	Market Cap
ETF Y		0.778	Fundamental
ETF X		0.670	Fundamental
ETF Z		0.611	Equally Weighted
ETF W		0.401	Market Cap

Source: Compiled by the author

The SA beta analysis reveals beta values that are very much in line with expectations. Two of the three beta funds (traditional market cap weighted ETFs) performed as expected and delivered betas very close to the market index. Fundamentally weighted and equally weighted ETF betas showed a deviation away from the value of one. As beta is representative of the amount of systematic risk, it can be gathered that the fundamentally weighted and equally weighted indexation categories carry less systematic risk, and subsequently more unsystematic risk. The beta analysis supports the findings from the performance ratios as it explains the good performance from the fundamentally weighted ETFs. Allocating greater weight to the smaller shares on the index, incurs more risk that is unsystematic. Whereas the greater amounts of unsystematic risk favoured the fundamentally weighted ETFs, it did the opposite for the equally weighted ETF. The negative Omega ratio analysis proved that greater amounts of risk were present in the alternatively indexed ETFs, while the beta comparison confirms that this increased risk is as a result of augmented unsystematic[70] risk.

Furthermore, the analysis provided a supplementary explanation for the poor tracking error of ETF W. Table 4.21 shows that ETF W, a market cap weighted ETF, performs poorly in attempting to mimic the daily returns of the index, as its beta value does not resemble that of the market. It can, therefore, be said that ETF W contains a great deal of unsystematic risk, which partly explains the large tracking errors and poor performance with other performance measures.

Table 4.22: US ETFs – Beta rankings for period - December 2010 to January 2014

Name:		*Beta Value:*	*Indexation Method:*
ETF I	> Market Beta	2.996	3x Long Leveraged
ETF G		1.979	2x Long Leveraged
ETF E		1.089	Equally Weighted
ETF D		1.013	Fundamental
Index	Market Beta	1.00	Index
ETF C	< Market Beta	0.995	Market Cap
ETF A		0.990	Market Cap
ETF B		0.987	Market Cap
ETF F		0.762	Fundamental
ETF H		-1.978	-2x Short Leveraged
ETF J		-3.011	-3x Short Leveraged

Source: Compiled by the author

The US beta analysis provides a clear view of the effectiveness of leveraged ETFs to deliver a multiple of the underlying index. The three times (3x) long leveraged ETF shows a beta value of approximately three; the two times (2x) long leveraged ETF has a beta that is as expected very close to two; while the short leveraged ETFs displayed beta values very similar to expectations as well. All leveraged ETFs, therefore, hold much greater levels of systematic risk.

[70] Unsystematic risk was discussed in Section 3.2.3.2 and refers to the unique or diversifiable risk associated with a security (Wuite, 2009:396).

As was the case with the SA market, the traditional market cap weighted ETFs showed beta values very close to one. The fundamentally weighted ETFs and the equally weighted ETF showed the existence of a greater amount of unsystematic risk in these ETFs.

Considering the findings obtained by the various performance and risk measures, the diversification of the various ETFs can be presented to determine which ETF indexation method provides the greatest amount of portfolio diversification.

4.4.4 Diversification

4.4.4.1 Standard error of estimate (SEE)

The standard error of estimate (SEE) was used as the diversification measurement for this study. Section 4.3.5 explained the use of this measure in detail. A linear regression analysis was performed between each ETF and the selected benchmark index. This analysis is based on the single index model as presented in Section 3.2.3.3, and provides a measure of the unsystematic risk present with each of the ETFs. The smaller the residuals variance, and subsequently the standard error of estimate, the more diversified the portfolio can be said to be. The return series of each ETF was considered as the dependent variable, while the selected market index was used as the independent variable during each regression analysis. The results obtained for the regression analysis are presented in Table 4.23 and Table 4.24 for SA and the US respectively.

Table 4.23: SA ETFs diversification rankings – standard error of estimate for period December 2010 to January 2014

Name:		*SEE Value:*	*R^2 Value:*	*Indexation Method:*
ETF U	Best	0.160%	0.977	Market Cap
ETF V	↓	0.357%	0.888	Market Cap
ETF Y		0.646%	0.618	Fundamental
ETF X		0.650%	0.542	Fundamental
ETF Z		1.226%	0.219	Equally Weighted
ETF W	Worst	1.732%	0.055	Market Cap

Source: Compiled by the author

The SEE analysis results for SA tie in well with the results obtained during the beta and negative threshold Omega analysis. Market cap weighted ETFs contained smaller residual variances, and subsequently contained less unsystematic risk according to the single index model. The beta values in Table 4.21 confirmed that the fundamentally weighted ETFs and the equally weighted ETF showed greater levels of unsystematic risk when compared to the market index, which is reconfirmed by the SEE. ETF W, a market cap weighted ETF does, however, show the greatest amount of unsystematic risk as highlighted by the extreme deviation between the estimated regression values and the actual returns of ETF W. The R squared[71] value for ETF W shows the exceptionally poor ability to track the market as only 5 percent of the variance of ETF W can be explained by the market variance. Therefore, the results of ETF W can not be seen as a true reflection of a typical market cap weighted ETF.

The conclusion to be drawn from this analysis is that during a bull-market with strong upward momentum, ETFs with beta values close to the market beta will have much lower tracking errors, while at the same time prove to possess less unsystematic risk. The negative threshold Omega analysis also showed that ETFs holding such characteristics contain less downside risk. It can be said that during the period under review, the market cap weighted ETFs were the best-diversified ETFs in the SA sample.

The US market sample showed similar results to the SA market as the market cap weighted ETFs were shown to contain the least amount of unsystematic risk. Leveraged ETFs proved to be more diversified than expected as two times (2x) and negative two times (-2x) leveraged ETFs outperformed relative to the fundamentally weighted and equally weighted ETFs in the sample. This occurrence can be attributed to the diversification contained in the underlying index of the leveraged ETFs (the market cap weighted index). As the leveraged ETFs are based on a more diversified index, their amplified results delivered a more diversified portfolio than would be expected from a product with such a high-risk ranking.

[71] The proportion of the variance of a response variable that is explained by the predictor variables when a linear regression is performed (Wuite, 2009).

Table 4.24: US ETFs diversification rankings – standard error of estimate for period December 2010 to January 2014

Name:		*SEE Value:*	*R^2 Value:*	*Indexation Method:*
ETF A	Best	0.052%	0.997	Market Cap
ETF B	↓	0.073%	0.995	Market Cap
ETF C		0.075%	0.995	Market Cap
ETF H		0.117%	0.997	-2x Short Leveraged
ETF G		0.130%	0.996	2x Long Leveraged
ETF D		0.146%	0.981	Fundamental
ETF E		0.163%	0.979	Equally Weighted
ETF J		0.204%	0.996	-3x Short Leveraged
ETF I		0.215%	0.995	3x Long Leveraged
ETF F	Worst	0.515%	0.700	Fundamental

Source: Compiled by the author

ETF F showed the largest tracking error out of the US sample, and subsequently, ranks poorly with the SEE as well. The same concluding remarks can be made for the US sample as with the SA sample. During the bull-market periods, the market cap weighted ETFs proved to be the most diversified ETFs in the sample. The close relation of these beta funds to the market index proved to deliver the smallest values for the standard error of estimate (least amount of unsystematic risk) and subsequently allowed the best rankings to be obtained by the Information ratio and negative threshold Omega analysis. Leveraged ETFs proved to be more diversified when compared to the market index, if only because of their dependence on an already diversified underlying market cap weighted index.

4.5 SUMMARY

Chapter 4 presented the empirical analysis for the study by comparing a sample of equity ETFs in both the SA and US market on the basis of risk-adjusted performance, volatility and diversification. Each of the metrics were used to determine the ranking of market cap weighted, fundamentally weighted, equally weighted and leveraged ETFs in relation to each other. The period under review was restricted to a three-year upward growth equity market (December 2014 to January 2014) due to the relative short dated existence of SA fundamentally weighted ETFs.

The risk-adjusted performance analysis included a comprehensive review of the six performance measures used during the study. The shape of the distribution of the return series was indicated to be the determining factor in selecting the optimal performance ratio. The descriptive statistics for the data set revealed that the assumption of normality does not hold for the period under review and as such requires a metric that incorporates the higher order moments of the distribution. The Omega ratio was identified as the superior ratio in this regard as it contains the ability to deliver consist ranking results at various levels of a return threshold.

The summary results contained in Table A and Table B (appendix) indicate that in general, the fundamentally weighted ETFs exhibited better risk-adjusted performance when using traditional performance measures. However, the decisive finding was obtained through the use of the negative threshold Omega ranking, which revealed the supremacy of market cap weighted ETFs, especially when analysing for negative returns. This finding concurs with the risk and diversification rankings, which indicated that equally weighted and fundamentally weighted ETFs on average contained more unsystematic risk than market cap weighted ETFs. Higher levels of unsystematic risk favoured the fundamentally weighted ETFs during the bull-market period, but limited the performance of the equally weighted ETFs. Leveraged ETFs as measured in the US sample showed the ability to deliver great returns, but similarly proved to contain the most risk out of all the ETFs in the sample.

In conclusion, it can be said that the direction and momentum of the overall market will be the determining factor that establishes which indexation category outperforms relative to the other.

CHAPTER 5
SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 SUMMARY

Exchange traded funds (ETFs) have gained increased popularity as an investment vehicle over the decade spanning from 2003 to 2013. The increased popularity brings with it continuous innovation and increased sophistication in the product offerings. As such, the more recent additions to the ETF market have moved away from the traditional passive tracking nature of market capitalisation weighted ETFs and instead used progressively more complex methodologies to construct the ETF portfolio. To determine the true benefits of these alternatively indexed ETFs, a comparison was made between the various indexation categories on a risk-adjusted performance basis.

Chapter 1 highlighted the background to the research and identified the rationale for researching the problem. The promotion of ETFs for their diversification benefits required that the comparative analysis include a consideration of the diversification potential that each of the various indexation methods holds. The primary objective of the study was stated subsequently to compare the returns and volatility of the four identified ETF categories (Market cap weighted, fundamentally weighted, equally weighted and leveraged ETFs) in order to determine which ETF indexation category offers the greatest diversification benefits.

Chapter 2 of the study provided a thorough discussion about ETFs as an investment vehicle. The foundational theory upon which passive investing stands, *inter alia* the efficient market hypothesis (EMH), provided the rationale for investing in ETFs. The EMH proposed that with the absence of abnormal performance in an efficient market, the passive investor could perform as well as the general market by simply tracking a broad market index.

The creation and redemption process whereby ETFs are issued into, or extracted from the market by authorised participants, was indicated as a key distinguishing characteristic of ETFs that helps to ensure liquidity and arbitrage-free trading in the market. The market prices of ETFs are as a result of the creation and redemption process never allowed to deviate too far from the NAV of the underlying securities. The variety of ETFs traded in the market was shown to offer investors the ability to gain access to very specific niche sectors. The overall breakdown of ETPs presented the difference between ETFs and ETNs. ETNs were shown to follow a debt-like structure and were subsequently excluded from further analysis in the study. Leveraged ETFs, a relatively new ETF category, were however included in the study. Daily leveraged ETFs were introduced to be an ETF type that seeks to deliver a multiple of the benchmark index on a daily basis. This characteristic greatly influenced the data frequency of the study as the daily reset rate of leveraged ETFs only allow for meaningful return calculations to be made on a daily basis.

Competing investment vehicles, such as unit trusts, index funds and hedge funds were compared to ETFs to separate ETFs as a distinctive investment product. Unit trusts (mutual funds) were indicated to be investment vehicles that hold the closest similarities to ETFs. The lack of transparency with regards to holdings disclosure and the excessive fees charged by unit trusts were listed as two of the major drawbacks of these actively managed funds. Furthermore, ETFs were shown to have the advantage of being listed on registered stock exchanges, and therefore, allowed for intra-day price observations – a characteristic that none of the other investment vehicles possess.

Chapter 2 furthermore identified the risks associated with ETFs. The passive index-tracking nature of ETFs revealed tracking errors as a great risk to potential investors. Counterparty risk could also be identified within the ETF structure, because securities lending and synthetic replication of an index added an additional layer of risk that might not be directly noticeable. Given the risks associated with ETFs, some of the regulations governing ETFs were discussed. The application of CISCA, FAIS and FICA to ETFs creates a highly regulated and robust market. The SA ETF market furthermore was indicated to restrict the creation of leveraged ETFs. Prohibition of leveraged ETFs within the SA market led to the inclusion of the US sample of ETFs, as such products are regularly traded in that market. The growing interest by institutional investors which leveraged ETFs attracted globally, and particularly in the US, necessitated that this ETF category be included in the comparison analysis.

Chapter 3 is based on a discussion of portfolio theory and its impact on diversification and risk of a portfolio. The Markowitz portfolio theory proposed that the most diversified portfolio could be constructed when investing in a portfolio of securities that have a close covariance. With a risk-free asset added into the asset mix, an optimal portfolio could be obtained that exhibits the best risk-adjusted returns. The Markowitz portfolio theory presented computational limitations as the inclusion of numerous securities into the portfolio created sizeable covariance matrices. The single index model was explained as an effective alternative to the Markowitz portfolio theory as it makes the simplifying assumption that all co-movements of individual assets in the portfolio can be accounted for by the variability of return in the market portfolio. The beta of each individual security, relative to the theoretical market portfolio, therefore, could be used to explain the amount of systematic (market) risk of the security. The resulting implication of the model shows that diversification can be obtained by increasing the number of securities in the portfolio. The variance of the unsystematic (unique) risk of the overall portfolio can be reduced and the portfolio risk that remains is the systematic risk.

The chapter also discussed the capital asset pricing model (CAPM) and arbitrage pricing theory (APT) as a means to determine the expected rate of return for a security. Whereas the CAPM follows similar mechanics as the single index model by using a single risk factor, the APT makes far fewer restrictive assumptions about the market and incorporates the use of multiple risk factors.

The second focus of Chapter 3 centered on the evaluation of fund performance. Various traditional risk-adjusted performance measures were discussed for their applications during the empirical analysis of the study. The Sharpe ratio, Treynor ratio, Sortino ratio, Calmar ratio and Information ratio were all distinguished based on the different measures of risk used during the performance evaluation. The Omega ratio was indicated as the superior ratio, because it possesses the distinctive characteristic that no assumptions are required of the return series, and as such incorporates both the skewness and kurtosis of the distribution when comparing performance.

The final focus of Chapter 3 dealt with various volatility measurements. Both implied (forward looking) and historical approaches to volatility were identified. The historical volatility measurement was described fully using the standard deviation, autoregressive conditional heteroscedasticity (ARCH) models and the exponentially weighted moving average (EWMA). The EWMA was selected as the volatility measurement of choice to compare the various ETF indexation categories. The use of a smoothing factor, lambda, allows the EWMA to assign a greater weighting to more recent price fluctuations.

Chapter 4 represents the crux of the dissertation as it addressed the primary objective of the study. A review of the four indexation methodologies revealed the distinguishing characteristics of each. Market capitalisation (market cap) weighted indexation was indicated to be the most widely used indexation methodology, but was shown to contain some shortcomings. Fundamentally weighted and equally weighted indexation methods were discussed as possible solutions to overcome the limitations with a market cap weighted methodology. Leveraged indexation was indicated to be an alpha-seeking approach that aims to outperform the market index by a set leveraged factor. Preservation of liquidity and the existence of low turnover rates were illustrated to be the main challenges for any alternative indexation methodologies. Previous empirical studies comparing the various indexation methodologies revealed the benefits of fundamentally weighted and equally weighted indices, but also proved that a strong upward momentum in the market could be advantageous to market cap-weighted indices. The exclusion of leveraged indexation from previous studies and the lack of direct application to ETFs necessitated the analysis of this study. A sample of US ETFs was included into the study due to the non-existence of leveraged ETFs in the SA market.

The empirical results obtained from the performance, volatility, risk and diversification comparisons are presented in the latter part of Chapter 4. Six different risk-adjusted performance measures were used to evaluate the various ETF indexation methodologies. Furthermore, the EWMA measurement was employed to establish the volatility characteristics of each ETF indexation method. The standard error of estimate was also used to determine the residual variance of the regression analysis between each ETF and the benchmark market index in order to establish the diversification potential that they hold.

The Sharpe ratio analysis provided a means to compare the ETF indexation methodologies on a risk-adjusted basis. The use of standard deviation as the risk measure delivered results that incorporated total risk into the computation. For the SA sample, it was indicated that the rankings based on the Sharpe ratio were consistent with the absolute return rankings. Fundamentally weighted ETFs were dominant, while the equally weighted ETF ranked lower compared to the other categories. For the US sample, the risk-adjusted rankings of the Sharpe ratio differed considerably from the absolute return rankings, which indicated that the equally weighted ETF was most affected by the risk-adjustment. The leveraged ETF category revealed risky characteristics and significantly poor risk-adjusted rankings.

The Treynor ratio analysis incorporated beta as the risk measurement. The analysis of the ETF indexation categories on the basis of their systematic risk characteristics proved to deliver alternate rankings to the Sharpe ratio analysis. The SA sample highlighted the importance of beta values, as market cap weighted ETFs ranked better when compared to the Sharpe rankings. A noticeable difference between the Treynor and Sharpe rankings exemplified the lack of diversification and the existence of higher levels of unsystematic risk in alternatively indexed ETFs. Inverse leveraged ETFs provided misleading results during the US Treynor analysis. The negative beta values and negative excess returns of this category skewed results in the favour of inverse leveraged ETFs. However, the close similarity between the Treynor and Sharpe rankings was a noticeable observation in the US sample. The improved diversification within the US sample, as indicated by this finding, could have resulted from the relatively large number of underlying securities included in the US ETF index.

The Sortino ratio analysis allowed for a comparison between the ETF indexation categories on the basis of a downside risk-adjusted performance measure. The Sortino rankings obtained from the SA sample showed inconsistent results to the Sharpe and Treynor rankings. In general, fundamentally weighted ETFs proved to outperform relative to other ETF categories, with some noticeable outliers observed for the market cap weighted category. The downside risk measure used during the Sortino analysis penalised those ETFs that showcased a severely skewed data distribution. The significantly skewed distributions of leveraged ETFs in the US sample subsequently were affected greatly as these ETFs delivered poor Sortino rankings.

The inclusion of the Calmar ratio into the study allowed for a measure to capture the extreme downturn of the ETF returns. The examination of a predominantly bull-market phase of the economy in this study, however, nullified the true benefit of the Calmar ratio. The Calmar ratio rankings for both the US and SA market provided mixed results with no clear ranking of ETF categories.

The importance of tracking errors was highlighted in previous chapters of the study and this led to the inclusion of the Information ratio into the performance evaluation. Comparisons in the South African ETF market showed that fundamentally weighted ETFs performed better when compared to alternative indexation methodologies. The US sample showed contrasting results as market cap weighted ETFs outperformed when analysing the Information ratios. The importance of the number of securities in the underlying index, the beta values of the ETFs, and the impact these factors have on the tracking errors were combined factors that create such differences between the various samples. Leveraged ETFs, as measured in the US sample, delivered good ranking results after adjusting tracking errors for the leveraged factor.

The Omega ratio was the decisive performance ratio for this study, as it exhibits an unique characteristic that allows the incorporation of higher order moments of the return distributions. The Omega ratio was considered at a positive value of the risk-free rate (0,187%) and negative value of the risk-free rate (-0,187%) as threshold levels. The separation between the threshold levels was made to illustrate the change in rankings that resulted from the respective threshold levels. Fundamentally weighted ETFs were shown to possess the ability to deliver an outperformance of alternatively indexed ETFs when returns were positive, as was indicated by the positive threshold level in the SA sample. Similarly, the US sample illustrated that leveraged ETFs, with the support of the significant benefits that they hold, could deliver substantial outperformance when returns were positive.

The negative Omega threshold analysis provided the most significant finding of this study. Analysis of a negative threshold level allowed for the riskiness of each ETF category to be evaluated. Rankings obtained from the negative Omega threshold analysis delivered significantly altered rankings compared to other performance measures. In the SA sample, the market cap weighted ETFs dominated and proved to be the preferred ETF indexation category when considering negative returns. The US sample delivered similar results and also proved the market cap weighted ETFs to be superior. Leveraged ETFs performed poorly when analysed on a negative return threshold basis. The high number of negative returns in the data series of leveraged ETFs had a severe impact on the rankings of both long and short leveraged ETFs.

The EMWA volatility measurements and alternative risk measurements (beta and tracking errors) were used to support the findings of the risk-adjusted performance measures. The SA EMWA analysis revealed that the fundamentally weighted ETFs highlighted the capacity to carry lower rates of volatility, but also that market cap weighted ETFs were, in general, not significantly more prone to market fluctuations. However, the equally weighted ETFs in both the SA and US markets exhibited some of the highest volatility measurements in the sample. Tracking error and beta results for both the US and SA provided contrasting results to the EWMA findings by indicating that market cap weighted ETFs carried the least amount of risk. This finding agreed with the results obtained from the negative Omega threshold analysis.

The final point of comparison between the various ETF indexation categories focused on the diversification potential of the various indexation methods. The standard error of estimate (SEE) obtained from the regression analysis made between each ETF and the specified benchmark indices served as the means of diversification comparison. This analysis was based on the single index model from which it could be seen that the residual variance values of the regression analysis pointed to the amount of unsystematic risk contained within each ETF. Lower levels of unsystematic risk were present in more highly diversified portfolios. The results of the SEE comparisons for both SA and the US confirmed the findings of the negative threshold Omega analysis by indicating that the market cap weighted ETFs were the most diversified, as these ETFs contained the lowest levels of unsystematic risk. Levels of diversification were higher than expected within leveraged ETFs, due to the close relationship with the underlying market cap weighted index.

5.2 CONCLUSIONS

The study sought to compare four selected indexation methods used during the construction of ETFs. The ETF indexation categories included; market cap weighted, fundamentally weighted, equally weighted and leveraged ETFs. The rise of competing indexation methodologies to traditional market cap weighted ETFs warranted an analysis of the category that delivered the best risk-adjusted return. This study primarily aimed to find the ETF indexation category that offers the greatest diversification benefits. Based on risk-adjusted performance measurements, volatility measurements and diversification measures, the following key conclusions can be drawn:

- Fundamentally weighted ETFs hold the capacity to perform well when analysed with traditional performance measures that do not incorporate the higher order moments of the return distribution. During a market upswing, measures such as the Sharpe ratio, Treynor ratio, Sortino ratio and Calmar ratio, that do not incorporate all moments of the distribution function, can show preferential results for fundamentally weighted ETFs. Advantageous volatility measurements for fundamentally weighted ETFs can be seen as supplemental byproducts of increased risk-adjusted performance.
- The Omega ratio holds the ability to capture higher order moments of the distribution of returns. This conveys alternative rankings of the indexation categories, particularly when analysed at a negative threshold level. Market cap weighted ETFs can be said to hold lower levels of risk than all other ETF categories when measured by a negative Omega threshold.
- ETF rankings obtained at a negative and positive Omega threshold level delivers alternate results due to the frequency of negative return observations. The use of a negative Omega threshold level allows downside risk to be fully encapsulated and therefore provides a more comprehensive risk measurement as opposed to a positive threshold level.

- Leveraged ETFs hold the capacity to deliver substantial returns, but significant risks are linked to improved returns. Leveraged ETFs receive added diversification benefits through close approximation with the underlying market cap weighted index.
- A strong upward trending market does not present favourable conditions for the performance of equally weighted ETFs, in comparison to alternatively indexed ETFs.
- The diversification measurements for market cap weighted ETFs concur with the rankings obtained by the Omega ratio and subsequently prove that the market cap weighted ETFs are superior, in that they are the most diversified category. Thus the primary objective was reached in the identification of this dominance by market cap weighted ETFs.

5.3 RECOMMENDATIONS FOR FUTURE RESEARCH

According to the single index model, used as a diversification measurement in this study, the market index can be regarded as the true market portfolio. The validity of the assumption that the market index represents the most diversified portfolio influenced this study as comparative rankings were based on the benchmark indices. Future research could include a comparison of ETF diversification with a measurement such as the principal component analysis (PCA), which is not dependent on the existence of a true market portfolio. The data frequency and observation period is another noteworthy area of future improvement for this study. With restricted historical data availability for some fundamentally weighted ETFs, this study was reduced to the most recent three-year period (Dec 2010 to Jan 2014). Extension of the time period would allow for analysis beyond that of an ordinary bull-market phase. Inclusion of data from multiple countries could further enhance the robustness of the findings.

An alternative study could also incorporate various Omega thresholds into the analysis. The selection of the Omega threshold at only one negative return threshold level provides a limited view. Future analysis might obtain the rankings of ETFs over the full spectrum of threshold levels (*inter alia* utilise the Omega function and obtained rankings with multiple Omega ratios). A final area of future expansion of the study might be to repeat the study, but to incorporate a statistical measure to be used as the basis for the ranking during the empirical analysis instead of using a pure ranking method.

However, at the time of wrting (Sept 2014) the significance of the findings proved successful as two new fundamentally weighted ETFs were being launched into the SA market, which indicated the continuous innovation in the SA ETF market. This study highlights that such ETF developments bring with it unique risks that justifies thoughtful adoption of alternative ETFs into a portfolio.

BIBLIOGRAPHY

Acts ***see*** South Africa.

Agapova, A. 2010. Conventional mutual index funds versus exchange traded funds. *Journal of Financial Market,* 14(2011):323-342.

Agung, I.G.N. 2009. Time series data analysis using Eviews. New York: Wiley.

Alam, N. 2013. A comparative performance analysis of conventional and Islamic exchange-traded funds. *Journal of Asset Management*, 14(1):27-36.

Amenc, N., Malaise, P., Martellini, L. & Vaisié, M. 2004. Fund of hedge fund reporting: a return-based approach to fund of hedge fund reporting. http://www.edhec-risk.com. Date of access: 03 Dec. 2013.

Anon. 2010. An independent view on asset classes: investment guide 2010. *Finweek*: 26, Dec.

Anon. 2013a. ETF overview – ETFs in detail http://www.nasdaq.com/indexshares/eqqqetfsindetail.stm. Date of access: 30 Mar. 2013.

Anon. 2013b. ETF trading strategies. http://www.nasdaq.com/investing/etfs/ETF-trading-strategies.aspx. Date of access: 23 Sep. 2013.

Arnott, R.D., Hsu, J. & Moore, P. 2005. Fundamental indexation. *Financial Analyst Journal*, 61(2):83-99.

Arnott, R.D., Kalesnik V., Moghtader, P. & Scholl, C. 2010. Beyond cap weight: the empirical evidence for a diversified beta. *Journal of Indices*, January/February:16-29.

Ashton, M. 2011. ETFs: the straight and the narrow. *Finweek*: 10, 3 Nov.

Asteriou, D. & Hall, S.G. 2007. Applied econometrics: a modern approach. Revised ed. New York, NY: Palgrave Macmillan.

Bacmann, J.F. & Scholtz, S. 2003. Alternative performance measures for hedge funds. *Alternative Investment Management Journal*. http://www.aima.org/uploads/2003%5CJune%Crmf.pdf. Date of access: 10 Dec 2013.

Bacon, C.R. 2004. How sharp is the share-ratio? – Risk-adjusted performance measures. www.statpro.com. Date of access: 2 Dec. 2013.

Bergh, G. & Van Rensburg, P. 2008. Hedge funds and higher moment portfolio selection. *Journal of Derivatives and Hedge Funds*, 14(2):102-126.

Bernstein, P.L. & Damodaran, A. 1998. Investment management. New York, NY: Wiley.

Bessis, J. 2006. Risk management in banking. 2nd ed. London: Wiley.

Black, F., Jensen, M.C. & Scholes, M. 1972. The capital asset pricing model: some empirical tests. (*In* Jensen, M.C., *ed.* Studies in theory of capital markets. New York: Praeger).

Blitz, D. & Huij, J. 2012. Evaluating the performance of global emerging markets equity exchange-traded funds. *Emerging markets review,* 13(2):149-158.

Board of Governors of the Federal Reserve System. 2014. Supplier of data. http://www.federalreserve.gov/releases/h15/update/. Date of access: 15 Feb.2014.

Bodie, Z., Kane, A. & Marcus A.J. 2010. Essentials of investments. 8th ed. New York, NY: McGraw-Hill.

Bodie, Z., Kane, A. & Marcus, A.J. 2011. Investments and portfolio management. 9th ed. New York, NY: McGraw-Hill.

Bollerslev, T. 1986. Generalized Autoregressive Conditional Heteroskedasticity. *Journal of Econometrics*, 31:307-327.

Bon, A.T. & Sinusi, A.A. 2011. Capital asset pricing model: the criticisms and the status qua. *Journal of Applied Sciences Research*, 7(1):33-41.

Botha, M. 2005. Risk management in hedge funds. Potchefstroom: NWU. (Dissertation – M.Comm).

Botha, M. 2006. A comparison of South African hedge fund performance measures. *South African Journal of Economics*, 73(3):459-477.

Brinson, G.P., Hood, L.R. & Beebower, G.L. 1995. Determinants of portfolio performance. *Financial Analysts Journal*, 50(1):133-139.

Brown, M. 2013. What are exchange traded funds? http://www.etfsa.co.za/education.htm. Date of access: 9 Jan. 2013.

Brown, M. 2013a. The development of the exchange traded funds (ETFs) and exchange traded notes (ETNs) market in South Africa. http://www.etfsa.co.za/docs/edu/dev_etf_in_sa_jan2013.pdf. Date of access: 1 Apr. 2013.

Brown, M. 2013b. Confusion about unit trusts and exchange traded funds (ETFs). http://www.etfsa.co.za/docs/edu/confusion_ut_etfs_jan2013.pdf. Date of access: 30 Aug. 2013.

Brown, M. 2013c. The use of exchange traded funds (ETFs) by financial service providers. www.etfsa.co.za/docs/edu/use_of_etfs_by_fsp_jan2013.pdf. Date of access: 21 Sep. 2013.

Cairns, P. 2013. These are SA's best unit trusts. http://www.moneyweb.co.za/moneyweb-investment-insights/these-are-sas-best-unit-trusts.aspx. Date of access: 20 Feb. 2013.

Chamberlain, G. 1983. Funds, factors and diversification in arbitrage pricing models. *Econometrica*, 51(1):1305-1323.

Chen, N., Roll, R. & Ross, S.A. 1986. Economic forces and the stock market. *Journal of Business*, 59(1):383-403.

Chong, J., Hussein, M.M. & Phillips, G.M. 2011. S&P 500 ETFs and index funds: Are fees all there is to it? *The Journal of Wealth Management,* 14(2):59-67.

Chordia, T., Sarkar, A. & Subrahmanyam, A. 2004. An empirical analysis of stock and bond market liquidity. *Review of Financial Studies,* 18(1):85-129.

Choueifaty, Y. & Coignard, Y. 2008. Toward maximum diversification. *Journal of Portfolio Management*, 35(1):40-51.

Chow, T., Hsu, J., Kalesnik, V. & Little, B. 2011. A survey of alternative equity index strategies. *Financial Analysts Journal*, 67(5):37-57.

Čisar, P. & Čisar. S.M. 2011. Optimization methods for EWMA statistics. *Acta Polytechnica Hungarica*, 8(5):73-87.

Clare, A., Motson, N. & Thomas, S. 2013. An evaluation of alternative equity indices. Part 1: Heuristic and optimised weighting schemes. www.cassknowledge.com. Date of access: 19 Mar. 2014.

Coronation. 2012. Profile's unit trusts & collective investments. Johannesburg: Profile Media.

Daly, K. 2008. Financial volatility: Issues and measuring techniques. *Physica A: Statistical Mechanics and its Applications*, 387(11):2377-2393.

De Wet, R., Krige, J.D. & Smit, E. 2008. An investigation into performance rankings of the Omega vs. the Sharpe ratio applied to the South African general equity unit trusts. *Journal of Studies in Economics and Econometrics*, 32(2):69-83.

Dirextion. 2012. Understanding taxable distributions. http://www.direxionfunds.com/literatures/understanding-taxable-distributions. Date of access: 20 Sep. 2013.

Eling, M. & Schuhmacher, F. 2007. Does the choice of performance measure influence the evaluation of hedge funds? *Journal of Banking and Finance*, 31(1):2632-2647.

Engle, R.F. 1982. Autoregressive conditional heteroscedasticity with estimates of United Kingdom inflation. *Econometrica*, 1982(50):987-1007.

etfSA. 2013. ETF product profiles. http://www.etfsa.co.za/ETF_profiles.htm. Date of access: 1 Apr. 2013.

Fama, E.F. 1965. The behavior of stock prices. *The Journal of Business*, 38(1):34-105.

Fama, E.F. 1970. Efficient capital markets: a review of theory and empirical work. *The Journal of Finance,* 25(2):383-417.

Fama, E.F. 2000. The new indexing. http://www.dfaus.com/library/articles/new_indexing/. Date of access: 12 Mar.2014.

Fama, E.F. & French, K.R. 1992. The cross section of expected stock returns. *Journal of Finance*, 47(2):427-465.

Fama, E.F. & French, K.R. 1996. Multifactor explanations of asset pricing anomalies. *Journal of Finance*, 51(1):55-85.

Fama, E.F. & French, K.R. 2004. The capital asset pricing model. Theory and evidence. *Journal of Economics Perspectives*, 18(3):25-46.

Fama, E.F. & MacBeth, J. 1974. Tests of the multiperiod two-parameter model. *Journal of Financial Economics*, 1(1):43-66.

Favre-Bulle, A. & Pache, S. 2003. The Omega measure: hedge fund portfolio optimization. Lausanne: University of Lausanne. (Thesis – MBF).

Fernholz, R. & Shay, B. 1982. Stochastic portfolio theory and stock market equilibrium. *Journal of Finance*, 37(2):615-622.

FINRA ***see*** Financial Industry Regulatory Authority.

Financial Industry Regulatory Authority (FINRA). 2009. Regulatory notice 09-3. http://www.finra.org/web/groups/industry/@ip/@enf/@ad/documents/industry/p126129.pdf. Date of access: 12 Nov. 2013.

Foster, M. 2012. Bank of England repeats ETF warning. *Financial News,* 5 Jul. http://www.efinancialnews.com/story/2012-07-05/bank-of-england-is-still-warning-about-etf-risks?ea9c8a2de0ee111045601ab04d673622. Date of access: 21 Sep. 2013.

French, K.R. & Roll, R. 1986. Stock return variance: the arrival of information and the reaction of traders. *Journal of Financial Economics*, 17(1):5-26.

Frino, A. & Gallagher, D.R. 2001. Tracking S&P 500 index funds. *The Journal of Portfolio Management,* 28(1):44-54.

FSB ***see*** Financial Services Board.

Financial Services Board (FSB). 2012. Notice 80 of 2012. https://www.fsb.co.za/Departments/cis/Documents/Notice%2080%20of%202012%20Replaced%20Notice%201503%20of%202005.pdf. Date of access: 12 Nov. 2013.

Fung, W. & Hsieh, D.A. 2006. Hedge funds: an industry in its adolescence. *Economic Review*, 91(4):1-33.

Gastineau, G.L. 2010. The exchange-traded manual. 2nd ed. New Jersey, NY: Wiley.

Ghosh, D. 2010. Asset acquisition, diversification, and revision-theoretic exercises in portfolio theory. *Journal of Finance and Accounting,* 49(1):19-38.

Gil, M.A. 2012. Measuring historical volatility. http://www.todaysgroep.nl/media/236846/measuring_historic_volatility.pdf. Date of access: 5 Feb. 2014.

Gitman, L.J. & Joehnk, M.D. 1990. Fundamentals of investing. 6th ed. New York, NY: HarperCollins.

Goldenberg, G. & Robin, A. 1991. The arbitrage pricing theory and cost-of-capital estimation: the case of electric utilities. *Journal of Financial Research*, 14(1):181-196.

Gopi, Y., Dugmore, B. & Bradfield, D. 2006. A new measure of portfolio diversification. (Unpublished.)

Grindrod. 2013. Proptrax fund fact sheets. http://www.proptrax.co.za. Date of access: 12 Apr. 2013.

Harper, D. 2008. FRM study material. http://www.bionicturtle.com/frm-study-planner. Date of access: 14 Mar. 2013.

Haugen, R.A. 1986. Modern portfolio theory. New Jersey, NY: Prentice-Hall

Hirt, G.A., Block, S.B. & Basu, S. 2006. Investment planning for financial professionals. New York, NY: McGraw-Hill.

Hsu, J.C. & Campollo, C. 2006. New frontiers in index investing. *Journal of Indices*, January/February:33-37.

Hudson-Wilson, J. 1990. New trends in portfolio theory. *Journal of Property,* 55(3):57.

Hull, J.C. 2000. Options, futures and other derivatives. 4th ed. New Jersey, NY: Prentice-Hall.

Hull, J.C. 2008. Fundamentals of futures and options markets. 6th ed. New Jersey, NY: Pearson Education.

Hull, L. 2011. Is Active Investing Better Than Passive Investing? *Podiatry Management,* 30(7):67-68.

IMF ***see*** International Monetary Fund.

Index Strategy Advisors (ISA). 2012. Investor Education: ETFs and index strategies. http://www.indexstrategyadvisors.com/insights/etfs-index-strategies/. Date of access: 10 Jan. 2013.

Index Strategy Advisors (ISA). 2013. Investor Education: the size of the US ETF market. http://www.indexstrategyadvisors.com/insights/the-size-of-the-u-s-etf-market/. Date of access: 10 Jan. 2013.

International Monetary Fund. (IMF) 2003. Financial asset price volatility: a source of instability? http://www.imf.org/external/pubs/ft/gfsr/2003/02/pdf/chp3.pdf. Date of Access: 19 Jan. 2014.

ISA ***see*** Index Strategy Advisors.

iShares. 2012. Black Rock Education: ETF transparency. http://us.ishares.com/understand_etf/benefits/transparent.htm. Date of access: 7 Jan. 2013.

iShares. 2013. ETF creation and redemption process. http://us.ishares.com/understand_etf/fundamental/etf_creation_redemption.htm. Date of access: 28 Mar. 2013.

Israelsen, C. 2005. A refinement to the Sharpe ratio and information ratio. *Journal of Asset Management,* 5(6):423-427.

J.P. Morgan/Reuters. 1996. RiskMetrics™ – technical document. 4th ed. http://gloria-mundi.com/UploadFile/2010-2/rmtd.pdf. Date of access: 5 Feb. 2014.

Jackson, M & Staunton, M. 2001. Advanced modeling in finance using Excel and VBA. Chichester: Wiley.

Jacobs, J. 2012. ETFs Part 2: The creation and redemption process. https://exchanges.nyx.com/jonathan-jacobs/etfs-part-2-creation-and-redemption-process. Date of access: 27 Mar. 2013.

Jensen, M. 1968. The performance of mutual funds in the period 1945-1968. *Journal of Finance*, 23(2):389-416.

Johnson, B., Bioy, H., Garcia-Zarate, J., Choy, J., Gabriel, J., Rose, G & Kellet, A. 2012. Synthetic ETFs under the microscope: a global study. http://media.morningstar.com/eu/ETF/assets/SyntheticETFsUnderTheMicroscope_AGlobalStudy_Morningstar.pdf. Date of access: 21 Sep. 2013.

Johnston, M. 2010a. Reviewing three different types of leveraged ETFs. http://etfdb.com/2010/reviewing-three-different-types-of-leveraged-etfs/. Date of access: 17 Apr. 2013.

Johnston, M. 2010b. Five facts every investor should know about leveraged ETFs. http://etfdb.com/2010/five-facts-every-investor-should-know-about-leveraged-etfs/ Date of access: 18 Apr. 2013.

Jones, C.P. 2010. Investments: principles and concepts. 11th ed. NY: Wiley.

JP Morgan. 2008. Creation and redemption. *JP Morgan thought magazine:* 23, Summer edition. https://www.jpmorgan.com/cm/BlobServer?blobcol=urldata&blobtable=MungoBlobs&blobkey=id&blobwhere=1158494213946&blobheader=application%2Fpdf&blobnocache=true&blobheadername1=Content-disposition&blobheadervalue1=attachment;filename=Creation_and_Redemption.pdf Date of access: 20 Sep. 2013. Date of access: 20 Jan 2014.

JSE (Johannesburg Stock Exchange). 2011. Exchange traded notes (ETNs). https://www.jse.co.za/trade/equity-market/exchange-traded-products/exchange-traded-notes. Date of access: 9 Apr. 2013.

Kanellakos, J. 2005. Hedge fund risk-adjusted performance measures: a critical review. Canada: Dalhousie University. (Dissertation – MSc).

Kazemi, H., Schneeweis T. & Gupta, R. 2003. Omega as a performance measure. Amherst: University of Massachusetts. http://ciber.fuqua.duke.edu/~charvey/Teaching/BA453_2005/Schneeweis_Omega_as_a.pdf Date of access: 12 Feb. 2014.

Keating, C. & Shadwick, F. 2002. A universal performance measure. http://www.performance-measurement.org/KeatingShadwick2002a.pdf. Date of access: 13 Feb 2014.

Kostovetsky, L. 2003. Index mutual funds and exchange-traded funds. *The Journal of Portfolio Management,* 29(4):80-92.

Kraus, A & Litzenberger, R. 1976. Skewness preference and the valuation of risk assets. *Journal of Finance*, 31(4):1085-1100.

Lane, D.M. 2007. Introduction to statistics. http://onlinestatbook.com/Online_Statistics_Education.pdf. Date of use: 15 Mar. 2014.

Lawrence, C. 2008. ETFs for the long run. New York, NY: Wiley.

Le Sourd, V. 2007. Performance measurement for traditional investment: literature survey. http://www.edhec-risk.com. Date of access: 2 Dec. 2013.

Levy, H. 2002. Fundamentals of invesments. New Jersey, NY: Prentice Hall.

Lydon, T. & Wasik, J.F. 2008. iMoney: profitable ETF strategies for every investor. New Jersey, NY: Pearson Education.

Markowitz, H.M. 1952. Portfolio selection. *Journal of Finance*, 7(1):77-91.

Marx, J., Mpofu, R., Van de Venter, G. & Nortjé, A. 2008. Investment management. 2nd ed. Pretoria: Van Schaik.

Mayo, H. 2000. Investments. 6th ed. New York, NY: Harcourt College.

McGregor BFA Expert.   2014. Supplier of data. https://expert.mcgregorbfa.com. Date of access: 10 Feb. 2014.

McWhinney, J.E. 2011. An inside look at ETF construction. http://www.investopedia.com/articles/mutualfund/05/062705.asp. Date of access: 29 Mar. 2013.

Megginson, W.L. 1996. Corporate finance theory. New Jersey, NY: Adison-Wesley.

Moneyweb. 2013. ETF and Unit trust database. http://www.moneyweb.co.za/moneyweb-click-a-unit-trust/. Date of access: 6 Sep. 2013.

Moneyweb. 2014. Moneyweb glossary. http://www.moneyweb.co.za/moneyweb-glossary-description/ftsejse-top-40-index. Date of access: 13 Jun 2014.

Mullaney, M.D. 2009. The complete guide to option strategies: advanced and basic strategies on stock, ETFs, indexes and stock index futures. New Jersey: Wiley.

Nedelijkovic, V. 2012. NewGold ETF to list on JSE. http://www.absacapital.com/AboutUs/News/Pages/NewGoldETFtolistonGSE.aspx. Date of access: 9 Apr. 2013.

Nelson, D.B. 1991. Conditional heteroscedasticity in asset returns: a new approach. *Econometrica*, 59(2):347-370.

Nelson, D.B. 1996. Modeling stock market volatility changes. (*In* Rossi, P., *eds*. Modeling stock market volatility. Academic Press. p.3-15).

Nyamongo, M.E. & Misati, R. 2010. Modelling the time-varying volatility of equity returns in Kenya. *African Journal of Economic and Management Studies*, 1(2):183-196.

Paavola, M. 2006. Tests of the arbitrage pricing theory using macroeconomic variables in the Russian equity market. Lappeenranta: Lappeenranta University of Technology. (Thesis – PhD).

Pagan, A.R. & Schwert, G.W. 1990. Alternative models for conditional stock volatility. *Journal of Econometrics*, 45(1):267-290.

Pennathur, A., Delcoure, N. & Anderson, D. 2002. Diversification benefits of iShares and closed-end country funds. *Journal of Financial Research*, 25(4):541-557.

Planting, S. 2013. This is the market for ETFs. http://www.moneyweb.co.za/moneyweb-financial/this-is-the-market-for-etfs. Date of access: 11 Jan. 2013.

Poon, S. 2005. Practical guide to forecasting financial market volatility. London: Wiley.

ProShares. 2011. Geared fund performance: understanding leveraged and inverse funds. http://www.proshares.com/media/documents/geared_fund_performance.pdf. Date of access: 11 Apr. 2013.

Ramaswamy, S. 2011. Market structures and systemic risks of exchange traded funds. *BIS Working Papers,* 343. www.bis.org/publ/work343.pdf. Date of access: 21 Sep. 2013.

Reilly, F.K. & Brown, K.C. 2009. Analysis of Investments and management of portfolios. 10th ed. Boston, MA: South-Western Cengage learning.

Roll, R. 1977. A critique of the asset pricing theory's tests part 1: on the past and potential testability of the theory. *Journal of Financial Economics*, 4(2):129-176.

Ross, S.A. 1976. The arbitrage theory of capital asset pricing. *Journal of Economic Theory*, 13(3):341-360.

Ross, S.A. 1977. Return, risk and arbitrage. (*In* Friend, I. & Bicksler, J.L., *eds*. Risk and return in finance. Cambridge: Ballinger).

Russel, J., Han, B. & Tung, Y. 2010. Thinking about indices and passive versus active management. *Journal of Portfolio Management, 36(4):35-47.*

SARB (South African Reserve Bank). 2014. Supplier of data. https://www.resbank.co.za/Research/Rates/Pages/CurrentMarketRates.aspx. Date of access: 15 Feb. 2014.

Saunders, A. & Cornett, M.M. 2006. Financial institutions management: a risk management approach. 5th ed. New York, NY: McGraw Hill.

Schwert, G.W. 1989. Why does stock market volatility change over time? *Journal of Finance*, 54(5):1115-1151.

SEC (Securities and Exchange Commission). 2001. Concept release: actively managed exchange traded funds. http://www.sec.gov/rules/concept/ic-25258.htm#secii. Date of access: 3 Apr. 2013.

SEC (Securities and Exchange Commission). 2009. Leveraged and Inverse ETFs: Specialized products with extra risks for buy-and-hold investors. www.sec.gov/investor/pubs/leveragedetfs-alert.htm. Date of access: 9 Apr. 2013.

Sharma, M. 2004. A.I.R.A.P. – Alternative RAPMs for alternative investments. *Journal of Investment Management*, 3(4):106-129.

Sharpe, W.F. 1966. Mutual fund performance. *Journal of Business*, 39(1):119-138.

Sharpe, W.F. 2000. Portfolio theory and capital markets. New York, NY: McGraw-Hill.

Siegel, J. 1994. Stock for the long run; the definitive guide to financial market returns and long-term investment strategies. Burr Ridge, IL: Irwin Professional Publishing.

Sinclair, E. 2008. Volatility trading. New York, NY: Wiley.

Sortino, F.A & Van der Meer, R. 1991. Downside risk. *Journal of Portfolio Management*, 17(4):27-31.

South Africa. 2002. Collective Investment Scheme Control Act 45 of 2002. http://www.saflii.org/za/legis/num_act/cisca2002403.pdf. Date of access: 12 Jan 2014.

Stevenson, D. 2012. Exchange traded funds and index funds. 2nd ed. Harlow: Pearson.

Svetina, M. 2010. Exchange traded funds: performance and competition. *Journal of Applied Finance,* 20(2):130-145.

The Economist. 2012. Hedge funds: going nowhere fast. http://www.economist.com/news/finance-and-economics/21568741-hedge-funds-have-had-another-lousy-year-cap-disappointing-decade-going Date of access: 2 Aug. 2013.

Tobin, J. 1958. Liquidity preference as behavior towards risk. *Review of economic studies,* 25(2):65-85.

Togher, S. & Barsbay, T. 2007. Fund of hedge funds portfolio optimization using the Omega ratio. Colorado: Investment management consultants' association. http://www.fortigent.com/uploads/published_articles/07Monitor%20JulyAug%20Togher-Barsbay.pdf Date of access: 10 Feb. 2014.

Treynor, J.L. 1965. How to rate management of investment funds. *Harvard Business Rreview*, 43(1):63-75.

Van Dyk, F., Van Vuuren, G. & Styger, P. 2012. Improved investment performance using the portfolio diversification index. *Journal of Economic and Financial Sciences*, 5(1):153-174.

Van Wyk, K., Botha, Z. & Goodspeed, I. 2012. Understanding South African financial markets. 4th ed. Pretoria: Van Schaik.

Wessels, D. & Krige, J. 2005. Active versus passive investing I: The South African experience. *Journal for Studies in Economics and Econometrics* , 29(2):1-34.

West, K.D. & Cho, D. 1995. The predictive ability of several models of exchange rate volatility. *Journal of Econometrics*, 69(2):367-391.

Wiandt, J. & McClatchy, W. 2002. Exchange traded funds. New York, NY: Wiley.

Wuite, R. 2009. The South African dictionary of finance. Johannesburg: Rollerbird Press.

Yahoo Finance. 2014. Supplier of data. http://finance.yahoo.com. Date of access: 10 Feb. 2014.

Young, T.W. 1991. Calmar ratio: a smoother tool. *Futures*, 20(1):40.

Zeng, L. & Luo, F. 2013. 10 years later: where in the world is equal weight indexing now? https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2257481
Date of access: 12 Mar. 2014.

APPENDIX

Table A: SA ETFs – Overall summary

Ranking Key	Best	→					Worst
Annual compound returns	Fundamental	Fundamental	Index	Market Cap	Market Cap	Market Cap	Equally Weighted
Sharpe	Fundamental	Fundamental	Index	Market Cap	Market Cap	Market Cap	Equally Weighted
Treynor	Market Cap	Fundamental	Fundamental	Market Cap	Index	Market Cap	Equally Weighted
Calmar	Index	Fundamental	Market Cap	Fundamental	Market Cap	Market Cap	Equally Weighted
Sortino	Fundamental	Fundamental	Index	Market Cap	Market Cap	Equally Weighted	Market Cap
Information	Fundamental	Fundamental	Market Cap	Market Cap	Market Cap	Equally Weighted	
Omega (+RFR threshold)	Fundamental	Index	Market Cap	Market Cap	Fundamental	Market Cap	Equally Weighted
Omega (-RFR threshold)	Index	Market Cap	Market Cap	Market Cap	Fundamental	Fundamental	Equally Weighted
EWMA	Fundamental	Index	Market Cap	Market Cap	Fundamental	Market Cap	Equally Weighted
Tracking Error	Market Cap	Market Cap	Fundamental	Fundamental	Equally Weighted	Market Cap	
Diversification - SEE	Market Cap	Market Cap	Fundamental	Fundamental	Equally Weighted	Market Cap	
R^2	Market Cap	Market Cap	Fundamental	Fundamental	Equally Weighted	Market Cap	

Source: Compiled by the author

Table B: US ETFs – Overall summary

Ranking Key	Best	→									Worst
Annual compound returns	3x Long Leveraged	2x Long Leveraged	Equally Weighted	Market Cap	Market Cap	Market Cap	Fundamental	Fundamental	Index	-2x Short Leveraged	-3x Short Leveraged
Sharpe	Fundamental	Market Cap	Market Cap	Market Cap	Fundamental	Equally Weighted	2x Long Leveraged	Index	3x Long Leveraged	-3x Short Leveraged	-2x Short Leveraged
Treynor	Fundamental	-2x Short Leveraged	-3x Short Leveraged	Market Cap	Market Cap	Market Cap	Fundamental	Equally Weighted	2x Long Leveraged	Index	3x Long Leveraged
Calmar	3x Long Leveraged	Fundamental	Market Cap	Market Cap	Equally Weighted	Fundamental	Market Cap	2x Long Leveraged	Index	-3x Short Leveraged	-2x Short Leveraged
Sortino	Fundamental	Market Cap	Market Cap	Market Cap	Fundamental	Equally Weighted	Index	2x Long Leveraged	3x Long Leveraged	-3x Short Leveraged	-2x Short Leveraged
Information	2x Long Leveraged	3x Long Leveraged	Market Cap	Market Cap	Market Cap	Equally Weighted	Fundamental	Fundamental	-3x Short Leveraged	-2x Short Leveraged	
Omega (+RFR threshold)	3x Long Leveraged	2x Long Leveraged	Market Cap	Market Cap	Market Cap	Index	Equally Weighted	Fundamentals	Fundamentals	-3x Short Leveraged	-2x Short Leveraged
Omega (-RFR threshold)	Market Cap	Market Cap	Market Cap	Index	Fundamental	Fundamental	Equally Weighted	2x Long Leveraged	3x Long Leveraged	-2x Short Leveraged	-3x Short Leveraged
EWMA	Fundamental	Fundamental	Market Cap	Market Cap	Market Cap	Index	Equally Weighted	-2x Short Leveraged	2x Long Leveraged	3x Long Leveraged	-3x Short Leveraged
Tracking Error	Market Cap	Market Cap	Market Cap	-2x Short Leveraged	2x Long Leveraged	Fundamental	Equally Weighted	-3x Short Leveraged	3x Long Leveraged	Fundamental	
Diversification - SEE	Market Cap	Market Cap	Market Cap	-2x Short Leveraged	2x Long Leveraged	Fundamental	Equally Weighted	-3x Short Leveraged	3x Long Leveraged	Fundamental	
R^2	Market Cap	-2x Short Leveraged	2x Long Leveraged	-3x Short Leveraged	3x Long Leveraged	Market Cap	Market Cap	Fundamental	Equally Weighted	Fundamental	

Source: Compiled by the author