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Return and risk performance: implications for the classification of South African unit trusts

Oyebola Farinde

A research report submitted to the Faculty of Commerce, Law and Management, University of the Witwatersrand, in partial fulfilment of the requirements for the degree of Master of Business Administration

Johannesburg, 2017

ABSTRACT

This study focussed on investigating the similarities and difference in the return and risk performance within and across classification categories of South African unit trusts. This study was done with a view of considering the validity and usefulness of industry based classification, in unit trusts selection by investors as well as relative performance comparison by investors, regulators and fund managers alike.

The sample was drawn from the equity classification category and NAV data was obtained over a 10-year period from January 2006 to December 2015 from INET BFA and Bloomberg. Using financial and statistical models, a one-way Welch's analysis of variance (ANOVA) and Tukey's test were used in addressing the proposition regarding similarities and differences in performance, while cluster analysis using the K-means non-hierarchical technique was utilized in addressing the movements of units trusts away from the initial industry based classification.

The study showed that performance of unit trusts *within* classification categories are not significantly different in all categories tested, while performance *across* classification categories are also not significantly different in most of the categories. When classification of unit trusts was examined on the basis of return and risk, only the unit trusts in one of the classification categories, retained a composition similar to the industry based classification. This is in contrast to other unit trusts that showed migration across categories.

In summary, the study provides evidence that supports the notion that performance of unit trusts in the equity classification category is mostly similar, suggesting possible limited diversification benefits when investing along the same asset type classification category.

Search Words: return and risk performance, classification of unit trusts, ANOVA, K-means clustering

DECLARATION

I, Oyebola Farinde, declare that this research report is my own work except as indicated in the references and acknowledgements. It is submitted in partial fulfilment of the requirements for the degree of Master of Business Administration in the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination in this or any other university.

Oyebola Farinde

Signed at Johannesburg, South Africa

On the 6th day of June 2017

DEDICATION

This is dedicated firstly to my queen, Oluwaseun Moyosore and then to my sons, Oyedamola, Oyeyisola and Oyewonuola - your love, support, encouragement and sacrifice was without measure through this journey. Thank you so dearly.

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CHAPTER 1. INTRODUCTION

1.1 Purpose of the study

The purpose of this research is to evaluate the relationship between ex-post return and risk performance of South African unit trusts and the effect it has on the validity and usefulness of industry classification basis currently in use. The study will seek to contribute to the growing body of literature and the recent industry tendency to lay emphasis not only on investment mandate, asset type and geographical location as bases of classification, but also on risk when classifying unit trusts (Clare, 2010; IFIC, 2016). Unit trusts classified by the Association for Savings and Investments of South Africa (ASISA) over the period January 2006 to December 2015 will be used.

1.2 Context of the study

The research will focus on the South Africa financial markets and particularly on the unit trusts segment.

South Africa has the largest stock exchanges by market capitalization in Africa (Lagoarde-Segot & Lucey, 2008). The Johannesburg Stock Exchange (JSE) had a market capitalisation of R12.8 trillion as at December 2015. Numerous empirical studies have been conducted on the market and its participants in the areas of corporate governance (Rossouw, Van der Watt, & Malan, 2002), fund managers and performance (Friis & Smit, 2004), return and volatility of various asset classes (Pask, 2008), performance of mutual funds (Nana, 2012) to name a few.

Unit trusts were first formed in 1965 to allow retail investors with limited funds and understanding of stock investing to take investment positions on the JSE without taking on the unnecessary risk of investing directly on the bourse (PSG, 2014). The unit trust structure presents significant diversification benefits and better quality of management from professional investment managers (Reilly & Brown, 2012d). Unit trusts are managed by asset managers who invest in a

variety of asset classes both locally and offshore. Despite the risk-mitigating nature of unit trusts, they are not entirely risk free. The variability in the prices of the assets that unit trusts invest in is a source of uncertainty in investment value.

According to ASISA (2016), over the 40-year existence of unit trusts in South Africa, it has grown to a total of 1,327 funds, with a market valuation of about R2.2 trillion as at December 31, 2015. 48 asset managers are responsible for the management of these financial assets. The top 10 asset managers with the most assets under management hold 72% of all the unit trusts assets (ASISA, 2016).

Beginning January 2013, South African unit trusts were classified on the basis of objectives and mandates. This was done on a three-level classification basis, which are:

level 1: geographical location - South Africa, global, worldwide and regional,

level 2: asset type - equity, interest bearing, real estate and multi asset,

level 3: sub-categories of asset types - financial, industrial, low equity, high equity, mid & small cap, large cap and others. (ASISA, 2016).

This classification is in line with the vast empirical body of research which supports predictability of asset returns over time based on investment asset type (Beebower, Brinson, & Hood, 1986; Ibbotson, 2010; Ibbotson & Kaplan, 2000; Pask, 2008; Sharpe, 1966, 1992). This perhaps justifies the current asset-based classification system.

However, actual performances of unit trusts tend to vary within classification categories. Studies by Gerlach and Maurer (2015), Moreno, Marco, and Olmeda (2006) and Tamara and Revina (2015) have shown unit trusts are misclassified when examined on a risk and return basis.

Secondly recent studies in a number of developed countries are exploring the possibility of developing a different basis of classification by utilizing data from

return and risk. This is aimed at a uniform and widely accepted basis of risk classification for unit trusts (Clare, 2010; IFIC, 2016).

Traditionally, standard deviation, downside deviation, beta, Sharpe ratio, Jensen's alpha, Treynors ratio, value at risk among others have been used to measure the relationship between return and risk in unit trusts (Caporin, Jannin, Lisi, & Maillet, 2014; Pask, 2008; Simpson, 2015). While they continue to be relevant, outputs from these measures need to be applied in the area of classification of funds and portfolio of investments. This is important to provide investors with an insight into the type of investment risk they are assuming by committing their funds to particular unit trusts.

The business problem – The reporting of return is not the issue – this is fairly standardized industry wide. However, the variability in the reporting of risk in unit trusts by asset managers is at the heart of the problem. Some asset managers report on risk sparingly while others report extensively. Due to the absence of a set of uniformly reported risk measures and ex-post performance that is not always indicative of classification categories, it becomes difficult to compare funds on a return and risk basis.

Secondly, the variability makes it even more difficult to work out a risk-based classification for unit trust funds. Despite the presence of some industry rating agencies like Morningstar and PlexusCrown, a compulsory and standard framework utilized by all market participants and supported by an independent industry body or government regulatory agency does not exist. This allows asset managers to choose the amount of detail they place in their unit trusts' memoranda and fact sheets. As a result, some investors make investment decisions without a good understanding of the relationship between potential return and risks.

The problem worsens when investors unknowingly assume high risk investments and are unfortunately not compensated with high returns. For this reason, it may be useful to look at unit trusts' historical performance from not only a return perspective, but incorporating both return and risk considerations

in order to investigate the possibility of grouping funds with comparable performance together.

1.3 Problem statement

1.3.1 *Main problem*

The research problem is to determine if the classification categories explain the similarities or differences in return and risk performance exhibited by South African unit trusts over time.

According to Ibbotson and Kaplan (2000) and Brinson et al.(1991) asset allocation policy contributed over 90% to the total return of an investment portfolio over time. Sharpe (1992) stated that a large part of the variability in asset returns can be explained by the investment portfolio's asset allocation. If asset allocation is important to portfolio return and if it is also used as one of the basis of fund classification, then we shall investigate if asset-type based classification offers any insights into risk-based classifications of unit trusts.

1.3.2 *Sub-problems*

Sub Problem 1

The first sub-problem is to determine if South African unit trusts within the same classification category exhibit similar return and risk performance over time.

Sub Problem 2

The second sub-problem is to determine if South African unit trusts across different classification categories exhibit different return and risk performance over time.

1.4 Significance of the study

Previous research on unit trusts in South Africa have focused on the performance during quantitative easing (Tan, 2015), persistence in return (Nana, 2012; Von Wielligh & others, 2000) and ability of fund managers to achieve active excess return over and above the benchmark stipulated for the funds (Manjezi, 2008). This research will be useful to various stakeholders in:

- possibly expanding the limited empirical literature in the area of return and risk classification of unit trusts in South Africa for both academia and industry players (fund managers and investors alike). This is in line with recent increased emphasis on the component of risk in unit trusts from more developed financial markets as depicted by the United Kingdom's Association of British Insurers and the Investment Management Association as well as Canada's Investment Fund Institute of Canada (Clare, 2010; IFIC, 2014, 2015).
- providing insights which may serve as guidance to regulators in incorporating a standardized form of risk reporting and classification basis in South African unit trusts. This may lead to the development of an industry-wide risk basis of classification that can be employed, to compare unit trusts available to the investing public.
- standardizing risk reporting, which may be of benefit to fund managers in comparing unit trusts performance with peers and across other categories (Aragon & Ferson, 2006; Friis & Smit, 2004) and in improving the levels of risk disclosure in their reporting, prospectus and periodically issued fact sheets.
- assisting investors to appraise, not just historical returns against benchmarks, but the interplay between return and risk performance relative to other unit trusts in the same or different classification categories. This may be of benefit to retail investors whose understanding of investment risks is limited and thereby make their investment making decision less onerous and more informed from the perspective of uncertainty.

1.5 Delimitations of the study

This research will extend previous research on South African unit trusts which were based on data from the old classification basis which was in place till December 31, 2012. The previous basis of classification of funds will be disregarded, while the research will take on data from unit trusts classification basis in existence as at date of the study.

In line with previous research which focused on a sample of a few selected funds (Tan, 2015) this research will also select an appropriate sample from the unit trusts in the geographical classification referred to as South African equity funds (1,110 unit trusts).

However, those categorized as Global funds (122 unit trusts), Worldwide (67 unit trusts) and regional funds (28 unit trusts) will be left out of this research because of their relatively smaller sample size.

This research will exclude unit trusts that are fund of fund (FoF), that is, unit trusts that invest in other unit trusts. This will help to rule out the effect of double counting of return and risk measures. The focus will be on unit trusts that invest in equities as the main underlying asset.

There are a number of return, risk and risk-adjusted return measures available for measurement of investment performance. Some examples include holding period return, absolute risk measures like standard deviation, downside deviation, relative measures like Sharpe ratio, Sortino ratio, Treynors ratio, Jensen's alpha, information ratio and others. Mibiola, (2013) used standard deviation, Sharpe ratio and Jensen's alpha in his work on performance evaluation of unit trusts in South Africa over the last two decades. Tan (2015) also utilized CAGR, Sharpe ratio, Treynor's Jensen's alpha. This research will however utilize holding period return and standard deviation to measure of returns and risk. Even though other measures exist, only these two measures will be used because they address return and risk return in a simple manner which can be easily understood by many.

1.6 Definition of terms

- Unit trusts – are forms of collective investment schemes. A unit trust is a pooled portfolio of investments managed on behalf of retail and institutional investors by an investment management entity. The investors pool their cash together in a common portfolio to buy the underlying assets. The size of their cash contribution entitles the investors to proportionate units within the fund (oftentimes it is referred to as mutual funds in the United States) (PSG, 2014).
- Fund classification – this is the grouping of unit trusts by a particular underlying basis, like geography, asset type, size, risk, mandate and others.
- Returns – are the gains that result from making an investment in a financial instrument. Returns are earned in the form of interest, capital growth, and dividend. (Tng, 2006) When negative returns are made, this is referred to as a loss.
- Risk – this is described as a measure of uncertainty and variability that is associated with the return on an investment asset. According to Modigliani & Modigliani, (1997) “the trade-off between risk and return is that investors do not like risk, and therefore require compensation for uncertainty in the form of a "risk premium” (p.45).
- Risk-adjusted performance / return – sometimes referred to as risk-to-reward performance and it measures the returns on an investment relative to level of risk assumed in making the returns (Reilly & Brown, 2011).

1.7 Assumptions

- Survivorship bias – it is also assumed that the selected sample will not exhibit survivorship bias and that the sources from which the data will be obtained will not exclude any unit trust from their portal because the fund has ceased to exist.

  Survivorship bias arises, when any form of analysis is done, only on unit trusts that are still in existence without incorporating unit trusts that were

discontinued during the period of the research. In the case of this research, risk adjusted return may be overstated if the sample does not include discontinued unit trusts.

- Accuracy of data – This research will obtain majority of its data on unit trusts from ASISA, INET BFA and Bloomberg. It is assumed that the information obtained from these sources will be accurate and correct.
  This assumption can be made because all the sources are reputable public sources of financial information.

- Sampling – it is assumed that the sample of unit trusts selected from each classification level will be a good representation of the population within the level.
  This can be reasonably assumed because the sample selection will comprise of the observed unit trusts in the selected classification category.

1.8 Outline of the Study

The chapters that follow are constructed to address various aspects of the research as follows:

- Chapter 2 employs the review of literature to discuss existing body of work in the areas of risk and return performance and classification of unit trusts, with the aim of formulating research propositions for the study.
- Chapter 3 outlines the research methodology, including the sample, mathematical models and statistical methods that are employed in addressing the research propositions, which were developed from the literature review in Chapter 2.
- Chapter 4 is a presentation of results obtained from the application of methodologies identified, to the selected sample described in Chapter 3.
- Chapter 5 discusses and interprets the results which were presented in Chapter 4 in relation to the literature review and propositions discussed and formulated in Chapter 2.

- Chapter 6 summarizes the findings with reference to the context of the study in Chapter 1 and evidence from the literature review in Chapter 2. Recommendations to stakeholders based on the outcomes of the research and suggestions on areas of further research in the study of performance and classification of unit trusts in South Africa concludes the final chapter.

CHAPTER 2. LITERATURE REVIEW

2.1 Introduction

The popularity of unit trusts as a preferred way for individual investors and many institutions to invest in the financial markets has grown over the years (Simons, 1998). One of the fundamental advantages of unit trusts is that it is a means of achieving both geographical and asset type diversification (French & Poterba, 1991). Investments in unit trusts help investors overcome investment biases of buying locally available investments instead of similar options which may be available offshore as well as having exposure to a number of securities in a well-diversified portfolio of assets instead of holding just a few stocks (French & Poterba, 1991). Overcoming these two biases has implications for reducing investment risk.

Traditional financial asset classes include cash, equities (which included unit trusts), bonds, real estate currency. Other alternative investment classes comprise of commodities, private equity, hedge funds and derivatives. To earn an investment return, it is necessary to make an investment in an asset and be part of the market with invested funds in financial instruments. Investment returns come with its risk. Investment risk is part and parcel of the investment process and has to be considered by investors and investment managers. Risk is associated with investments because the outcomes of all investments are not always guaranteed from the outset. Different financial instruments have different levels of expected return which is influenced by the level of its inherent risk.

2.2 Definition of Topic and Background Discussions - Return, Risk & Risk Adjusted Performance in Unit Trusts

Information about return performance is the most likely sought after statistic when investors consider unit trusts. Investors want to base their decision to invest on the level of return they are likely to get for their investment. Especially for the retail investors, there is always the question of how to determine what a good rate of return is as well as the consistency of the level of return earned over time. Evidence from literature suggests that, not only is performance important to investors, but also, it determines which funds attracts the most flows of new investments (Arendse, Muller, & Ward, 2016).

Some other questions and concerns that arise with unit trust investments are:

1) is it considered good performance if a benchmark is surpassed, but money is lost in absolute terms?
2) should returns be calculated gross or net of fees?
3) what is the impact that volatility in markets can have on the variability of returns and how does this affect the riskiness of investments in unit trusts?

Investors and investment professionals grapple with these issues and attempt to find answers on a daily basis to these questions, as they set out their acceptable investment return and risk objectives.

2.2.1 *Return in Unit Trusts*

Returns expectations are influenced largely by asset class (Beebower et al., 1986; Brinson, Singer, & Beebower, 1991). Portfolio performance by extension can also be explained to a good extent by the composition of the asset classes represented in the portfolio. So it expected that with greater exposure to certain asset classes, greater expected returns can be envisaged. This however, is not always the case, because the assumption of greater investment risk is not always rewarded and does not always translate to a proportionate greater investment return. In some instances, it could actually translate to investment losses.

Unit trust portfolios hold a number of different securities in them. The value of the unit trust portfolio is therefore determined by the market value of all the securities it holds.

Investment returns on unit trust investments arise from two sources, they are income and capital gains or losses (Simons, 1998). Income is earned either as interest and / or dividends while capital gain or losses arises from an increase or decrease in the value of the asset itself (Simons, 1998).

2.2.2 *Risk in Unit Trusts*

Beyond all the questions that arise about return and what constitutes a good return, there is an even more pertinent issue about risk and what an acceptable level of risk is. Any return earned with excessive risk taking is likely not good.

There are several definitions and explanations for risk. Uncertainty in a possible outcome is one way to describe risk. However, in the context of investments, volatility in the value or market price of a security can be seen as a measure of risk (Simpson, 2015), it can also be seen as the uncertainty of future returns (IFIC, 2016). The likelihood of having negative returns or returns that are below an acceptable threshold can also be regarded as risk (Simpson, 2015). Some other definitions are explored in later sections.

According to (Simpson, 2015), investment risk can be categorised into three main subdivisions. The first being absolute risk, which in the case of unit trusts measures the variability of monthly returns. The second is downside risk, which is the risk of the unit trust making negative returns with its focus on variability in the downward direction. Thirdly, he highlighted relative risk, which talks to variability in excess returns relative to the performance of an appropriate benchmark.

2.2.3 *Risk-Adjusted Performance of Unit Trusts*

Two measures, the expected rate of return (R_e) and the predicted variability or risk, oftentimes, expressed as the standard deviation of return (σ_e), both of

which have been described above are needed to predict the performance of a portfolio investments (Sharpe, 1966). Hence the study of the relationship between returns and risk is important to understand the actual performance of investments. This may be useful in helping to identify portfolios with higher returns for the same level of risk, or portfolios with lower risk for the same level of return.

This is particularly useful in the selection of unit trusts when there is a need to create an optimal portfolio for an investor. It may also assist an investor to assess a manager's return performance relative to the amount of risk taken to achieve it. However, this study will not focus on risk adjusted performance.

2.3 Similarity in Risk and Return Performance within Classification Categories

2.3.1 *Contribution of Asset Type to Expected Return and Risk*

Advances in modern portfolio theory and portfolio diversification have been based on empirical studies on the efficient frontier (Maher, White, Fry, & Wilkerson, 2013). These describe the relationship between risk and return, and how the returns of optimal portfolios increase from low to high along the frontier as the risk assumed in making the increasing returns rise. The efficient frontier depicts the highest expected return for each level of risk. All portfolio below the frontier are sub-optimal either because they do not give enough return for the level of risk of the investment or because they have assumed excessive risk to obtain a return which could have been obtained with lower risk.



Source: Reilly and Brown (2012c)

Figure 1: The efficient frontier

Markowitz (1952) pioneered work in the area of setting expectation, what he referred to as “relevant beliefs” about future performances with the choices made in selecting what constitutes a portfolio. Further work by Ibbotson and Kaplan (2000) revealed that asset allocation contributed about 90% to the variability of expected investment returns over time. They also found that only a smaller proportion of long term performance was determined by the actual

security selection within the chosen asset allocation. Indicating that within an asset allocation or asset type, performance of different individual assets is expected to perform similarly.

Drobetz and Köhler (2002) using German mutual funds, found that about 60% of variability of expected returns across funds to was explained by asset allocation, while 80% of the variability in a fund over time was explained by asset allocation.

This notion on the contribution of asset allocation, was accepted as consensus in literature until Ibbotson (2010) in an update to his earlier work, arrived at the conclusion that general market movements was responsible for 75% of the variability of returns of funds, while the asset allocation and stock selection, split roughly evenly, were responsible for remainder for variability in returns. Their work was partly informed by the patterns of market movements, during upswings and market crashes, where the broad market usually moved in one direction.

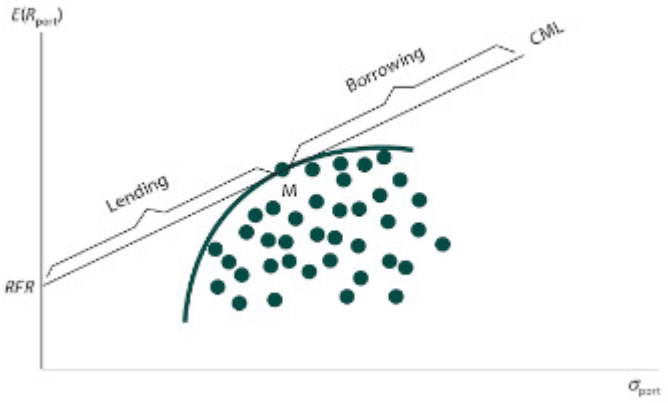
On the contrary, Selvam and Palanisamy (2011), found in their study that the returns and risks performance of most of the equity unit trusts they examined were not significantly related to market movements.

The role of general market movement may therefore be mixed, but the asset class impact should largely influence performance of unit trusts in the same classification category to exhibit similar return and risk because they are subject to largely similar factor influences. The remainder of the performance that is explained by idiosyncratic factors may account for differences in performance and potentially, this is where managers are able to generate alphas.

2.3.2 *Contribution of Diversification to Expected Return and Risk*

The next graph shows the capital market line, which describes the relationship between the efficient frontier of risky assets and the effects of the ability to borrow and lend at the risk free rate. It is possible to reduce the risk of an

investment portfolio by lending at the risk-free rate. Also, the portfolio returns can be enhanced while maintaining the level of risk by borrowing at the risk free rate to invest in the portfolio of risky assets. This buttresses the effect of diversification benefits and the relationship between return and risk of different asset classes.



Source: Reilly and Brown (2012b)

Figure 2: The capital market line

One of the benefits of unit trusts is that it serves as a means of diversification, because investments in different assets can be made, this is in contrast to a portfolio with only a few assets that are not well diversified.

However, investment risks are either diversifiable (idiosyncratic) or non-diversifiable (market). When diversifiable risk is not diversified by investing in a diversified portfolio of assets and along different industries and geographies, then there should be no compensation expectation for undue and excessive risk taking which could be diversified away. Goetzmann and Kumar (2008) found that the level of under-diversification that an investor presents with is correlated with investment choices made with over-confidence, herd behaviour and local investing bias. Ben-Horim and Levy (1980) also described diversifiable and non-diversifiable risks as the two complementary components of standard deviation which measures variability in the returns of securities or a portfolio of investments.

While the efficient frontier is traditionally a stock/bond frontier, the study by Maher et al. (2013) included other asset classes to the frontier and was able to show that while the diversification benefit was obvious, significant risk/return benefits was observed only with the real estate asset class.

Selecting securities from different asset classes, industries and in different countries with low or negative correlation helps to reduce the risk profile of investment portfolios. However Meric and Meric (1989) found that diversification across countries lines resulted in better diversification and risk reduction benefits than investing in different industries. Lustig and Verdelhan (2012) found some business cycle variations in risk-return trade-offs, which suggested higher risk adjusted performance in recessionary periods than is obtainable when expansion is prevalent.

2.3.3 *Contribution of Sector/Security Selection to Expected Return and Risk*

It is clear that the returns and risk performance are primarily a function of asset class (Brinson et al., 1991). It is therefore expected that unit trusts in the same sector classification category should have exposure to the same type of asset class with securities with similar sector specific characteristics, even though the if specific securities differ. Consequently, the expected performance for unit trusts in the same classification category is likely to be similar and highly correlated.

The stock selection process for unit trusts portfolios will be from the index universe for the particular chosen sector classification which will, more often than not respond to the same broad market conditions, except in situations where idiosyncratic factors apply to specific stocks.

2.3.4 *Unit trusts - The Return-risk trade-off*

Following the establishment of the roles of asset allocation, diversification and sector selection on the performance of stocks and how it affects the performance of unit trusts and especially those in the equities classification, the following section will briefly summarize the varied positions from literature on the interaction of return and risk broadly to investment assets and unit trusts in particular.

This portfolio return and risk relationship is expected to explain the return and risk performance in unit trusts categories. Categories with low expected returns are expected to be low risk categories, while categories with high expected returns are expected to be high risk categories, with the asset allocation of the category reflecting the riskiness thereof according to the modern portfolio theory. However this is not always the case. There is evidence of both positive and negative relationships between expected return and risk, depending on the statistical model used and time horizon used. Campbell and Hentschel (1992), reported a mild relationship between the relationship between return and risk. Lundblad (2007) using nearly two centuries of US data was able to establish a positive and significant risk return trade-off in US equities. Turner, Startz, and Nelson (1989) and Nelson (1991) reported instances where a negative relationship has been established.

Bandi and Perron (2008), however attributed the mixed positions to time horizons that are too short. In their study, they found only a mild correlation between return and past market variance when using short horizons, however with longer periods of about six to ten years, the relationship changes to a strong correlation. This relationship is important if ex-post performance will be used in describing classification basis for unit trusts.

In a six-year longitudinal study, Selvam and Palanisamy (2011), found that majority of the selected unit trust samples, which belonged to different classification categories, did not have similar return and risk performance when compared on a year-on-year basis.

From the above, a diversified portfolio of unit trusts may be able to offer some risk reduction benefits through the selection of a variety of unit trusts from different classifications into the portfolio of investments. However, the wrong classification problem may arise, where unit trusts are misclassified and the correlation of their returns and risk with others in their category are significantly different. This is one reason that buttresses the need for studies to determine if performance is similar within unit trusts classification categories or different across unit trusts with different sector classifications.

2.3.5 *Proposition 1*

This research seeks to find evidence in support of, or against the propositions that:

South African unit trusts within the same classification category exhibit similar return and risk performance over time.

2.4 Differences in Risk and Return Performance across Classification Categories

Asset allocation and classification categories of various asset types play a role in the investment decision making process. Classifications categories help to group assets of similar characteristic together. This can be at the asset type, industry or sector level, before we get to the individual security.

Ibbotson and Kaplan (2000) studied the performance across mutual funds and found about 40% of the variability of expected investment returns across categories of funds to be explained by asset allocation. They also found that only a smaller proportion of long term performance was determined by the actual security selection within the chosen asset allocation.

For this reason, unit trusts in different classification categories, (even if they have exposure to same or different asset classes) are expected to exhibit some dissimilarities, both from a risk and return perspective.

Different sectors are expected to have different return and risk characteristics, however, there are instances where high positive correlated returns occur over the same time period for different sectors (Jagannathan & Suresh, 2014). Despite the correlation, the study was able to rank the different return and risk performance of the indices in their sample.

This begs the questions about the significance of the contribution made by sector classification to returns and risk performance in unit trusts, if there are significant differences in performance across classification categories, if there are diversification benefits, and if performance justifies classification into sectoral categories.

2.4.1 *Unit Trusts Classification – Importance of Return and Risk performance*

Unit trusts are highly regulated financial instruments in many markets. Classification suggested by regulation therefore seeks to position offerings into categories that enable buyers to make choices based on their investment objectives, preferences and requirements.

The asset manager uses two variables to determine what unit trust is appropriate for an investor. They are investment objectives and constraints, which are peculiar to the investor (Reilly & Brown, 2012a). Investment objectives consist of return and risk objectives.

Return objectives include the following four, capital preservation, capital appreciation, current income, and total return. Return objectives, viewed differently can also be described as goal based (Nevins, 2004), either as targeted towards a particular amount or an investment rate of return by a particular date.

Risk objectives are set by assessing the investor's risk appetite. Risk appetite is described by the investor's willingness to take risk and secondly the ability to take risk. Where there is the ability to take risk, but no willingness, the risk appetite is considered low. Also, where the willingness to take risk is high and the ability to take risk is low, then the risk appetite is still considered low. Investment constraints are usually subdivided into five parts, liquidity, time horizon, taxes, legal and unique circumstances (Reilly & Brown, 2012a).

Since both return and risk are important measures to consider when making an investment decision, it should also play a part in the classification basis for investment assets.

2.4.2 *Unit Trusts Classification – Industry versus Return and Risk performance*

Classification of units trusts are based on a number of characteristics, which range from objectives in both Indonesia (Tamara & Revina, 2015) and Spain (Moreno et al., 2006), investment styles (DiBartolomeo & Witkowski, 1997) in the US, a tiering system combining geographical location with asset allocation in South Africa (ASISA, 2014b), to touch on a few.

Some studies have been conducted to check if the original classifications of unit trusts are appropriate, when examined in the context of the actual risk and return performance of the funds.

DiBartolomeo and Witkowski (1997) examined misclassification based on investment styles and found that 9% of US equity funds to be seriously misclassified while an additional 31% were somewhat misclassified.

Using the clustering method, (Moreno et al., 2006), found that 40% of Spanish unit trusts had historical return and risk performance that did not conform with the officially designated classification category. Excessive number of categories was suggested as a possible reason for the misclassification and this could minimize the diversification benefit accruable to investors (Moreno et al., 2006).

In Indonesia, Tamara and Revina (2015) also used the K-means clustering technique to identify funds which belonged to their original classification and those funds which seemed to have been wrongly placed in classification categories. Their work found that about 43% of Indonesian unit trusts were misclassified.

Gerlach and Maurer (2015) using the K-means algorithm was able to confirm that return based classification of unit trusts was more effective in segmenting unit trust categories than the prevalent classification based on objectives and asset classes in England.

Current literature suggests that majority of unit trusts are correctly classified, even though a significant percentage of unit trusts are seen to be misclassified.

This buttresses the need to investigate the research problems stated in Chapter 1, and raises questions on the appropriateness of classification categories officially provided to the investment public.

If the classification categories, which are meant to be indicative of the return and risk performance are made up of misclassified unit trusts which result in selections and choices that do not meet objectives and ultimately losses, then investors may develop an apathy for investments. A big fiduciary problem which may be threatening to the entire investment industry may ensue. This is another reason why investigating the appropriateness of classification categories is important.

At the time of this research, it does not appear that any study has investigated the appropriateness of the classification categories of unit trusts in South Africa by examining return and risk performances.

2.4.3 *Unit Trusts – Industry Classification variations in selected locations*

South Africa – From the inception of unit trusts in 1965 up until December 31 2012, unit trusts were classified according to investment styles like size, income, growth and value, a system with was implemented over twelve years ago, when there were less than 40 unit trusts (Liebenberg, 2012). Today, there are over a thousand unit trusts in existence (ASISA, 2016). From January 1, 2013 a three tier classification system was adopted which focused on “where” the asset was invested and “what” the nature and investment focus of the underlying is (Funds Data, 2016). Tier one is based on geographic location, tier two describes the kind of asset the fund may invest in while the third tier describes the specific investment focus (Witbooi, 2013).

Europe - The European Fund and Asset Management Association (EFAMA), is the organisation that deals with classification on unit trusts in Europe to facilitate comparison of funds (EFAMA, 2012). There are four main classification categories of Equity, Bond, Money Market and Mixed. The four are further subdivided along nine criteria lines of Country / Region, Sector, Market

Capitalization, Currency Exposure, Credit Quality, Interest Rate Exposure, Emerging Market Exposure, Asset Allocation and Structural Characteristics

Indonesia - Tamara and Revina (2015) indicated that unit trusts in Indonesia were classified as fixed income, equity, money market and structured. From its inception as an investment instrument in 1990 the number of funds had grown to about 700 as at 2013.

Spain - The Securities Market National Commission and the Spanish Association of Collective Investments established the classification of unit trusts in 1999. Unit trusts are classified into 14 categorises according to the number of type of assets and proportion of the asset held by the unit trusts (Moreno et al., 2006).

Canada – According to CIFSC (2016), investment funds are categorised along security types into cash, fixed income, equities, commodities and other which consist of other alternative investment asset classes.

2.4.4 *Proposition 2*

This research seeks to find evidence in support of, or against the propositions that:

South African unit trusts across different classification categories exhibit different return and risk performance over time.

2.5 Conclusion of Literature Review

From the literature review above, there is ample evidence that there is always variability in returns. A proper understanding of this variability is critical in assessing if historical performance supports classification categories offered by industry and regulators. To assist both the investor and the investment manager, research is required to determine if the classification categories explain the similarities or differences in return and risk performance exhibited by South African unit trusts over time.

This research seeks to find evidence in support of, or against the following research propositions that:

2.5.1 *Proposition 1:*

South African unit trusts within the same classification category exhibit similar return and risk performance over time.

2.5.2 *Proposition 2:*

South African unit trusts across different classification categories exhibit different return and risk performance over time.

CHAPTER 3. RESEARCH METHODOLOGY

This section outlines the research methodology that is employed in addressing the research propositions stated below, which were developed from the literature review in Chapter 2:

1. South African unit trusts within the same classification category exhibit similar return and risk performance over time.
2. South African unit trusts across different classification categories exhibit different return and risk performance over time.

The chapter begins with a description of the research paradigm that is utilized as well as the research design that is put forward to support the research proposition. Following this, the population, sample and sampling methodology for the research is discussed. Next is the research instruments utilized as well as the selected techniques for collecting, analysing and interpreting data. In doing this, the fit of the theory with the research as well as shortcomings and possible ways of overcoming them is briefly discussed.

In concluding the chapter, a discussion of the limitation, validity and reliability of the chapter is presented.

3.1 Research methodology /paradigm

Three main research paradigms exist, they are qualitative, quantitative and mixed methods (Creswell, 2013; Williams, 2011). This research utilized quantitative methods.

Due to the use of quantitative data derived from sources like INET BFA, Bloomberg and ASISA, quantitative methods that employ statistical analysis and inferential drawings are necessary in addressing the research propositions.

Quantitative methodology is appropriate for this research, because previous studies in the areas of performance evaluation (Ibbotson & Kaplan, 2000;

Simons, 1998) and classification of unit trusts using clustering have employed quantitative methods (Lisi & Otranto, 2010; Marathe & Shawky, 1999).

3.2 Research Design

The approach for this study combines both mathematical and statistical modelling. These have been used in previous studies for analysing performance variances (Jan & Shieh, 2014; Tomarken & Serlin, 1986) and clustering of unit trusts performance in different countries as well as other asset classes like hedge funds (Das, 2003; Gerlach & Maurer, 2015; Tamara & Revina, 2015).

An advantage of the statistical method which carries out an analysis of variance is that it is useful in checking for differences in the performance of unit trusts and unit trust categories. It also assists in identifying unit trusts which are misclassified, that is, situations where historical return and risk performance do not align with those of others in its official classification category (Moreno et al., 2006). Another advantage is that, clustering allows the use of classification based on actual return and risk performance, which have not been subjected to a benchmark or reference point which may be inappropriate for calculating risk adjusted return or for performance evaluation.

Cluster analysis may be impacted by the scale of the data set used. However, the data in this study are reported in percentages, for both risk and return. Hence, normalising the variables was not required, even though cluster analysis is able to deal with data of different scales. (Moreno et al., 2006).

This research utilizes the K-means, non-hierarchical cluster analysis method. Some disadvantages of the non-hierarchical clustering algorithm are that the results of the partitioning are not always visually appealing or easy to interpret as other hierarchical clustering techniques which utilize dendrograms. Also, the output is not unique and is influenced by input choices applied to the descriptive technique. Lastly, even though literature suggests that groups exist in terms of classification of unit trusts and their level of expected return and risk, clustering will always produce groups which may lead to false or weak assumptions.

3.3 Population and sample

3.3.1 *Population*

The population of this study comprises of all unit trusts that existed in South Africa, as described by ASISA's list of collective investment schemes as at December 31, 2015.

3.3.2 *Sample and sampling method*

The sample is made up of 202 unit trusts, drawn from six classification categories. The sample drawn consists of equity unit trusts within the South Africa geographic classification only, offered to retail investors – Class A unit trusts. The selected categories within the equity asset type are Financial, General, Industrial, Large Capitalization, Mid & Small Capitalization and Resources & Basic Industries.

Table 1: Current classification of unit trusts in South Africa

Tier 1 Geographic	**Tier 2** (Asset Type)	**Tier 3** (Category)			
South Africa	Equity	General	Large Cap	Mid & Small Cap	
		Resources & Basic Industry	Industrial	Financial	Unclassified
	Multi-Asset	Income	Low Equity	Medium Equity	High Equity
		Flexible	Target Date Portfolios		
	Real Estate	General			
	Interest Bearing	Variable Term	Short Term	Money Market	
Worldwide	Equity	General	Unclassified		
	Multi-Asset	Flexible			
	Interest Bearing	Variable Term	Short Term		
Global	Equity	General	Unclassified		
	Multi-Asset	Flexible			
	Interest Bearing	Variable Term	Short Term		
Regional	Equity	General	Unclassified		
	Multi-Asset	Flexible			
	Interest Bearing	Variable Term	Short Term		

Source: (ASISA, 2014a)

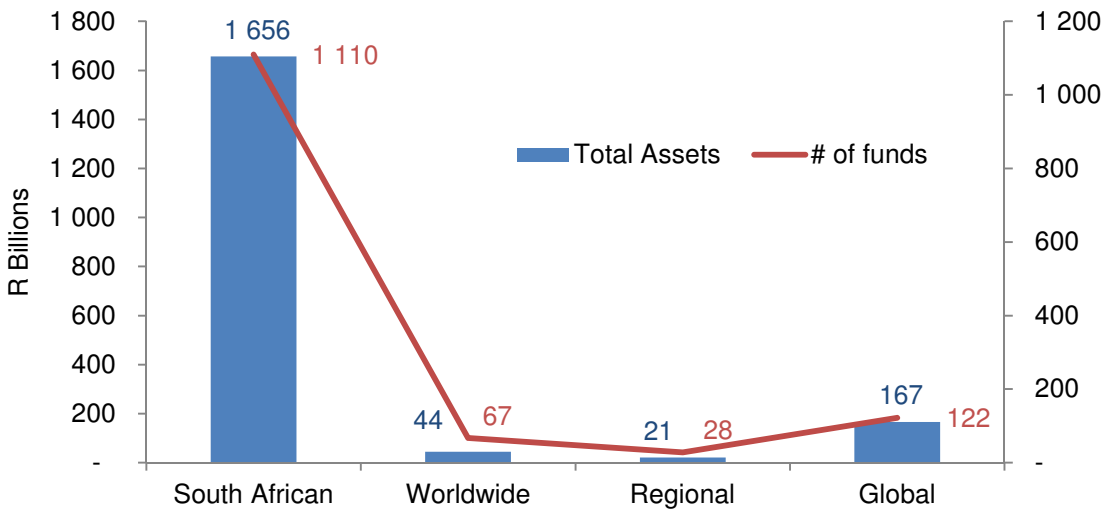
Table 1 above shows the current classification of unit trusts in South Africa. The classification of the entire population of the study is depicted, while the portion highlighted in blue, represents the classification categories selected for this study.

South Africa was chosen as the geographic classification basis because it represents the largest proportion of unit trusts available and because it has the largest assets under management (AUM), at R1.7 billion as at December 31, 2015.

Table 2: Unit trusts percentage composition

Tier 1 Geographic	% Value	% of total # of funds
South Africa	88	84
Worldwide	2	5
Global	1	2
Regional	9	9

South African unit trusts have portfolios that invest at least 70% of their assets in South African investment markets. They may invest a maximum of 25% of their assets outside of South Africa plus an additional 5% of their assets in Africa excluding South Africa. Worldwide unit trusts portfolios invest in both South African and foreign markets. There are no limits set for the percentages that can be invested in either domestic or foreign assets. Global unit trusts also have exposure of 80% to other countries but have no restrictions to specific geographical areas where they can invest. Regional unit trusts have exposure of 80% to other countries, but with restrictions on the specific country, where they can invest (ASISA, 2014b).



Source: Data obtained from ASISA (2016)

Figure 3: AUM & numbers of unit trusts for each category

Equity unit trusts were chosen as the asset type classification basis because equities as an asset class are able to show unpredictable variability in asset returns. Also, the nature of the variability in returns observed can be related to one asset class type, that is, equities.

The unclassified equity South African unit trusts were left out of the study, because of the small number of unit trusts in this category – only two (2) unit trusts.

South Africa Real Estate, Interest Bearing and Multi-Asset unit trusts did not form part of this study because of the near steady state volatility they exhibit by virtue of the nature of their underlying assets, that is, money market, fixed income and property.

Unit trusts classified under the geographic classifications of Worldwide, Global and Regional were not part of this study because of their relative smaller size (R0.2 billion) and fewer numbers of unit trusts representation (217 unit trusts) majority of which is not available to retail investors.

Previous studies carried out on South African units trusts when the population was less than 400 funds, tended to utilize the universe of funds, while more

recent studies tend to select a sample from the various categories either randomly (Mibiola, 2013) or by linking the sample to an available benchmark as at the date of study (Kubelo, 2013).

A sample incorporating unit trusts from the geographic classification category of South Africa also helps to reduce the effects of returns and variability attributable to changes in currency, which the other three categories will be more exposed to.

From the fairly large sample chosen, about 24,840 data points served as input into the research. The data on month-end close NAV for each unit trust was obtained from INET BFA and Bloomberg over a 10-year period spanning January 2006 to December 2015.

3.4 The research instrument

The research instrument is a combination of mathematical models and statistical methods. Holding period returns is calculated on a monthly basis for all the unit trusts using month-end unit trust NAV. Statistical methods are then used to derive mean returns and standard deviation respectively.

3.5 Procedure for data collection

The list of the constituent unit trusts of each classification category as at December 31, 2015 was obtained from ASISA. Historical monthly NAV data were obtained from INET BFA for the 12 months of the year, for the period starting January 2006 through to December 2015 and downloaded to Microsoft excel spreadsheets. The same data were obtained from an additional source, Bloomberg. Both sources complemented each other because where one source did not report necessary data, the other source was oftentimes able to provide the required NAV values.

3.6 Data analysis and interpretation

Two main models are used to analyse the means of the returns and risk (standard deviation) for all the different unit trusts and categories. The one way Welch's Test ANOVA and the post hoc Tukey's Test (where necessary) were used for analysis and interpretation of the first sub problem, while the same one way Welch's Test ANOVA, the post hoc Tukey's Test (where necessary) and the K-means non-hierarchical clustering analysis methods were used for the second sub problem.

In dealing with the first proposition, monthly mean returns and risk metrics of unit trusts within the same classification category obtained from the statistical research instruments using the 10-year data were subjected to a one way ANOVA, using the statistical software Minitab. Where the results revealed a significant difference in the mean return and risk performance among the various unit trusts, a post hoc analysis is done to determine the unit trust(s) with performance that are significantly different from those of others within the classification category using Minitab.

In dealing with the second proposition, the same process was replicated with the mean monthly return and risk values obtained at the category level, by combining the mean values of all the unit trusts in that category. The category level data was then subjected to a one way ANOVA using Minitab. Where the results revealed a significant difference in the mean return and risk performance among the various categories, a post hoc analysis is done to determine the category with performance that are significantly different from those of others across the different categories using Minitab.

The test of significance was set at the 5% level.

In addition to the above, to tackle the second proposition, cluster analysis was used. The K-mean clustering technique previously used by Lisi and Otranto (2010) and Marathe and Shawky (1999) in categorising mutual funds was employed. Tamara and Revina (2015) utilised the K-means cluster analysis to identify funds which belonged to its original classification and to determine

funds which needed to be reclassified. The K-means clustering algorithm was used to divide the data set for the return and risk variables into non-overlapping homogenous cluster of points which are internally cohesive (Marathe & Shawky, 1999), in order to reclassify the unit trusts on the basis of the relationship between return and risk.

3.6.1 *Return Measurement in Unit Trusts*

Holding period return (HPR)

This is used to calculate the returns earned from an asset held over a period. The returns in unit trust investments are calculated using the change in net asset value (NAV):

$$\mathrm{NAV} = \frac{\text{market value of all the securities held}}{\text{number of shares (units)held in the portfolio}} \quad (1)$$

Oftentimes, HPR is calculated on a monthly basis using the formula:

$$\mathrm{R_t} = \frac{\mathrm{NAV_t} - \mathrm{NAV_{t-1}}}{\mathrm{NAV_t}} \quad (2)$$

Where:

$\mathrm{R_t}$ = rate of return on the last trading day of the month

$\mathrm{NAV_t}$ = closing NAV on the last trading day of the month

$\mathrm{NAV_{t-1}}$ = closing NAV on the last trading day of the previous month

3.6.2 *Risk Measurement in Unit Trusts*

Standard deviation

The simplest form and most commonly used measure of volatility in unit trusts is standard deviation (Simons, 1998; Simpson, 2015) with its origins in the work of Markowitz (1952). Standard deviation measures the variability in the monthly returns and is an absolute measure of risk. Despite the popularity of standard deviation, it has its weakness in assuming a normally disturbed pattern of returns, when there is empirical evidence to suggest that distribution of returns are often skewed, exhibit kurtosis and suffer from heteroskedasticity (Nevins, 2004). Standard deviation is calculated using the following formula:

$$\sigma = \sqrt{\frac{1}{n-1}\sum_{t=1}^{n}(R_p - \overline{R})^2} \qquad (3)$$

Where:

σ = standard deviation

R_p = rate of return on the investment portfolio

$\overline{R}$ = mean rate of return on the investment portfolio

n = number of periods (usually monthly)

Focus was not placed on other forms of risk and risk-adjusted performance measures like downside deviation, Beta, Sharpe ratio, Sortino ratio, Trenynors ratio and others, because the research excludes the use of those risk and risk-adjusted measure in its analysis.

3.7 Limitations of the study

This study did not investigate risk-return performance, using any metric that measures risk relative to a benchmark. To date, no other work has been done using cluster analysis to classify unit trusts in South Africa and it may be good to begin with simple measures like return and standard deviation before moving to studies that investigate performance relative to some other variable or even a benchmark.

This study did not seek to have predictive ability, based on the limitation inherent in the use of ex-post returns in forecasting without additional input that helps to model possible factors that may affect return and risk in the future.

3.8 Validity and reliability

Quantitative research deals with data and measurements (Ary, Jacobs, Sorensen, & Walker, 2013) and the use of validity and reliability is common practice (Golafshani, 2003). While validity relates to the extent to which the research truly and meaningfully measures that which it was intended to, with the ability to make appropriate interpretations from the instruments of measurement, reliability relates to the ability to obtain consistent results from the same instrument over time (Ary et al., 2013).

3.8.1 *External validity*

External validity describes the ability to generalize the conclusions obtained from a particular study to other contexts, the larger population and other time frames (Kalof, Dan, & Dietz, 2008; Ormrod & Leedy, 2010).

The ANOVA and cluster analysis model used in this study have been used widely with success in the engineering (Medhat, Ramesh, Bonakdarpour, & Fischmeister, 2015), medical (Jung & Chung, 2016; Scott & Knott, 1974) and finance fields (Blake, Lehmann, & Timmermann, 2002) to name a few. A

number of studies have also applied cluster analysis to unit trusts risk and return performance (Lisi & Otranto, 2010; Marathe & Shawky, 1999).

In order to improve validity of this study, the sample was designed to include the South African equity unit trusts in all the categories, but for one category which had too few members. This contributed to improving external validity for unit trusts in the South African geographic classification. However, the results cannot be generalised for unit trusts in other geographic categories like Worldwide, Global or Regional, even though they represent 22% of the market share nor for other time frames outside the period of this research.

3.8.2 *Internal validity*

In order to ensure internal validity and to deal with confounding effects, a number of measures were taken. Firstly, the sampling error was minimized by eliminating the need to select a few unit trusts which could lead to the selection of funds with non-representative return and risk performance.

The study's time frame was also set at 10 years, a period which is long enough to incorporate the brief era preceding the 2008 financial crisis and a longer period, post the start of the crisis, periods which have had meaningful impact on the perception of risk and return on investments particularly as it relates to emerging markets like South Africa.

The use of manager chosen benchmarks was also avoided to deal with the problem of inappropriate benchmarks. Rather, each unit trust was examined relative to its peer and other classification categories over the period of the study.

The risk measure, standard deviation was chosen to highlight the volatility of returns - a simple enough measure, for non-sophisticated investors to understand.

3.8.3 *Reliability*

To ensure that consistent results are obtainable from the research instruments when applied repeatedly, the calculations of the return and risk measures were done iteratively to satisfy the condition that the outcomes were consistent. Using the same set of data and the model / methods is expected to give exactly the same results if done by another researcher.

Though NAV values should be same, irrespective of source, the data obtained from INET BFA was verified, by comparing this with those obtained from Bloomberg to make sure that the raw data utilized is accurate.

CHAPTER 4. PRESENTATION OF RESULTS

4.1 Introduction

In this chapter, there will be a presentation of results obtained from the application of methodologies identified, to the selected sample described in Chapter 3.

The first section of the Chapter will begin with a presentation of the sample profile. The next section will detail the presentation of results from the analysis of the similarity in performance of South African unit trusts within the same classification category over time.

This will be followed by the presentation of the results from the analysis of the differences in performance of South African unit trusts across different classification categories over time. Following this, will be the presentation of results from the classification of unit trusts based on returns and risk.

The chapter will be concluded by a summary of statistical significance for the similarities and difference in performance within and across the unit trusts and unit trust categories.

4.2 Sample Profile

Over the period January 2006 to December 2015, the mean monthly returns and risk (standard deviation), were obtained from 202 South African equity unit trusts, from month-end close prices over 120 month periods. This translated to a maximum obtainable number of 119 observations of mean return and standard deviation per unit trust.

Table 3: Descriptive Statistics – Across Categories

	N	Range	Minimum	Maximum	Mean	Std. Deviation
Financial	7	0.66%	0.75%	1.42%	0.95%	0.24%
General	151	7.30%	-4.47%	2.83%	0.57%	0.80%
Industrial	7	0.61%	1.03%	1.63%	1.33%	0.22%
Large Capitalisation	20	1.75%	-0.35%	1.40%	0.72%	0.43%
Mid& Small Cap	7	0.61%	0.55%	1.16%	0.81%	0.23%
Resources & Basic Ind.	10	0.59%	-0.06%	0.53%	0.26%	0.22%
	202					

Table 3 shows the mean monthly returns and standard deviation for South African equity unit trusts grouped in accordance to the ASISA sector classification categories.

A summary of the descriptive statistics for the constituents of the six different classification categories are presented in Appendix C below.

4.3 Results pertaining to similarity in performance within classification categories over time

The one way single factor Welch's Test ANOVA was used in comparing the mean returns of the unit trusts within the same category and equal variances were assumed for the analysis following the Levene's test for homogeneity. The one way single factor ANOVA was also used in comparing the mean returns of six different unit trusts classification categories.

A post hoc test is presented where the result from the ANOVA suggests that a difference in mean returns exist.

4.3.1 *Similarity in Performance within Financials*

Table 4: Analysis of Variance – Financial

Source	*SS*	*df*	*Contribution*	*MS*	*F*	*p-value*
Factor	0.00312	6	0.17%	0.000520	0.22	0.970
Error	1.81985	777	99.83%	0.002342		
Total	1.82297	783	100.00%			

Table 4 shows the result of the ANOVA for mean returns in the Financial classification category.

A p-value of 0.970 from the ANOVA suggests that the differences between the return means of constituent unit trusts in the Financial classification category are not significant statistically at a significance level of 0.05. A post hoc test was therefore not required.

The Levene's test returned a p-value of 0.814. Refer to APPENDIX C for details.

There were 7 unit trusts in this classification category. Refer to APPENDIX A for details.

4.3.2 *Similarity in Performance within General*

Table 5: Analysis of Variance – General

Source	*SS*	*df*	*Contribution*	*MS*	*F*	*p-value*
Factor	0.11960	150	0.87%	0.000798	0.54	1.000
Error	13.56070	9262	99.13%	0.001464		
Total	13.68030	9412	100.00%			

Table 5 shows the result of the ANOVA for mean returns in the General classification category.

A p-value of 1.000 from the ANOVA suggests that the differences between the return means of constituent unit trusts in the General classification category are not significant statistically at a significance level of 0.05. A post hoc test was therefore not required.

There were 151 unit trusts in this classification category. Refer to APPENDIX A for details.

4.3.3 *Similarity in Performance within Industrial*

Table 6: Analysis of Variance – Industrial

Source	*SS*	*df*	*Contribution*	*MS*	*F*	*p-value*
Factor	0.00298	6	0.25%	0.000497	0.33	0.924
Error	1.16928	766	99.75%	0.001526		
Total	1.17226	772	100.00%			

Similarly, Table 6 shows the result of the ANOVA for mean returns in the Industrial classification category.

A p-value of 0.924 from the ANOVA suggests that the differences between the return means of constituent unit trusts in the Industrial classification category are not significant statistically at a significance level of 0.05. A post hoc test was therefore not required.

The Levene's test returned a p-value of 0.391. Refer to APPENDIX C for details.

There were 7 unit trusts in this classification category. Refer to APPENDIX A for details.

4.3.4 *Similarity in Performance within Large Cap*

Table 7: Analysis of Variance – Large Cap

Source	*SS*	*df*	*Contribution*	*MS*	*F*	*p-value*
Factor	0.01459	19	0.64%	0.000768	0.44	0.981
Error	2.27145	1314	99.36%	0.001729		
Total	2.28604	1333	100.00%			

Table 7 above shows the result of the ANOVA for mean returns in the Large capitalization classification category.

A p-value of 0.981 from the ANOVA suggests that the differences between the return means of constituent unit trusts in the Large capitalization classification category are not significant statistically at a significance level of 0.05. So, a post hoc test was not required.

The Levene's test returned a p-value of 0.003. Refer to APPENDIX C for details.

There were 20 unit trusts in this classification category. Refer to APPENDIX A for details.

4.3.5 *Similarity in Performance within Mid & Small Cap*

Table 8: Analysis of Variance – Mid & Small Cap

Source	*SS*	*df*	*Contribution*	*MS*	*F*	*p-value*
Factor	0.00302	6	0.30%	0.000503	0.34	0.915
Error	0.99395	674	99.70%	0.001475		
Total	0.99697	680	100.00%			

Table 8 shows the result of the ANOVA for mean returns in the Mid & Small capitalization classification category.

A p-value of 0.915 from the ANOVA suggests that the differences between the return means of constituent unit trusts in the Mid & Small capitalization classification category are not significant statistically at a significance level of 0.05. A post hoc test was therefore not required.

The Levene's test returned a p-value of 0.099. Refer to APPENDIX C for details.

There were 7 unit trusts in this classification category. Refer to APPENDIX A for details.

4.3.6 *Similarity in Performance within Resources & Basic Industries*

Table 9: Analysis of Variance – Resources & Basic Industries

Source	*SS*	*df*	*Contribution*	*MS*	*F*	*p-value*
Factor	0.00461	9	0.10%	0.000512	0.12	0.999
Error	4.73785	1092	99.90%	0.004339		
Total	4.74246	1 101	100.00%			

Table 9 shows the result of the ANOVA for mean returns in the Resources & Basic Industries classification category.

A p-value of 0.999 from the ANOVA suggests that the differences between the return means of constituent unit trusts in the Resources & Basic Industries classification category are not significant statistically at a significance level of 0.05. A post hoc test was therefore not required.

The Levene's test returned a p-value of 0.385. Refer to APPENDIX C for details.

There were 10 unit trusts in this classification category. Refer to APPENDIX A for details.

In conclusion, there is evidence to support the proposition that South African unit trusts within the same classification category exhibit similar return and risk performance over time.

4.4 Results pertaining to differences in Performance across classification categories over time

The one way single factor Welch's ANOVA was also used in comparing the return means of the six different unit trusts classification categories. Equal variances were assumed for the analysis following the Levene's test for homogeneity.

A post hoc test is presented where the result from the ANOVA suggests that a difference in return means exist.

This is followed by a presentation of returns and standard deviation means as per industry classification and a non-hierarchical clustering into six clusters, to test for appropriateness of traditional industry classification, in line with the objective of testing for deviations of performance from the traditional industry classification as suggested by ASISA and suggesting a basis for classification related to risk and return.

4.4.1 *Differences in Performance across classification categories*

Table 10: Analysis of Variance – Across Categories

Source	*SS*	*df*	*Contribution*	*MS*	*F*	*p-value*
Factor	0.00065	5	6.22%	0.000130	2.60	0.027
Error	0.00979	196	93.78%	0.000050		
Total	0.01044	201	100.00%			

Table 10 shows the result of the ANOVA for return means across the six classification categories – Financials, General, Industrial, Large Capitalization, Mid & Small Capitalization and Resources & Basic Industries.

A p-value of 0.027 from the ANOVA indicates that the return means between the classification categories are statistically different at a significance level of 0.05.

The Levene's test returned a p-value of 0.255. Refer to appendix D for details.

A total number of six classification categories were used in this ANOVA and the Tukey Simultaneous test for Differences of Means was selected as an appropriate post hoc test.

Table 11: Tukey Simultaneous Test – Across Categories

Tukey Simultaneous Tests for Differences of Means

Difference of Levels	Difference of Means	SE of Difference	95% CI	T-Value	Adjusted P-Value
General - Financial	-0.00385	0.00270	(-0.01171, 0.00401)	-1.41	0.721
Industrial - Financial	0.00385	0.00378	(-0.00702, 0.01472)	1.02	0.911
Large Cap - Financial	-0.00233	0.00310	(-0.01126, 0.00660)	-0.75	0.975
Mid and Small - Financial	-0.00141	0.00378	(-0.01228, 0.00946)	-0.37	0.999
Resources - Financial	-0.00685	0.00348	(-0.01688, 0.00317)	-1.97	0.365
Industrial - General	0.00770	0.00273	(-0.00017, 0.01556)	2.82	**0.059**
Large Cap - General	0.00152	0.00168	(-0.00332, 0.00636)	0.91	0.945
Mid and Small - General	0.00244	0.00273	(-0.00543, 0.01030)	0.89	0.948
Resources - General	-0.00300	0.00231	(-0.00964, 0.00364)	-1.30	0.784
Large Cap - Industrial	-0.00618	0.00310	(-0.01511, 0.00276)	-1.99	0.352
Mid and Small - Industrial	-0.00526	0.00378	(-0.01613, 0.00561)	-1.39	0.732
Resources - Industrial	-0.01070	0.00348	(-0.02072, 0.00068)	-3.07	**0.029**
Mid and Small - Large Cap	-0.00091	0.00310	(-0.00802, 0.00985)	0.29	1.000
Resources - Large Cap	-0.00452	0.00274	(-0.01240, 0.00335)	-1.65	0.565
Resources - Mid and Small	-0.00544	0.00348	(-0.01546, 0.00458)	-1.56	0.625

Individual confidence level = 99.56%

Table 11 above shows the Tukey Simultaneous Tests for Differences of Means for the six classification categories under study. A p-value of 0.029 from the Tukey test indicates that the return means between Resources & Basic Industries and Industrial classification categories are statistically different at a significance level of 0.05.

Worthy of note also, is the p-value of 0.059 from the Tukey test for the return means between the Industrial and General classification categories, that can be considered to be marginally similar, as it is a few basis points away from being statistically different at a significance level of 0.05. The other Tukey

simultaneous tests however show that there are no significant differences in the performance of 14 out of 16 possible paired categories.

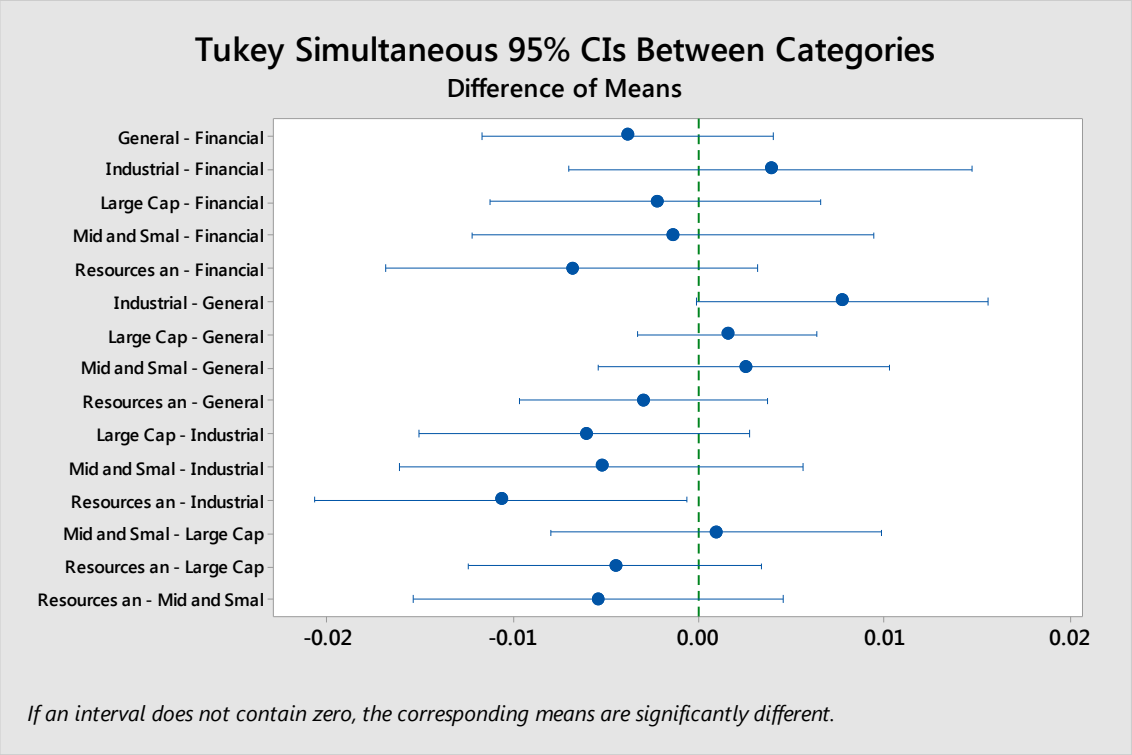


Figure 4: Tukey Simultaneous Mean Differences – Across Categories

Figure 4 also shows a graphical representation of the test for differences of means at a 95% confidence interval. The intervals that do not contain zero are for the categories, where the means of the paired categories are significantly different. The interval for Resources & Basic Industries and Industrial do not contain zero, indicating significant differences in means while the interval for Industrial and General only marginally contains zero.

4.4.2 *Reclassification of Unit Trusts based on Return and Risk performance*

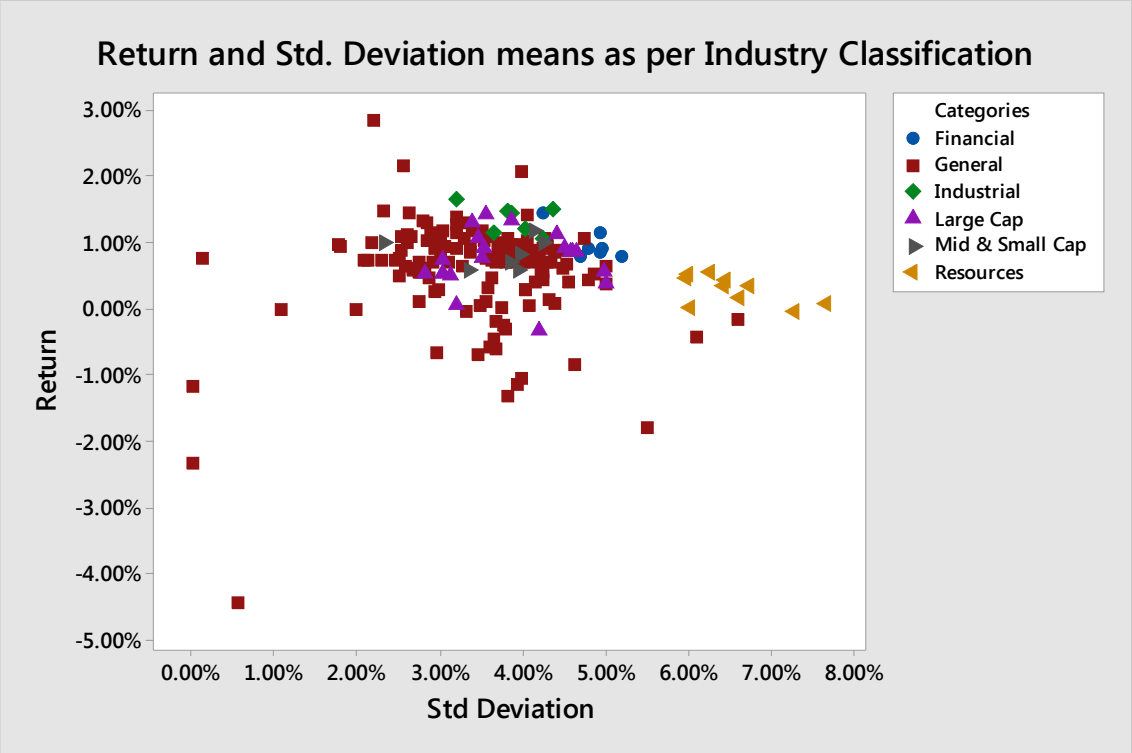


Figure 5: Return vs Std Deviation before clustering observations

Presented in Figure 5 above is a scatter plot of the returns and risks for the different unit trusts, depicted according to their industry classification category, which are the categories, Financial, General, Industrial, Large Cap, Mid & Small Cap and Resources & Basic Industries.

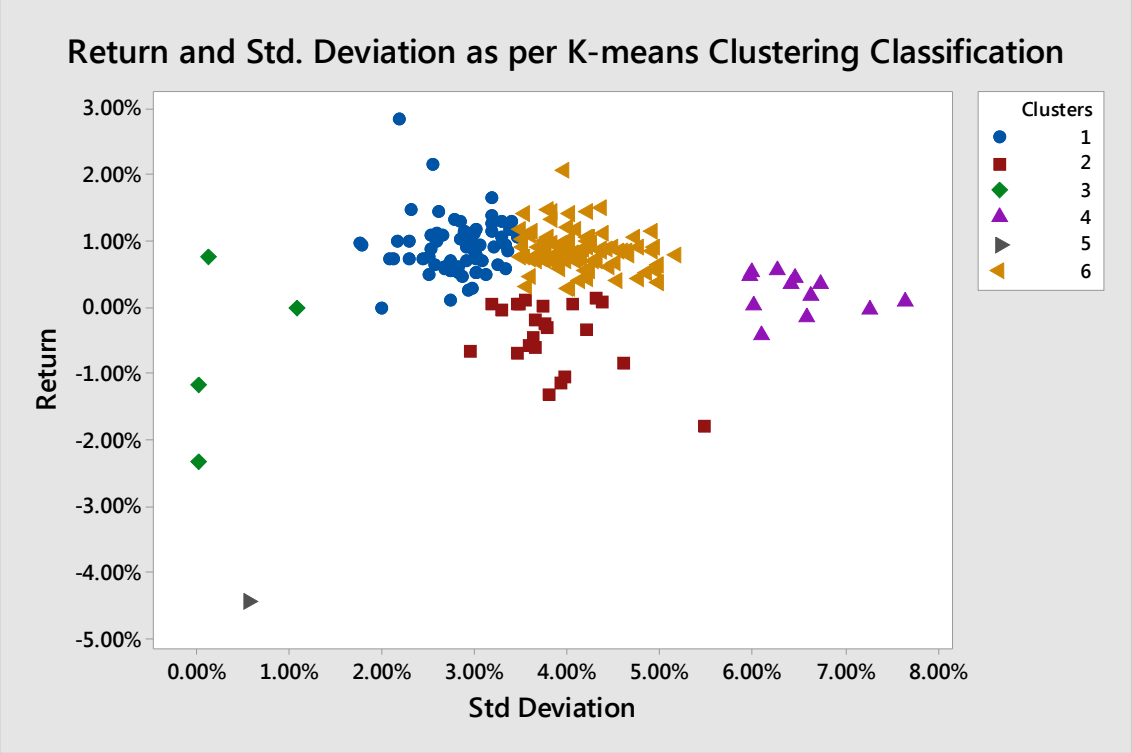


Figure 6: Return vs Std Deviation after clustering into six clusters

Figure 6 shows the result of clustering the return into six categories, required to compare the industry based plot to classification based on risk and return alone.

Table 12: Reclassification using K-means clustering

Cluster	Financials	General	Industrial	Large Cap	Mid & Small	Resources and Basic Industry
1	0	56	1	7	2	0
2	0	20	0	2	0	0
3	0	4	0	0	0	0
4	0	2	0	0	0	10
5	0	1	0	0	0	0
6	9	68	6	11	5	0

Table 12 above shows the reclassification of various unit trusts based on risk and return performance and how the unit trusts move relative to the traditional classification basis.

Table 13: Result of Final Cluster Centres

Cluster	1	2	3	4	5	6
Return Means	0.90%	-0.47%	-0.71%	0.17%	-4.47%	0.82%
Standard Deviation	2.80%	3.80%	0.30%	6.50%	0.53%	4.13%
Number in Cluster	66	22	4	12	1	97

Table 13 shows the final cluster centers of return and standard deviation means as well as the number of unit trusts present in each cluster after the k-means reclassification. This outcome was achieved following seven (7) iterations of small or no changes to the cluster centers, performed by the Minitab.

Table 14: Distances between Fund Cluster Centers

Distances between Final Cluster Centres						
Cluster	1	2	3	4	5	6
1		1.694	2.975	3.774	5.828	1.335
2	1.694		3.508	2.779	5.164	1.335
3	2.975	3.508		6.266	3.766	4.130
4	3.774	2.779	6.266		7.561	2.458
5	5.828	5.164	3.766	7.561		6.402
6	1.335	1.335	4.130	2.458	6.402	

Table 14 indicates that the shortest distance between the cluster centers is 1.335 between clusters 1 and 6, while the longest distance between the cluster centers are for those of clusters 4 & 5 respectively.

Table 15: Analysis of Variance – Clusters

	Cluster		*Error*		*F*	*Sig.*
	Mean Square	*df*	*Mean Square*	*df*		
Return Means	14.137	5	0.171	196	82.82	0.000
Standard Deviation	44.475	5	0.185	196	239.83	0.000

The ANOVA in Table 15 shows that the clusters were chosen to maximize the differences among the unit trusts in the different clusters and that the contribution of each unit trust is significant to the clustering exercise.

In conclusion, there is evidence against the proposition that South African unit trusts in different classification categories exhibit different return and risk performance over time.

4.5 Summary of the results

Using the proposed methodology in Chapter 3, the analysis revealed that South African unit trusts within the same classification category exhibit similar return and risk performance while those in different classification categories more often than not, exhibit similarities in return and risk performance over time.

Table 16: Analysis of Variance – p values of return means within Category

Within Classification Category Comparison	*p-value*
Financial	0.970
General	1.000
Industrial	0.924
Large Cap	0.981
Mid & Small Cap	0.915
Resources & Basic Industries	0.999

*Significant at the 5% level

The p-values shown in Table 16 obtained from the ANOVA test, suggests that there is no significant difference in the performance of unit trusts in the same classification category.

This is in support of the proposition that performance of South African unit trusts within the same classification category exhibit similar return and risk performance in all cases.

Table 17: Analysis of Variance – p values of return means across Categories

Between Classification Categories Comparison	*p-value*
The six different classification categories	*0.027

*Significant at the 5% level

The p-value show in Table 17, obtained from the ANOVA test suggests that there are significant differences in the performance of different classification categories. However, the post hoc Tukey's test suggested that the significant

differences are with the pair of Resources & Basic Industries and Industrials. There appears to be a marginal difference between the Resources & Basic Industries and General classification categories, while all the other pairwise combinations do not show a significant difference in performance across categories.

Similarly, using the proposed methodology in Chapter 3, the analysis revealed that using return and risk measures, it is possible to group unit trusts from different classification categories on the basis of risk and return, showing those with similar and different performance.

There is evidence against the proposition that different classification categories exhibit different return and risk performance.

CHAPTER 5. DISCUSSION OF THE RESULTS

5.1 Introduction

In this chapter, there will be a discussion and interpretation of the results which were presented in Chapter 4 in relation to the literature review and propositions discussed and formulated in Chapter 2.

The first section in the Chapter will begin with a discussion of the sample and its characteristics. The next section will detail the discussion and interpretation of the results from the similarity in performance of South African unit trusts within the same classification category over time.

This will be followed by the discussion and interpretation of the results from the analysis of the differences in performance of South African unit trusts across different classification categories over time. This will be followed by the discussion and interpretation of the results from the classification of unit trusts based on returns and risk.

The chapter will be concluded by a summary of the hypothesis testing for statistical significance and a summary of the conclusions regarding the propositions.

5.2 Sample Characteristics

Of the 217 South African equity unit trusts, offered to retail investors and not Fund of Funds, only 202 were used in the study. The 2 unit trusts in the unclassified category were dropped because of the small number of constituent unit trusts in the category. The other unit trusts did not have reported or insufficient NAV data on both INET BFA and Bloomberg.

The numbers of unit trusts in each of the classification categories were not equal - see Table 3 above.

The NAV raw data from the various unit trusts within the classification categories mostly did not follow a normal distribution, some outliers were observed – See box plots in APPENDIX D.

The F test used in ANOVA is based on the assumption that the variance is the same for the populations of all the different categories. The requirement for homogeneity of variances was tested prior to the analysis of variance using the Levene's test of equality of variances.

Using the Levene's test, the requirement for equality of variances was met by the Financial, Industrial, Mid & Small Cap and Resources & Basic Industries, allowing the use of the ANOVA for testing the differences in means of unit trusts and classification categories. The requirement for homogeneity of variance was also assumed for the General classification category because of its large sample size of 151 units (Minitab, 2016).

The Large cap categories returned a p-value from the Levene's test that was less than the 0.05 significance level, indicating a likelihood of unequal variances.

For the above reason, the Welch's test, an alternative F test that does not require that the samples have equal variances was used for all the ANOVA testing, because of the General and Large Capitalization categories. The Welch's test performs well with unequal variances and when the sample sizes are not equal (Jan & Shieh, 2014; Tomarken & Serlin, 1986).

5.3 Discussion pertaining to similarity in performance within classification categories over time

5.3.1 *Similarities in Performance within classification categories*

The summary of the results of the test for significance of differences in means for the different unit trusts categories are presented in Table 16.

The p-values from the ANOVA test support the proposition that performance of South African equity unit trusts within the same classification category exhibit similar return and risk performance in all cases.

These results are in line with studies by (Ibbotson & Kaplan, 2000) and (Drobetz & Köhler, 2002). The convergence of the influences of same asset class as well as the presence of the unit trusts in the same classification category, meant that the classification category could explain a large proportion - more than 90% of the returns and variability thereof, of the unit trusts present within the Financial, General, Industrial, Large Cap, Mid & Small Cap as well as Resources & Basic Industries categories. This explains why their returns and standard deviation mean performance within categories are not significantly different.

This study however does not suggest that return and risk are purely the only two factors that influence the performance of unit trusts. Some of the factors that may be responsible for the similarities in performance of the different unit trusts managed by different fund managers will include:

1. A high correlation in the performance of the underlying assets in which the different unit trusts invest. Indicating reduced benefit from stock selection, which already contributes very little to performance within a fund (Ibbotson & Kaplan, 2000).
2. The influence of the general market conditions, that tend to make securities move upwards when optimism is high or downwards in periods where fear is prevalent (Ibbotson, 2010).
3. A bias by fund managers of investing in stocks that are the best performers among the available securitises in the sector.
4. A similarity in the investment styles of the fund managers particularly if it tends more toward a passive buy and hold strategy, lacking active management and good market timing abilities which some researchers have suggested to be ways of generating alphas.

5.3.2 *Diversification Benefits - Implications for Investors*

Due to the similarities in the risk and return performance of unit trusts within the same classification category as observed with all the members of the six categories in this study, there might therefore not be much diversification benefit for investing in several units within the same traditional industry classification. However, some diversification and overall risk reduction benefit may be obtained by investing in unit trusts that are members of different classification categories.

5.3.3 *Similarities in Performance and Implications for Classification*

When the classification of unit trusts, is examined at this level (the presence of several individual unit trusts within a single classification category), it appears there is agreement between the industry classification basis and ex-post risk and return performance grouping, a suggestion that is at variance with some research in literature which have established misclassification based on assessment of return and risk (Gerlach & Maurer, 2016).

Even though the p-values from the ANOVA tests show that for all the unit trusts within the same category, there is no significant difference in the mean returns and risk. The fact that performance is similar, for unit trusts within the same classification categories does not tell much about possible similarities or expected differences that may exist across categories. This will thus lead to the discussion of the second proposition which is the differences in performance across classification categories over time.

Despite the issues discussed about the implications for diversification and classification of unit trusts, there is evidence in support of the first proposition that suggests that South African unit trusts within the same classification category exhibit similar return and risk performance over time.

5.4 Discussion pertaining to differences in performance across classification categories over time

5.4.1 *Differences in Performance across classification categories*

The result of the test for significance of differences in return means for the different unit trust categories is presented in Table 17. The post hoc test from the Tukey's Simultaneous Tests for Differences of Means for the six classification categories under study, which was done following an ANOVA test is presented in Table 11.

The p-values from the post hoc test, did not support the proposition that the performance of South African unit trusts in different classification categories exhibit different return and risk performance in fourteen out of the sixteen pairings of classification categories.

The remainder of the test for differences however returned p-values from the post hoc test that seem to support the proposition that performance of South African unit trusts in different classification categories exhibit different return and risk performance.

A p-value of 0.029 from the Tukey test indicates that the return means between the Resources & Basic Industries and Industrial classification categories are statistically different at a significance level of 0.05. The differences in the performance of these two categories over the period of the study can be explained by the responses of the stock market to the economic crisis in many regions with impact on different global markets and on emerging markets in particular starting from the year 2007.

Worthy of note also, is the p-value of 0.059 from the Tukey test for the mean returns between the Industrial and General classification categories, that is marginally similar, as it is a few basis points away from being statistically different at a significance level of 0.05. The other Tukey simultaneous tests however show that there are no significant differences in the performance of 14 out of 16 possible paired categories.

This result is also contrary to literature which suggests that a smaller percentage of performance across funds, is determined by asset allocation. In the case of Ibbotson and Kaplan (2000) it was 40%, while it was 60% in the study by Drobetz and Köhler (2002), suggesting that asset allocation should have less explanatory power for performance across funds. By extension, when considering performance across different classification categories and sectors, it is expected that there will be differences in performance, but this does not appear to be the case.

From the current study, what is observed is that there is no significant difference in the return and risk performance of the unit trusts in majority of the different classification categories. Mean performance from a risk and return perspective appear to overlap, refer to Figure 5. The graph shows that it is difficult to separate the return and risk performance of all the unit trusts as they appear to agglomerate mainly on top of each other in majority of the cases. Only the Resources & Basic Industries category lines up separately from the others and this may explain its significant difference from Industrial classification category.

Some of the factors that may be responsible for differences in the performance of the different unit trusts categories managed by different fund managers will be include:

1. a persistent low correlation in the performance of the underlying assets in which the different unit trusts categories invest.
2. a sector specific challenge or idiosyncratic event which results in performance that is not in-line with the overall market performance.
   The Resources & Basic Industries category stands out clearly as a segment with performance that is significantly different from those of others. This can be explained by the fall and accompanying volatility observed with commodity prices from 2007 when the financial crises began.

5.4.2 *Reclassification of Unit Trusts based on Return and Risk performance*

Oftentimes, the assessment of unit trusts performance is done relative to a selected benchmark or on a risk adjusted basis. While these methods have their advantages and disadvantages, recent studies in countries like US, India and Spain are uncovering the value in performance comparison on a relative basis. The return and risk of a unit trusts is compared to those of other unit trusts in its category or other classification categories - a deviation from the more prevalent assessment using benchmarks or risk adjusted measures that are related to industry based classifications which assumes that same objective or industry sector classification basis will exhibit similar risk and return performance (Gerlach & Maurer, 2016).

In line with previous research, the k-means clustering techniques could be used to provide some insight into the assessment of the appropriateness of industry based classification vis-à-vis classification based on return and risk (Lisi & Otranto, 2010; Moreno et al., 2006; Tamara & Revina, 2015).

A non-hierarchical classification of the mean monthly returns was done for the six classification categories to examine them for any misclassifications based on return and risk. The result showed that the performance of different unit trusts classified in accordance with current industry based categories was markedly different from what their return and risk based classification suggested except in the case of Resources & Basic Industries.

All the unit trusts in the Resources & Basic Industries category remained in one cluster, with two other unit trusts from the General classification category exhibiting similar performance.

All of the Financial unit trusts also exhibited similar performance to the dominant cluster in the General classification category which is cluster 6.

All but one of the Industrial unit trusts also exhibited similar performance to the dominant cluster in the General classification category which is cluster 6.

The clustering exercise supports findings from the ANOVA test with respect to the return and risk performance. However, the clustering goes further to show how risk and return performance is grouped across different unit trusts and unit trust categories, see Figure 6.

Of the 202 unit trusts in the study, only 78 (39%) unit trusts retained their presence in the classification suggested by industry based classification after the clustering based on return and risk was carried out. Please refer to Table 12.

These 78 are made up of 68 unit trusts – Cluster 6, which we can refer to as taking dominance in the General classification category and all the 10 Resources & Basic Industries unit trusts which remained in one cluster – Cluster 4, mirroring the industry based classification.

Cluster 6, shows a similarities in performance of unit trusts in the General, Financial, Industrial, Large Cap and Mid & Small cap classification categories, accounting for 49% of the unit trusts universe under study.

Worthy of note is cluster 1, which also drew 56 units trusts (the second largest grouping from the erstwhile General classification category, combined with 7, 2 and 1 unit trusts from the Large Cap, Mid & Small Cap and Industrial classification categories respectively. Overall the cluster accounts for 33% of the entire sample under study.

From the discussion above, there is evidence against the second proposition that suggests that South African unit trusts in different classification categories exhibit different return and risk performance over time.

5.5 Research hypothesis testing

This research seeks to find evidence in support of, or against the following research propositions that:

Proposition 1:

South African unit trusts within the same classification category exhibit similar return and risk performance over time.

To test the hypothesis, for comparison of performance of unit trusts within the same classification category:

H_{null} : difference in performance intra-classification (within) category = 0

$H_{alternate}$: difference in performance intra-classification (within) category ≠ 0

There is evidence from the study to accept the null hypothesis and reject the alternate hypothesis

Proposition 2:

South African unit trusts across different classification categories exhibit different return and risk performance over time.

To test the hypothesis, for comparison of performance across different classification categories:

H_{null} : difference in performance inter-classification (across) categories ≠ 0

$H_{alternate}$: difference in performance inter-classification (across) categories = 0

There is evidence from the study to reject the null hypothesis and accept the alternate hypothesis

5.6 Conclusion

In summary, from the analysis and results there is evidence in support of the first proposition that suggests that South African unit trusts within the same classification category exhibit similar return and risk performance over time. While there evidence against the second proposition that suggests that South African unit trusts in different classification categories exhibit different return and risk performance over time.

CHAPTER 6. CONCLUSIONS & RECOMMENDATIONS

6.1 Introduction

In this final chapter, there will be a summary of the findings with reference to the context of the study in Chapter 1 and evidence from the literature review in Chapter 2. Following this will be recommendations to stakeholders based on the outcomes of the research.

The chapter will be concluded by suggestions on areas of further research which can be explored in the study of performance and classification of unit trusts in South Africa.

6.2 Conclusions of the study

The notion that the choice of portfolio provides relevant insight into future performance in terms of expected returns and risk was at the core of the pioneering studies on portfolio selection by Markowitz (1952).

Despite many complex methods in academia utilized in explaining the performance of unit trusts, return and risk remain simple and efficient measures that are required in understanding the performance of financial instruments (Lisi & Otranto, 2010). Earlier studies have established the usefulness of return and risk data in unit trusts and their application in the portfolio selection process (Sharpe, 1967) as well as in the description of the utility derived by investors (Markowitz, 1976).

Unit trusts have gained much popularity over the years as a means of diversification and risk reduction by retail investors, with limited investment knowledge and experience as well as institutional investors, which are more adept in security selection, manager selection and performance evaluation. The everyday investor however, may not have access to sophisticated information of performance measures which the institutional investor is able to utilize in understanding the potential reward and attending risk being assumed.

In order to investigate the performance of unit trusts and the appropriateness of industry based classification, equity unit trusts in the categories, Financial, General, Industrial, Large capitalisation, Mid & Small capitalisation and Resources & Basic Industries were studied.

This study found that the investors in unit trusts were rewarded with similar return and risk performance when investing in different South African equity unit trusts which are present in the same classification category and the return means and risk levels were not significantly different. This is in line with studies by Beebower et al. (1986), Ibbotson and Kaplan (2000) and Ibbotson (2010) that suggested a small contribution of security selection to performance of securities and unit trusts. The similarity in performance on the bases of return and risk within classification categories, is in-line with previous research which suggests that prior stated basis of classification is expected to explain return and risk performance (Gerlach & Maurer, 2016).

The study also found that performance across majority of the different classification categories to be similar in most cases, with only two of the sixteen pairwise comparison scenarios exhibiting performance that was found to be significantly different from each other.

There was also evidence of clustering of unit trusts performance despite belonging to different classification categories. The observed clustering, when performance return and risk metrics were used, did not conform with the initial industry based classification except for the Resources & Basic Industries classification category which largely retained its members as it was in the initial industry classification following the K-means clustering. The migration of unit trusts across industry based categories, to clusters categorized by similar performance was prevalent. This pattern of clustering, different from industry based classification is in-line with previous research, which reported situations of misclassification and movements in unit trusts when examined relative to return and risk in Europe (Gerlach & Maurer, 2015), Indonesia (Tamara & Revina, 2015) and Spain (Moreno et al., 2006).

The study observed with the Resources & Basic industries category, a consistency in the membership of the classification under both the industry basis as well as when the K-,means clustering was performed. This aspect of the result is quite interesting and goes against the observed movements that unit trusts in other classification categories exhibited. It also goes against previous studies where evidence of misclassification was identified (DiBartolomeo & Witkowski, 1997; Gerlach & Maurer, 2015; Moreno et al., 2006; Tamara & Revina, 2015). The Resources & Basic Industries classification categories is closely linked with Resources and Commodities, segments of the financial markets that have been significantly impacted by the series of economic and financial crisis that plagued and continue to impact markets globally.

In summary, the study found evidence of similarity in performance within classification categories in all cases, which supported an acceptance of the null hypothesis for the first proposition, while there was predominant evidence of similarity in performance across categories, despite the observation of a few cases where performance was found to be significantly different, a result which led to the rejection of the null hypothesis for the second proposition.

6.3 Recommendations

As suggested in Chapter 1, this study is aimed at possibly:

1. expanding literature in the area of return and risk based classification of unit trusts in South Africa.
2. providing guidance to regulators on ways of incorporating a standardized risk reporting and classification basis. Results of which may be used to compare unit trusts available to the investing public.
3. encouraging fund managers to compare unit trusts performance with peers and across other categories.
4. suggesting to investors an alternate and simple means of performance evaluation different from the assessment relative to a benchmark (which

is selected by the fund manager), to appraising performance relative to other unit trusts in the same or different classification categories, using return and risk measures.

This research serves as a base, upon which further studies can be conducted in academia and industry, in the areas of return and risk classification. Details on recommendations and suggestions for further research are provided in the next section. However, the following stakeholder groups may find the following recommendations useful and practical:

Regulators – as suggested by Gerlach and Maurer (2015) that there is benefit to segmenting unit trusts based on return performance, it is recommended that industry and regulatory bodies like ASISA, adopt a clustering approach to segmenting the universe of unit trusts. Since it has been established that within categories, performance is not different, but across categories where differences are expected to be significant, there are instances where actual performance overlaps and investors experience similar return and risk patterns. It may be useful to seek ways of reducing the number of categories or sub-divisions that exist in the classification structure.

Fund managers – it is recommended that fund managers contribute to and support the development of a standardized return and risk classification methodology that will be reported by all fund managers. The output of the adopted methodology should be such that the less sophisticated investor can understand with ease, the message that is being transmitted by the cluster categorisation of unit trusts based on return and risk performance.

Investors – the recommendation aimed at the investor grouping is that they should show deeper interest in understanding the variability of the returns that they expect to earn and push the drive for an easy to understand and industry-wide basis of return and risk reporting and classification of unit trusts. In line with the results of this study, if investors are not aware of the similarities in the performance within unit trusts categories and areas where similarities and difference exist in the different unit trusts categories, they may be making sub-optimal and non-diversified choices. Investors should also advocate for return

and risk reporting that allows for the easy identification of unit trusts with performance that are not in line with peers, both in terms of identifying outperformance, but more importantly in identifying sub-optimal choices that will result in underperformance. Recognising instances where misclassifications exist will also assist in making better investment decisions which will be geared towards meeting the objectives of the investors.

6.4 Suggestions for further research

The results of this study begs several questions, that dwell on the validity and need for the currently utilized classification basis set by the industry and regulators which employs geographic location, asset type and even in some cases, investment objectives. Further research can help in uncovering salient answers that address questions on the benefits of diversification enjoyed by investors. This is especially important for investors that have funds allocated to assets, based on sector selection that rely on choosing unit trusts from different classification categories. Further research will also shed light on the understanding of investors in appraising the dynamics of return and risk as well as the similarity and differences across unit trusts and unit trusts categories with varying economic cycles.

Many of the suggestions below arose in the course of conducting this study and can serve as precursors for further research to better understand the classification of unit trusts in the context of returns and risk. Some suggestions of areas of further research include:

1. incorporating all the asset classes, in examining the differences in return and risk performance of unit trusts, despite the likelihood that asset classes like money market, fixed income and real estate may show less variability in returns when compared to equity unit trusts. This is beside the very tedious task of putting the data set together.

2. potentially adding other attributes to the clustering technique such as liquidity, volumes traded, other asset classes, use of leverage and others.
3. analysing return and risk on a rolling time period basis, to smooth the effect of specific market events
4. further research can also be done with daily returns as opposed to monthly data, to reflect the daily volatility of investments and effects which the use of monthly data may dampen.
5. future research can build on this work by seeking expert opinions which can be modelled into return and risk expectations. This can then be applied to regression and Monte Carlo simulation and can be useful in forecasting future performance and potential clustering.

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APPENDIX A

Descriptive Statistics

Table 18: Descriptive Statistics – Financial

	N	Range	Minimum	Maximum	Mean	Std. Deviation
Coronation Financial Fund	117	26.11%	-11.39%	14.72%	0.90%	4.77%
Momentum Financials Fund	117	25.72%	-13.34%	12.38%	0.87%	4.94%
Nedgroup Investments Fin. Fund	117	31.08%	-17.44%	13.64%	1.11%	4.93%
Newfunds S&P GIVI SA Fin. ETF	78	21.37%	-7.73%	13.64%	1.42%	4.23%
Old Mutual Financial Ser. Fund	117	28.17%	-14.83%	13.34%	0.82%	4.91%
Satrix FINI Portfolio	119	27.20%	-13.29%	13.90%	0.75%	5.18%
Stanlib Financials Fund	119	24.74%	-14.04%	10.70%	0.76%	4.67%

Table 19: Descriptive Statistics – General

	N	Range	Minimum	Maximum	Return Mean	Std. Deviation
Absa Multi-Managed Equity Fund	17	17.49%	-9.00%	8.49%	0.59%	4.46%
Absa Select Equity Fund	119	18.09%	-9.45%	8.64%	0.87%	3.68%
Absa Smart Alpha Equity Fund	5	11.00%	-3.73%	7.28%	-0.86%	4.61%
Allan Gray Equity Fund	117	20.39%	-10.12%	10.27%	0.98%	3.75%
Allan Gray SA Equity Fund	9	12.90%	-3.60%	9.29%	0.05%	4.37%
Ashburton Multi Mgr Equity Fund	4	9.58%	-3.17%	6.41%	0.11%	4.31%
Ashburton SA Equity Fund	30	12.92%	-5.79%	7.13%	0.91%	3.04%
Anchor Bci Equity Fund	32	9.89%	-2.20%	7.68%	2.14%	2.53%
Anchor Bci SA Equity Fund	13	10.94%	-3.77%	7.17%	1.12%	2.87%
Autus Bci Global Equity Fund	17	9.94%	-2.33%	7.62%	1.42%	2.61%
Bci Best Blend Specialist Equity	21	9.92%	-4.21%	5.70%	0.57%	2.67%
Bci Enhanced Equity Fund	3	7.03%	-0.40%	6.63%	2.04%	3.97%
Bci SA Equity Fund	18	10.81%	-2.97%	7.84%	1.06%	2.64%
Bci Select Equity Fund	17	9.64%	-3.05%	6.59%	1.10%	2.59%
Capstone Bci Equity Fund	119	20.12%	-11.05%	9.07%	0.74%	3.91%
Colourfield Bci Equity Fund 1	20	10.04%	-3.43%	6.61%	-0.04%	1.98%
Cratos Bci Equity Fund Class	7	8.53%	-3.21%	5.32%	-0.70%	2.94%
Efficient General Equity Fund	23	29.66%	-17.05%	12.61%	-0.17%	6.59%
Harvard House Bci Equity Fund	108	22.81%	-13.31%	9.50%	0.88%	4.01%
Nefg Bci Equity Fund	88	22.17%	-12.44%	9.73%	0.52%	4.23%
Optimum Bci Equity Fund	3	9.09%	-2.79%	6.30%	1.02%	4.72%

	N	Range	Minimum	Maximum	Return Mean	Std. Deviation
Visio Bci General Equity Fund	21	10.00%	-3.53%	6.47%	0.60%	2.66%
Cadiz Mastermind Fund	117	23.62%	-13.95%	9.67%	0.67%	4.32%
Analytics Ci Managed Eq. Fund	26	11.14%	-3.84%	7.30%	0.22%	2.93%
NFB Ci Equity Fund	23	8.23%	-2.32%	5.90%	0.70%	2.44%
Community Growth Fund	117	22.62%	-12.86%	9.75%	0.68%	3.87%
Coronation Equity Fund	119	20.56%	-10.52%	10.04%	1.01%	4.03%
Coronation SS Equity Fund	3	11.40%	-4.91%	6.49%	-0.44%	6.09%
Coronation Top 20 Fund	119	21.46%	-9.54%	11.92%	0.94%	4.27%
Discovery Dynamic Equity Fund	34	13.14%	-5.44%	7.70%	0.90%	3.19%
Discovery Equity Fund	97	28.73%	-13.68%	15.05%	0.54%	4.19%
Element Earth Equity Fund	118	17.61%	-9.99%	7.62%	0.30%	3.56%
Element Islamic Equity Fund	118	20.66%	-10.93%	9.73%	0.44%	3.60%
Fedgroup General Equity Fund	2	0.75%	-4.85%	-4.10%	-4.47%	0.53%
Foord Equity Fund	119	23.39%	-13.42%	9.97%	1.02%	3.79%
Gtc Active Equity Fund	28	4.98%	-1.63%	3.35%	1.12%	3.10%
Gtc Value Fund	28	11.48%	-4.30%	7.18%	0.90%	3.02%
Grindrod Equity Income Growth	29	14.93%	-7.10%	7.83%	0.91%	3.34%
Gryphon All Share Tracker Fund	117	24.60%	-13.71%	10.89%	0.85%	4.37%
Investec Active Quants Fund	119	26.66%	-15.43%	11.23%	0.82%	4.37%
Investec Equity Fund	119	21.72%	-13.04%	8.68%	0.87%	3.97%
Investec Value Fund	119	24.31%	-14.11%	10.20%	0.61%	4.98%
Investec Wealth & Inv. Dynamic	1	0.00%	-1.20%	-1.20%	-1.20%	1.00%
Emperor IP Momentum Equity	15	11.91%	-5.58%	6.33%	1.29%	3.28%
Flagship IP Equity Fund	47	14.82%	-7.69%	7.13%	0.04%	3.46%
Focus IP Wealth Fund	50	10.33%	-3.23%	7.09%	1.44%	2.30%
IP Equity Fund	47	15.13%	-8.02%	7.10%	0.03%	3.48%
Mi Plan IP Beta Equity Fund - Ring	89	22.16%	-13.23%	8.93%	0.69%	3.66%
Mi Plan IP Beta Equity Fund	89	23.06%	-13.95%	9.10%	0.68%	3.76%
Mitonoptimal IP High Conviction Eq	36	11.17%	-4.10%	7.07%	0.90%	2.91%
Miton Optimal IP Smart Eq. Fund	35	13.27%	-5.29%	7.98%	0.61%	3.25%
Trillian IP Fcf Equity Fund	34	8.39%	-2.97%	5.42%	0.96%	1.76%
Kagiso Equity Alpha Fund	119	20.08%	-9.18%	10.90%	0.94%	3.85%
Kagiso Islamic Equity Fund	62	13.00%	-4.92%	8.08%	0.58%	2.81%
Marriott Dividend Growth Fund	117	17.39%	-10.09%	7.30%	0.84%	3.36%
36one Met Equity Fund	119	20.84%	-13.06%	7.78%	1.23%	3.18%
Cannon Met Equity Fund	119	24.96%	-16.03%	8.93%	0.42%	4.23%
Contego B6 Met Value Eq. Fund	106	21.66%	-12.26%	9.40%	0.81%	4.09%
Contego B7 Met Growth Eq. Fund	48	12.94%	-6.12%	6.82%	1.02%	2.84%
Counterpoint Met High Yield Eq. Fu	37	9.15%	-4.05%	5.09%	0.69%	2.12%
Counterpoint Met Value Fund	119	24.31%	-15.10%	9.21%	0.72%	4.15%
Imara Met Equity Fund	89	19.59%	-11.87%	7.72%	1.14%	3.49%
Lion of Africa Met Equity Fund	97	24.36%	-14.12%	10.23%	0.27%	4.02%
Met General Equity Fund	117	22.83%	-12.11%	10.72%	0.85%	4.17%

	N	Range	Minimum	Maximum	Return Mean	Std. Deviation
Perpetua Met Equity Fund	14	14.20%	-8.55%	5.66%	-1.16%	3.92%
Sasfin Met Equity Fund	108	14.67%	-7.67%	7.01%	0.48%	2.50%
Seed Equity Fund	31	15.86%	-7.94%	7.92%	0.74%	3.67%
Truffle Met General Equity Fund	61	13.19%	-5.46%	7.73%	1.28%	2.84%
Warwick Met Equity Fund	7	10.33%	-3.80%	6.53%	-0.71%	3.45%
Warwick Met Intl. Managed Feeder	5	4.73%	0.02%	4.75%	2.83%	2.18%
Ampersand Momentum Equity Fun	32	12.05%	-5.03%	7.02%	0.44%	2.85%
FNB Growth Fund	117	22.30%	-12.87%	9.43%	0.76%	4.00%
Momentum Best Blend Sp. Equity	99	17.91%	-10.08%	7.82%	0.85%	3.77%
Momentum Equity Fund	119	22.33%	-12.80%	9.53%	0.77%	4.10%
Momentum MOM Opportunistic Eq	21	10.72%	-4.28%	6.44%	0.69%	2.72%
Momentum MOM Specialist Equ.	21	14.76%	-8.53%	6.23%	-0.63%	3.65%
Momentum Value Fund	117	29.44%	-16.20%	13.24%	0.35%	4.99%
Nedgroup Inv. Growth Fund	119	20.46%	-11.92%	8.54%	0.77%	3.71%
Nedgroup Inv. Quants Core Eq.	118	20.19%	-11.57%	8.62%	0.68%	3.99%
Nedgroup Inv. Rainmaker Fund	117	20.81%	-12.35%	8.46%	0.90%	3.71%
Nedgroup Inv. Value Fund	119	23.49%	-13.88%	9.61%	0.80%	3.89%
Bettabeta Green ETF	48	19.41%	-8.18%	11.23%	0.26%	4.00%
Newfunds NewSA Index Port.	84	19.51%	-5.82%	13.69%	1.00%	3.52%
Newfunds S&P Givi SA Top 50 ETF	90	22.04%	-10.69%	11.35%	0.86%	4.17%
Oasis Crescent Equity Fund	117	20.95%	-11.01%	9.94%	0.74%	3.55%
Oasis General Equity Fund	119	20.05%	-9.99%	10.05%	0.72%	3.72%
Old Mutual Active Quant. Fund	119	19.83%	-10.68%	9.15%	0.94%	3.95%
Old Mutual Albaraka Equity Fund	117	23.05%	-14.38%	8.67%	0.72%	3.80%
Old Mutual Growth Fund	117	23.71%	-12.38%	11.34%	0.83%	4.13%
Old Mutual High Yield Opp. Fund	117	23.53%	-15.64%	7.89%	0.38%	4.13%
Old Mutual Investors Fund	117	21.91%	-12.51%	9.40%	0.89%	4.22%
Old Mutual Prem. Equity Fund	29	11.72%	-5.12%	6.60%	0.81%	2.99%
Old Mutual Top Companies Fund	117	24.27%	-12.05%	12.22%	0.77%	4.05%
Old Mutual Umbono Rafi 40 Fund	98	21.89%	-11.37%	10.52%	0.41%	4.77%
Personal Trust Sa Equity Fund	77	12.28%	-6.97%	5.31%	0.53%	2.73%
PPS Equity Fund	89	22.55%	-11.54%	11.00%	0.68%	4.28%
27Four Shariah Active Equity	87	20.01%	-10.49%	9.52%	1.05%	3.60%
3laws Climate Change Equity	32	10.64%	-4.77%	5.87%	0.08%	2.73%
Abax Equity Prescient Fund	34	13.61%	-4.77%	8.84%	1.15%	3.37%
Aeon Enhanced Equity Prescient F	54	13.41%	-4.41%	9.01%	1.10%	3.00%
Afena Equity Prescient Fund	64	13.94%	-5.57%	8.38%	0.68%	3.08%
African Allian. Equity Prescient	11	12.23%	-5.07%	7.16%	-0.26%	3.75%
African Allian. SA S&P Givi Fund	11	13.64%	-7.78%	5.86%	-0.60%	3.58%
Aylett Equity Prescient Fund	89	16.26%	-8.27%	7.98%	0.98%	2.97%
Bateleur Equity Prescient Fund	6	9.73%	-2.80%	6.93%	0.07%	3.53%
Clucasgray Equilibrium Prescient F	11	7.10%	-2.20%	4.90%	0.70%	2.28%
Clucasgray Equity Prescient Fund	50	11.87%	-4.84%	7.03%	0.98%	2.58%

	N	Range	Minimum	Maximum	Return Mean	Std. Deviation
Fairtree Equity Prescient Fund	50	13.67%	-4.71%	8.96%	1.38%	3.18%
Huysamer Equity Prescient Fund	111	21.83%	-11.21%	10.61%	0.67%	4.10%
Laurium Equity Prescient Fund	10	11.05%	-3.72%	7.33%	-0.06%	3.29%
Maestro Equity Prescient Fund	117	25.99%	-15.22%	10.76%	0.79%	4.08%
Mergence Equity Prescient Fund	61	13.06%	-4.22%	8.84%	1.10%	2.88%
Nedbank Itf Balondolozi Absolute R	18	4.30%	-1.64%	2.65%	-0.04%	1.07%
Prescient Equity Fund	89	23.03%	-12.89%	10.14%	0.74%	4.10%
Prescient Equity Income Fund	44	11.43%	-5.21%	6.21%	0.76%	3.00%
Seed Equity Fund	29	15.86%	-7.92%	7.94%	0.72%	3.74%
Tower Capital Equity Prescient Fun	22	8.17%	-2.85%	5.32%	0.97%	2.17%
Hollard Prime Equity Fund	20	9.68%	-5.32%	4.36%	0.86%	2.52%
Mazi Capital Prime Equity Fund	3	7.22%	-1.16%	6.05%	1.40%	4.04%
Prime Equity Fund Of Funds	23	8.52%	-2.42%	6.10%	0.91%	1.77%
Prime SA Equity Fund Class B	10	11.17%	-4.23%	6.94%	-0.48%	3.63%
Prudential Dividend Maximiser Fund	89	18.15%	-8.21%	9.94%	1.05%	3.27%
Prudential Equity Fund	106	21.47%	-11.17%	10.30%	0.91%	3.76%
Psg Equity Fund	117	25.45%	-14.70%	10.74%	0.90%	4.27%
Psg SA Equity Fund	26	13.58%	-7.23%	6.35%	0.00%	3.72%
Recm Flexible Equity Fund	24	8.83%	-2.45%	6.38%	0.70%	2.06%
Rezco Equity Fund	21	9.03%	-3.35%	5.68%	0.75%	2.49%
First Avenue Sanlam Equity	53	13.76%	-4.92%	8.84%	1.17%	3.01%
Sim General Equity Fund	9	11.15%	-3.75%	7.39%	-0.23%	3.65%
Sim Top Choice Equity Fund	111	24.24%	-13.60%	10.64%	1.04%	4.24%
Sim Value Fund	9	10.98%	-5.46%	5.51%	-1.34%	3.79%
Spi Equity Fund	56	14.29%	-5.89%	8.40%	1.09%	2.91%
Satrix Alsi Index Fund	20	11.60%	-4.05%	7.55%	0.26%	2.97%
Satrix Dividend Plus Portfolio	100	21.13%	-11.81%	9.32%	0.39%	4.55%
Satrix Dividend+ Index Fund	20	14.29%	-8.42%	5.87%	-1.07%	3.97%
Satrix Momentum Index Fund	26	14.68%	-5.52%	9.16%	1.14%	3.18%
Satrix Quality Index Fund	4	11.33%	-4.96%	6.36%	-1.83%	5.48%
Satrix Rafi 40 Total Return ETF	1	0.00%	-2.35%	-2.35%	-2.35%	1.00%
Melville Douglas Stanlib Alpha	57	13.87%	-5.54%	8.33%	1.30%	2.78%
Stanlib Equity Fund	117	24.33%	-14.84%	9.48%	0.81%	4.12%
Stanlib Growth Fund	51	24.52%	-16.00%	8.52%	0.50%	4.85%
Stanlib Index Fund	117	26.96%	-15.21%	11.76%	0.86%	4.44%
Stanlib Multi Mgr Equity Fund	117	18.70%	-10.52%	8.18%	0.70%	3.61%
Stanlib SA Equity Fund	117	28.59%	-19.02%	9.57%	0.64%	4.52%
Stanlib Shariah Equity Fund	99	28.10%	-18.32%	9.78%	0.03%	4.06%
Stanlib Value Fund	119	21.99%	-11.39%	10.59%	0.72%	4.12%
Sygnia Active Equity Fund	21	9.35%	-4.11%	5.24%	0.63%	2.56%
Sygnia Divi Index Fund	30	14.79%	-8.36%	6.43%	-0.33%	3.78%
Sygnia Equity Fund	29	9.57%	-3.70%	5.87%	1.06%	2.52%
Sygnia Swix Index Fund	26	10.60%	-4.97%	5.63%	0.54%	2.73%
Sygnia Value Fund	11	8.03%	-2.68%	5.35%	0.69%	2.91%

Table 20: Descriptive Statistics – Industrial

	N	Range	Minimum	Maximum	Mean	Std. Deviation
Coronation Industrial Fund	117	22.88%	-13.12%	9.76%	1.43%	3.84%
Momentum Industrial Fund	117	20.75%	-12.01%	8.75%	1.13%	3.63%
Newfunds S&P SA Industrial ETF	78	17.42%	-6.24%	11.18%	1.63%	3.18%
Old Mutual Industrial Fund	106	24.05%	-15.14%	8.92%	1.03%	4.23%
Sim Industrial Fund	119	22.80%	-14.13%	8.67%	1.45%	3.79%
Satrix Indi Portfolio	119	23.77%	-12.69%	11.08%	1.48%	4.36%
Stanlib Industrial Fund	117	25.34%	-14.90%	10.44%	1.19%	4.01%

Table 21: Descriptive Statistics – Large Cap

	N	Range	Minimum	Maximum	Mean	Std. Deviation
Absa Rand Protector Fund	119	25.15%	-12.78%	12.37%	1.09%	4.39%
Kagiso Top 40 Tracker Fund	62	17.13%	-6.84%	10.29%	0.90%	3.52%
Saffron Met Top 20 Fund	41	12.69%	-4.88%	7.81%	0.71%	3.01%
Momentum Top 25 Fund	93	22.85%	-8.08%	14.76%	1.40%	3.53%
Momentum Top 40 Index Fund	117	28.96%	-16.15%	12.81%	0.82%	4.60%
Betta Beta Eq. Weighted Top 40	69	16.08%	-6.97%	9.12%	0.73%	3.49%
Newfunds Equity Momentum ETF	47	15.75%	-6.95%	8.80%	1.31%	3.84%
Newfunds Shariah Index ETF	80	27.88%	-11.69%	16.19%	0.35%	4.99%
Newfunds Swix 40 Etf Portfolio	45	15.26%	-5.57%	9.68%	1.29%	3.38%
Oldmutual Top 40 Fund	119	28.55%	-16.29%	12.25%	0.83%	4.64%
Integre Large Cap Prescient Fund	53	12.16%	-5.58%	6.58%	0.48%	3.12%
Prescient Equity Top 40 Fund	91	28.17%	-15.45%	12.73%	0.52%	4.96%
Rmb Top 40 ETF	45	17.55%	-7.26%	10.29%	1.04%	3.45%
Satrix 40 Portfolio	26	12.19%	-4.36%	7.83%	0.49%	3.00%
Satrix Eq. Weighted Top 40 Index	20	11.97%	-5.23%	6.75%	0.03%	3.18%
Satrix Rafi 40 Index Fund	20	15.47%	-7.47%	8.00%	-0.35%	4.19%
Satrix Swix Top 40 Index Fund	116	24.88%	-13.26%	11.61%	0.89%	4.50%
Satrix Top 40 Index	26	12.17%	-4.35%	7.83%	0.50%	3.00%
Stanlib ALSI 40 Fund	119	28.36%	-15.68%	12.68%	0.82%	4.57%
Sygnia Top 40 Index Tracker Fund	26	10.28%	-4.02%	6.26%	0.49%	2.81%

Table 22: Descriptive Statistics – Mid & Small Cap

	N	Range	Minimum	Maximum	Return Mean	Std. Deviation
Coronation Smaller Comp. Fund	117	23.87%	-14.67%	9.20%	0.67%	3.83%
Investec Emerging Comp. Fund	119	27.95%	-17.62%	10.33%	0.96%	4.22%
Momentum Small Midcap Fund	119	19.30%	-11.95%	7.35%	0.80%	3.93%
Nedgroup Inv. Entrepr. Fund	119	24.49%	-15.46%	9.04%	1.16%	4.10%
Old Mutual Small Comp. Fund	102	20.84%	-14.53%	6.31%	0.55%	3.92%
RMB Midcap Fund	40	15.45%	-8.97%	6.48%	0.56%	3.32%
Sim Small Cap Fund	65	10.83%	-3.94%	6.89%	0.97%	2.29%

Table 23: Descriptive Statistics – Resources & Basic Industries

	N	Range	Minimum	Maximum	Return Mean	Std. Deviation
Coronation Resources Fund	117	37.71%	-18.97%	18.74%	0.32%	6.41%
Investec Commodity Fund	119	38.13%	-21.62%	16.52%	0.53%	6.25%
Momentum Resources Fund	117	44.25%	-25.63%	18.62%	0.33%	6.73%
Nedgroup Inv. Mining & Res. Fund	117	31.63%	-17.97%	13.66%	0.49%	5.98%
Newfunds S&P Givi SA Res. ETF	78	24.43%	-12.00%	12.43%	0.44%	5.96%
Oldmutual Gold Fund	117	35.67%	-20.35%	15.32%	0.05%	7.64%
Old Mutual Mining & Res. Fund	117	36.39%	-18.65%	17.74%	0.40%	6.44%
Sim Resources Fund	87	28.53%	-15.43%	13.11%	-0.02%	6.01%
Satrix Resi Portfolio	116	41.53%	-24.33%	17.19%	-0.06%	7.27%
Stanlib Resources Fund	117	39.48%	-22.04%	17.44%	0.14%	6.62%

APPENDIX B

Mean Interval Plots

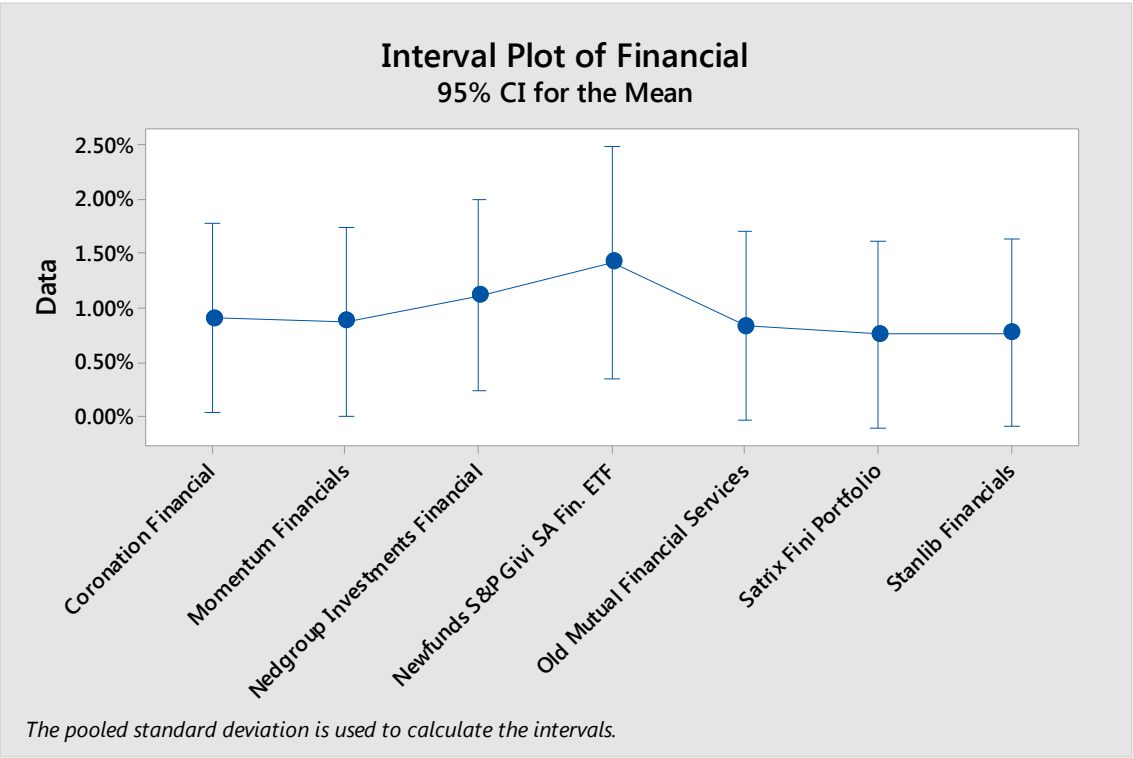


Figure 7: Mean Monthly Returns with 95% Confidence Intervals – Financial

General

Due to the number large number of unit trusts in General classification category (151), an interval plot is not practical.

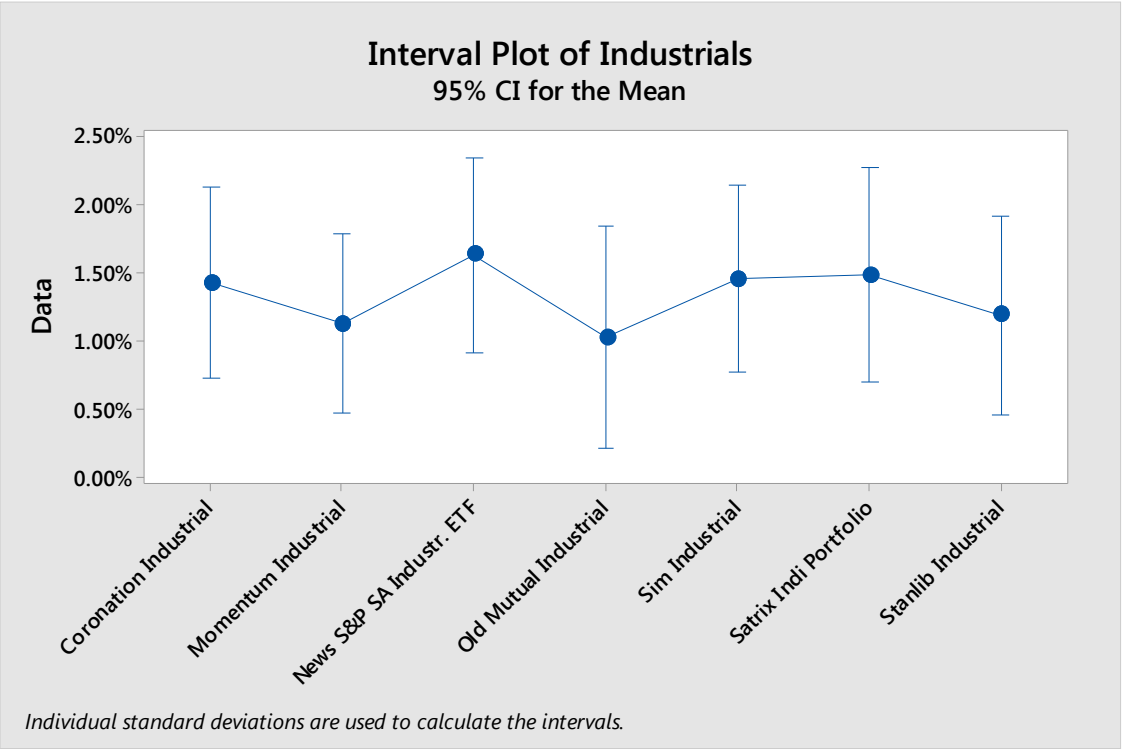


Figure 8: Mean Returns with 95% Confidence Intervals – Industrial

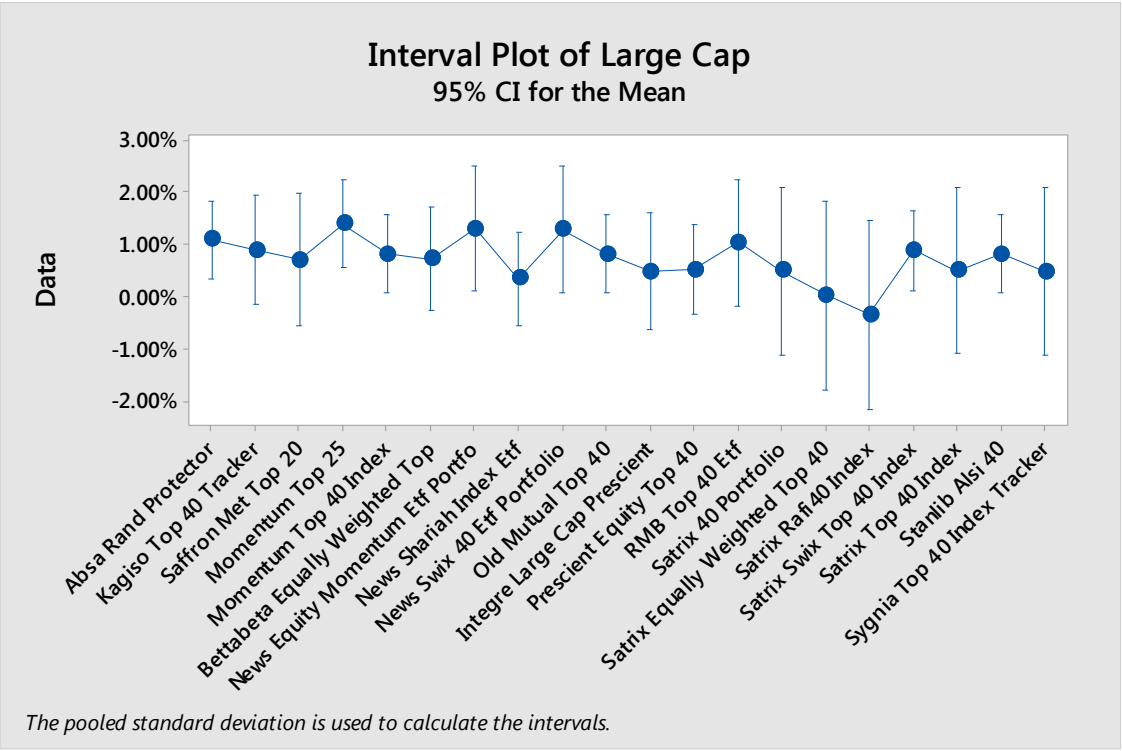


Figure 9: Mean Returns with 95% Confidence Intervals – Large Cap

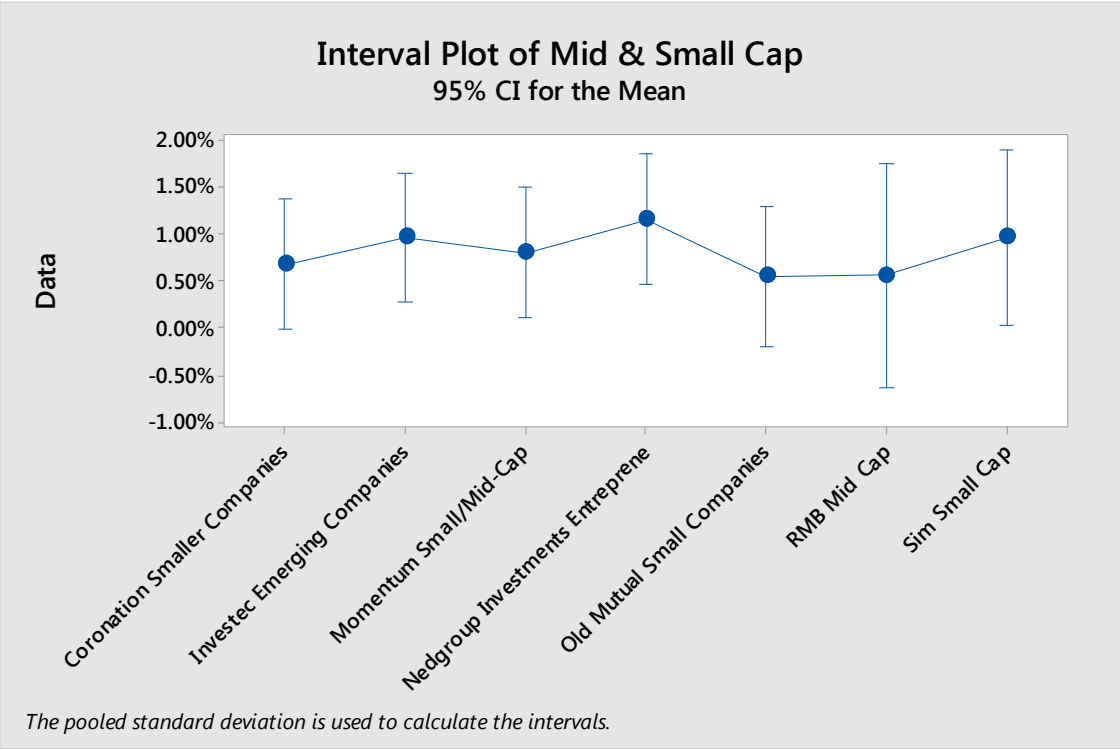


Figure 10: Mean Returns with 95% Confidence Intervals – Mid & Small Cap

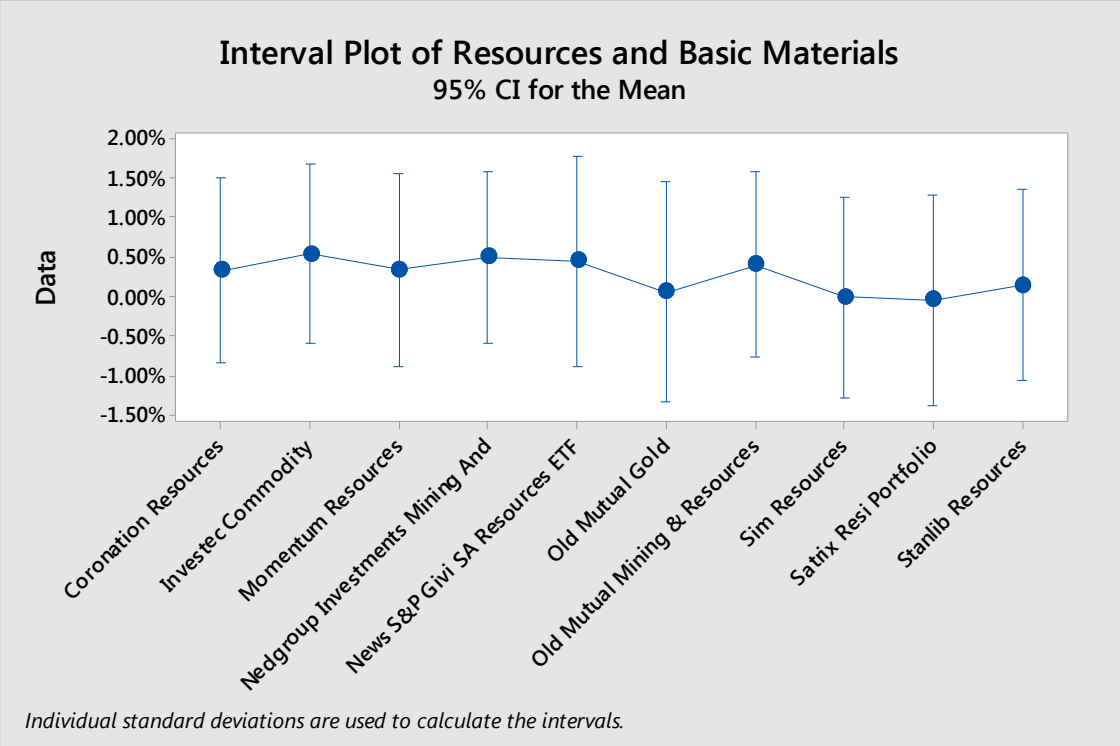


Figure 11: Mean Returns with 95% CIs – Resources & Basic Industries

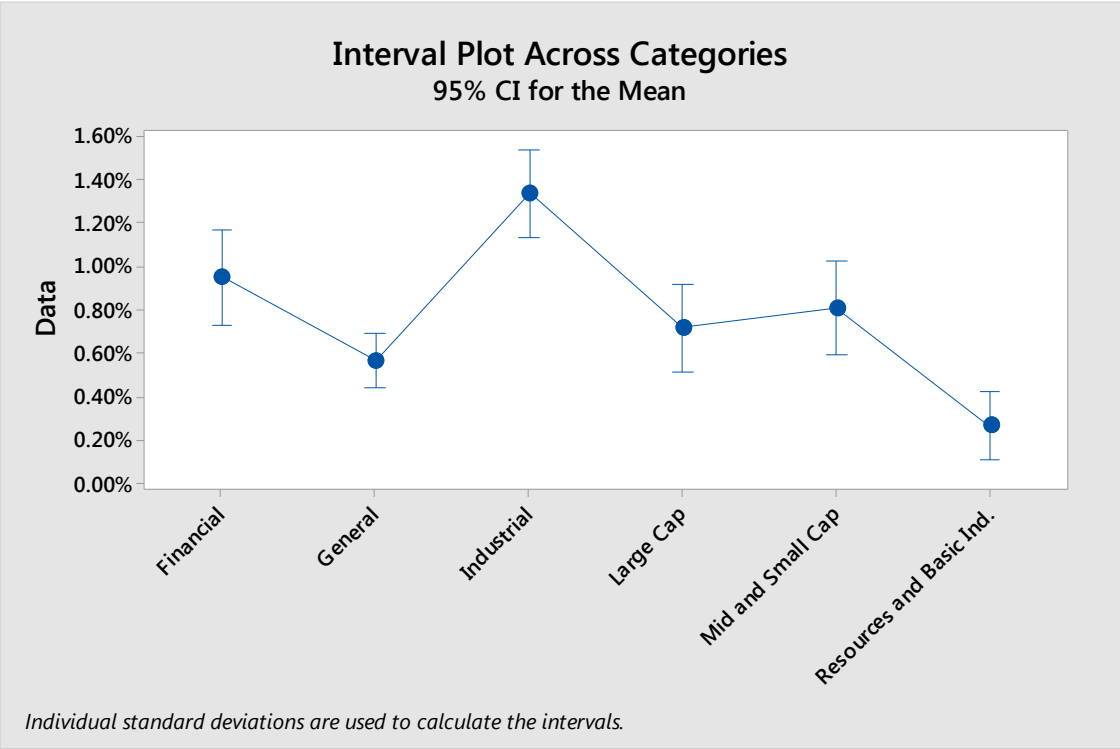


Figure 12: Mean Returns with 95% Confidence Intervals – Across Categories

APPENDIX C

Levene's Test

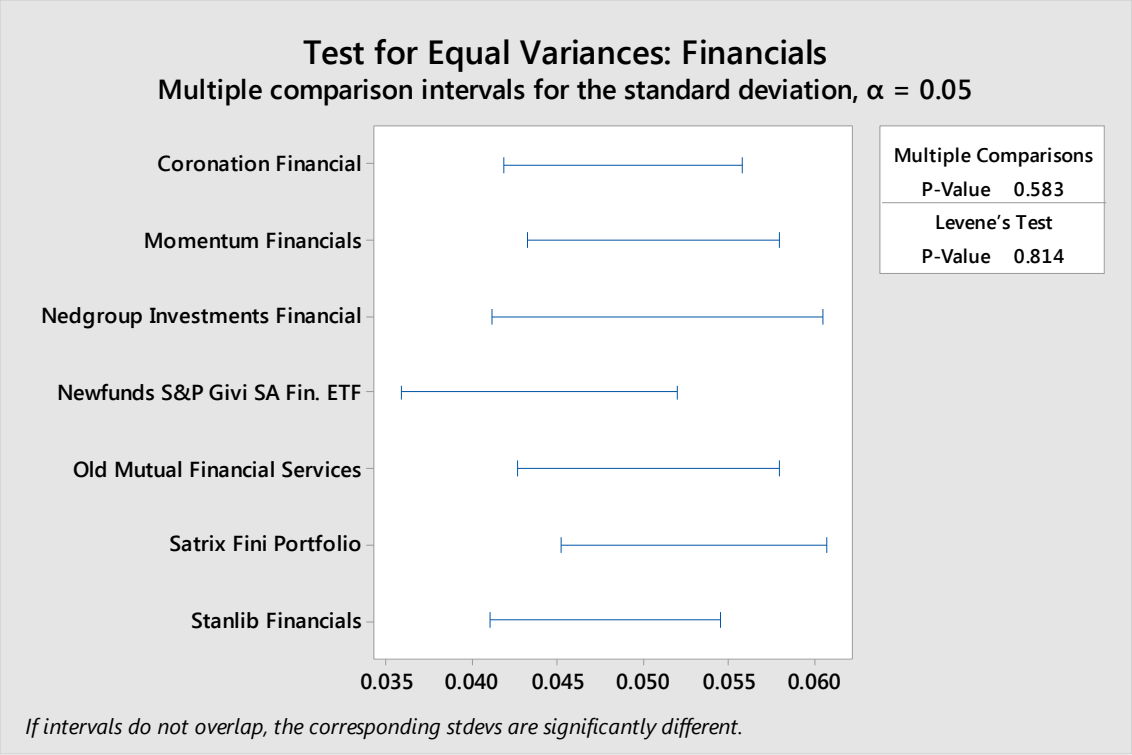


Figure 13: Test for Equality of Variances – Financial

General

Due to the number large number of unit trusts in the General classification category (151), a similar chart to the others for this section is not practical and will not display outputs in a readable or meaningful manner.

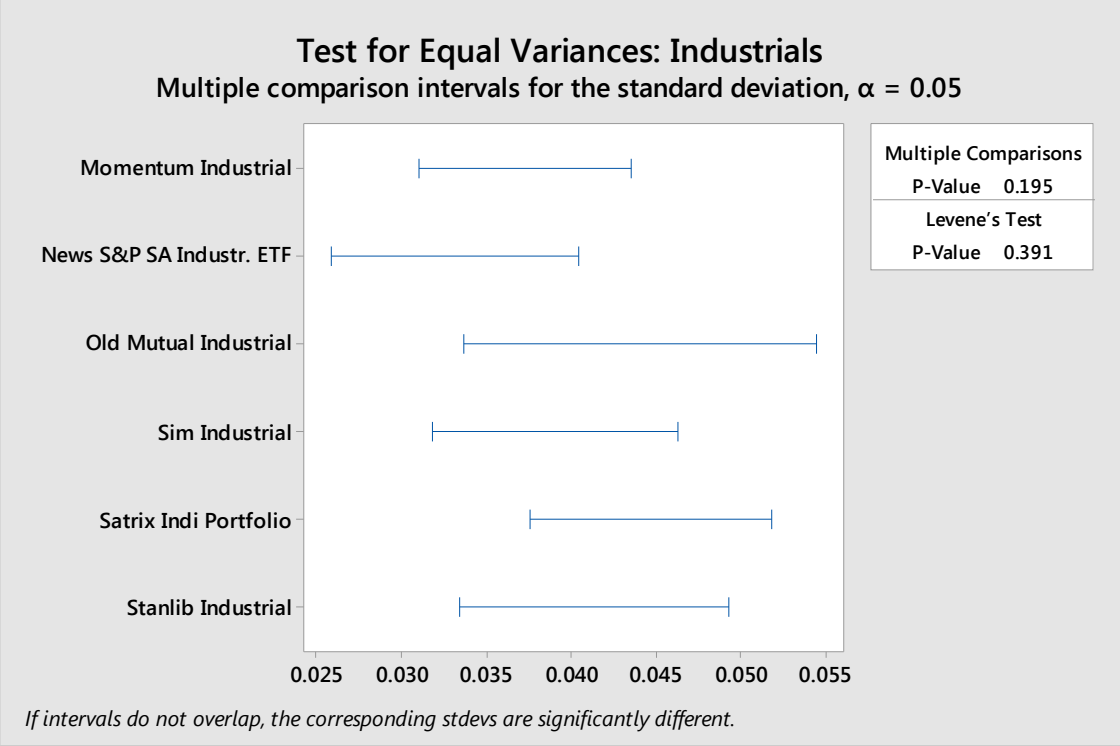


Figure 14: Test for Equality of Variances – Industrial

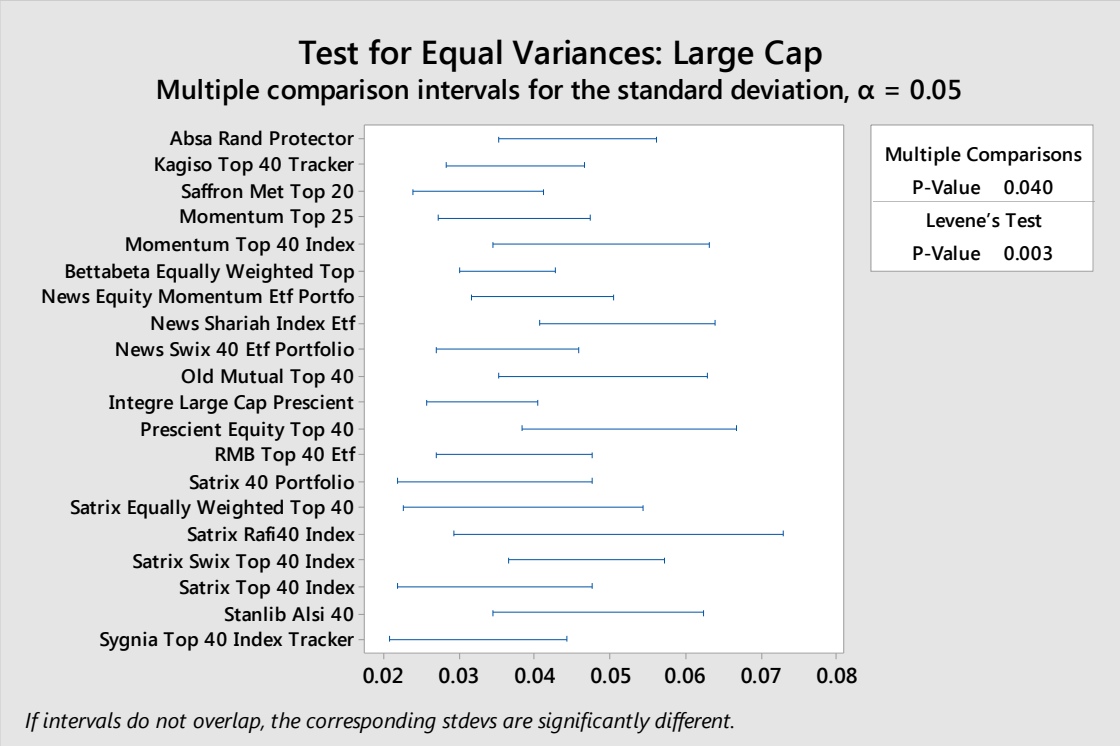


Figure 15: Test for Equality of Variances – Large Cap

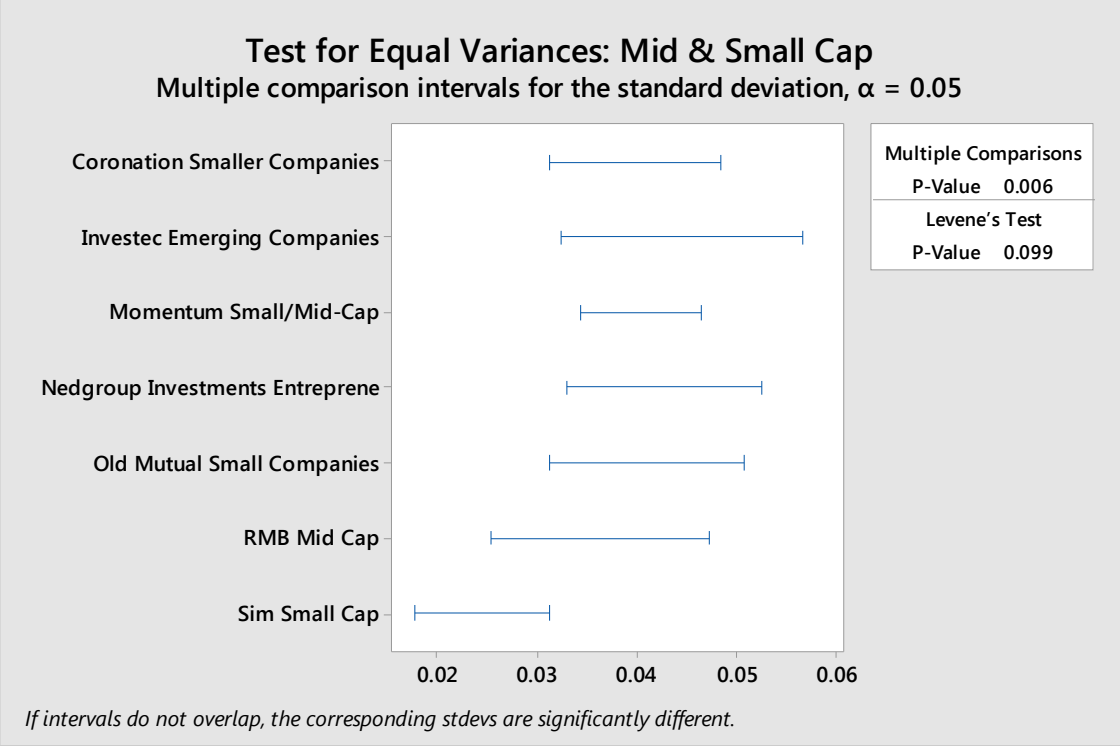


Figure 16: Test for Equality of Variances – Mid & Small Cap

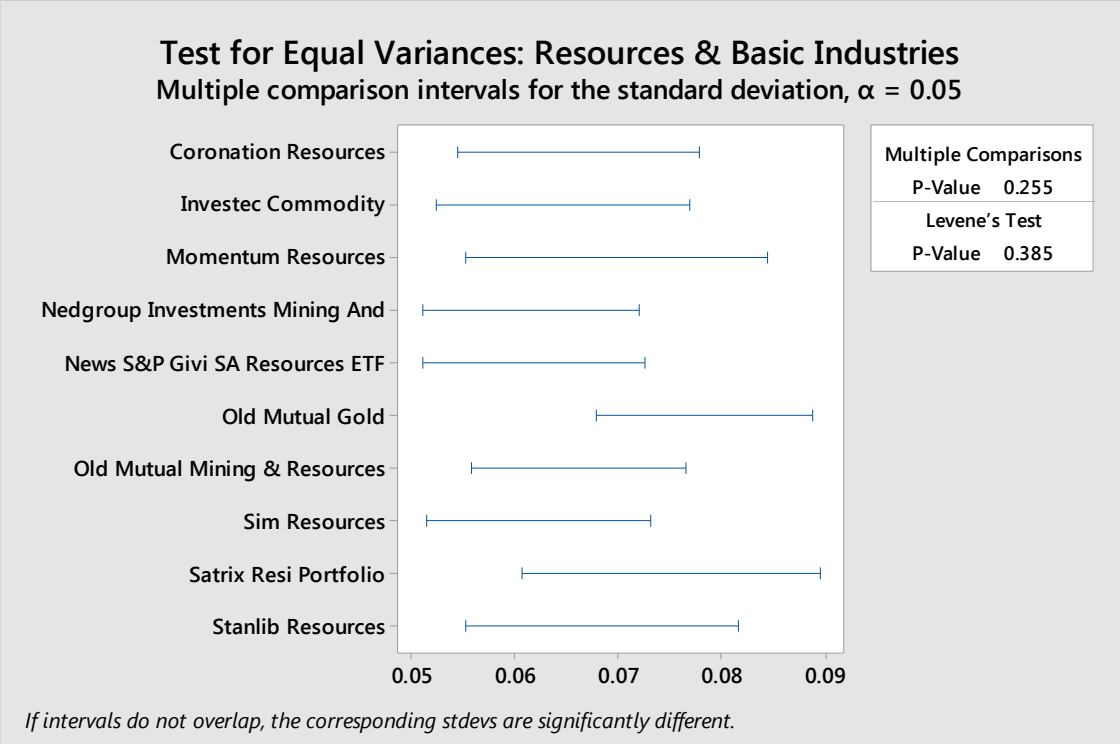


Figure 17: Test for Equality of Variances – Resources & Basic Industries

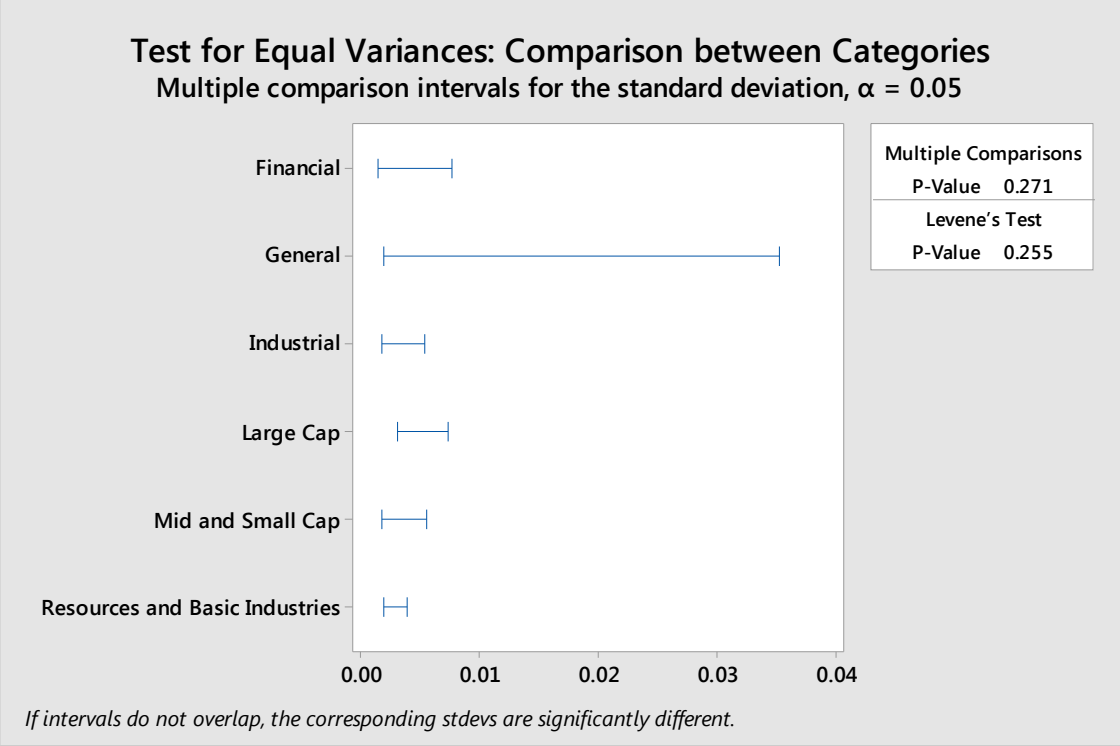


Figure 18: Test for Equality of Variances – Across Categories

APPENDIX D

Boxplots

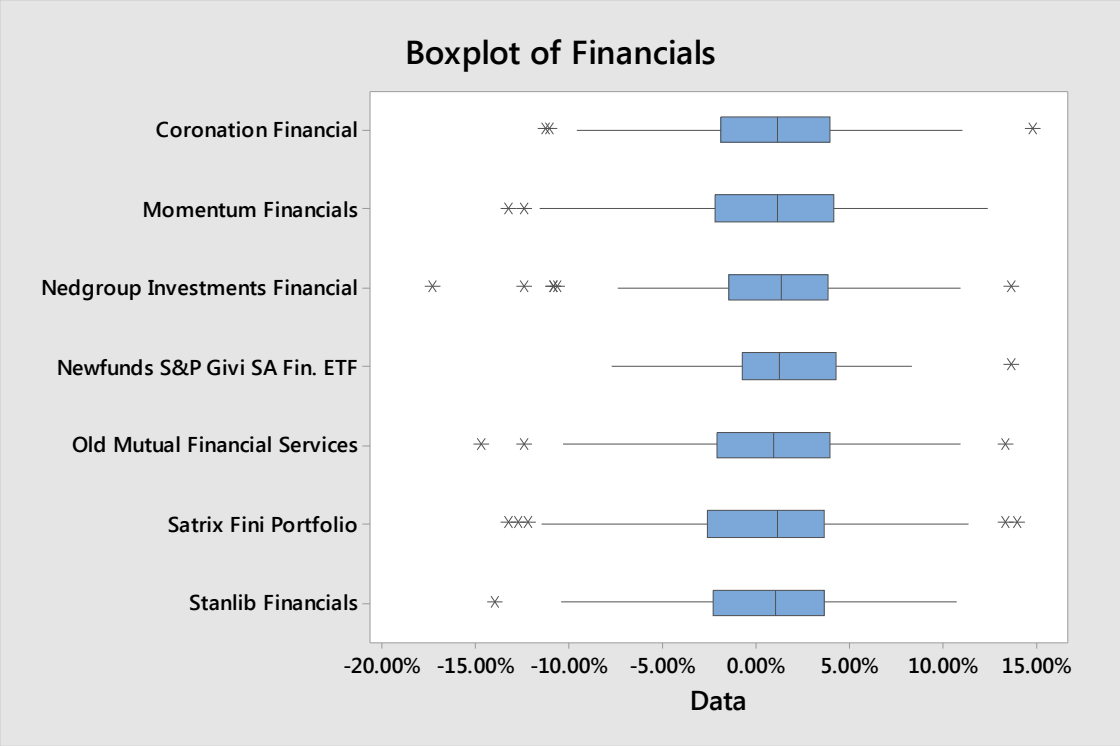


Figure 19: Test for Distribution – Financials

General

Due to the number large number of unit trusts in the General classification category (151), a similar chart to the others for this section is not practical and will not display outputs in a readable or meaningful manner.

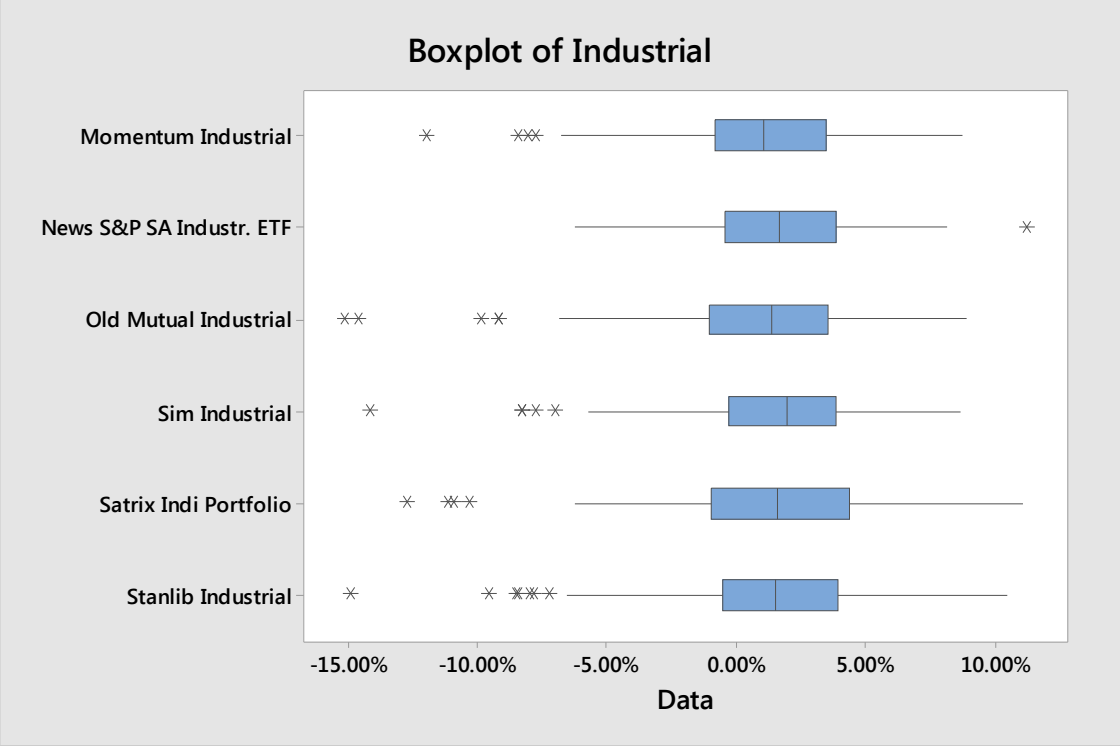


Figure 20: Test for Distribution – Industrial

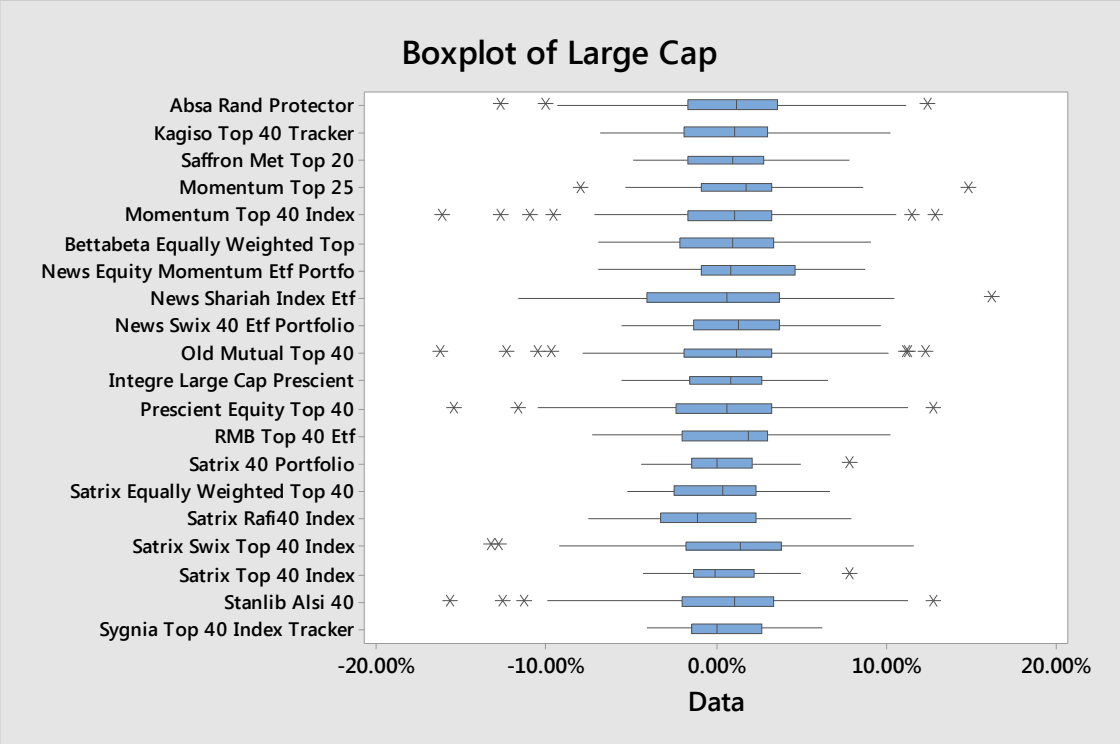


Figure 21: Test for Distribution – Large Cap

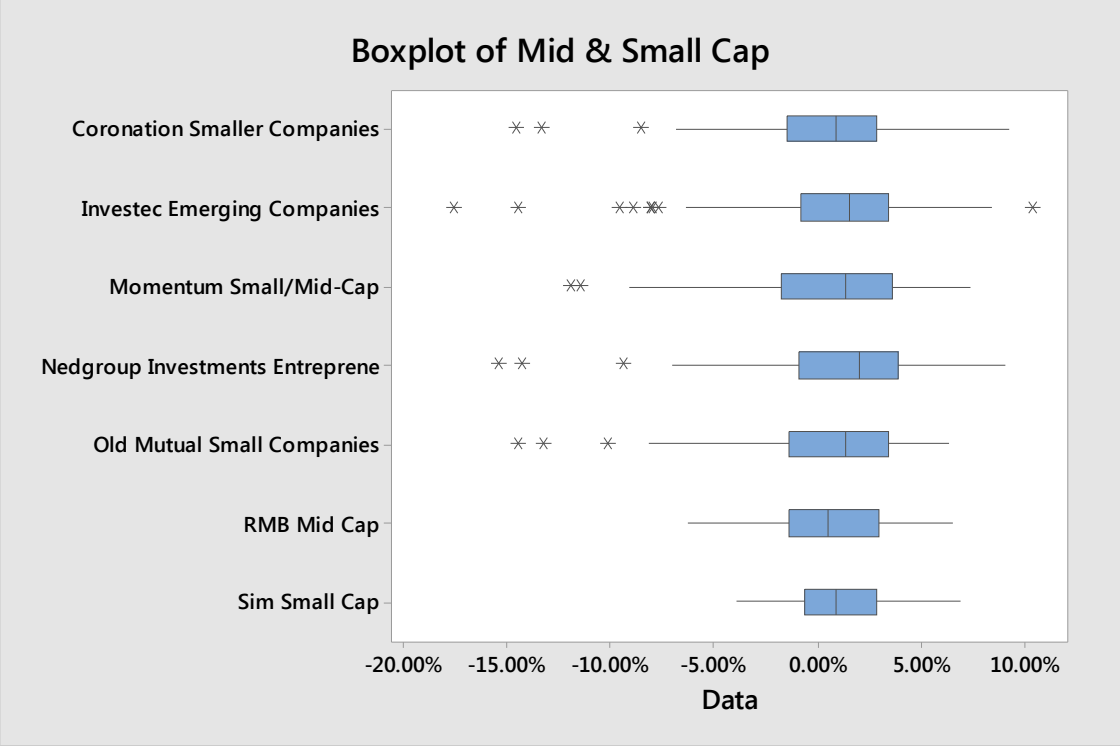


Figure 22: Test for Distribution – Mid & Small Cap

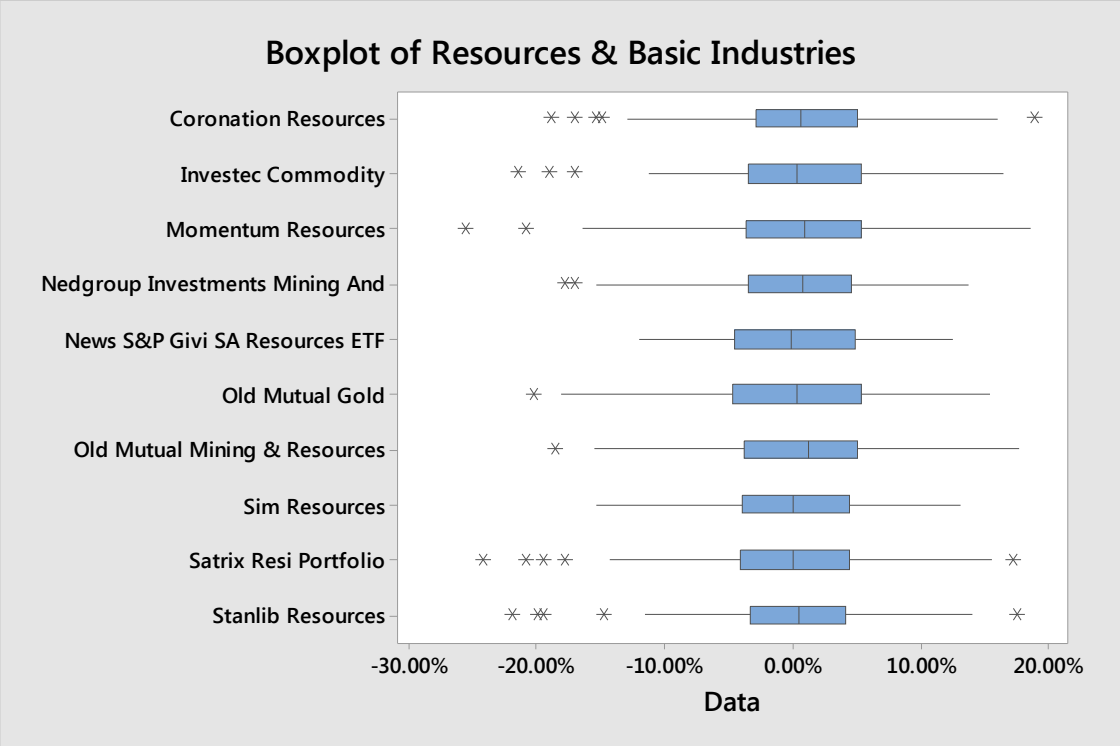


Figure 23: Test for Distribution – Resources & Basic Industries

APPENDIX E

Cluster Membership

Initial Category	Fund Name	Return	Std Deviation	K-means Cluster	Distance
Financial	Coronation Financial Fund	0.90%	4.77%	6	0.647
Financial	Momentum Financials Fund	0.87%	4.94%	6	0.814
Financial	Nedgroup Investments Fin. Fund	1.11%	4.93%	6	0.847
Financial	Newfunds S&P GIVI SA Fin. ETF	1.42%	4.23%	6	0.602
Financial	Old Mutual Financial Ser. Fund	0.82%	4.91%	6	0.781
Financial	Satrix FINI Portfolio	0.75%	5.18%	6	1.050
Financial	Stanlib Financials Fund	0.76%	4.67%	6	0.543
General	Absa Multi-Managed Equity Fund	0.59%	4.46%	6	0.406
General	Absa Select Equity Fund	0.87%	3.68%	6	0.453
General	Absa Smart Alpha Equity Fund	-0.86%	4.61%	2	0.902
General	Allan Gray Equity Fund	0.98%	3.75%	6	0.405
General	Allan Gray SA Equity Fund	0.05%	4.37%	2	0.774
General	Ashburton Multi Mgr Equity Fund	0.11%	4.31%	6	0.738
General	Ashburton SA Equity Fund	0.91%	3.04%	1	0.249
General	Anchor Bci Equity Fund	2.14%	2.53%	1	1.273
General	Anchor Bci SA Equity Fund	1.12%	2.87%	1	0.237
General	Autus Bci Global Equity Fund	1.42%	2.61%	1	0.558
General	Bci Best Blend Specialist Equity	0.57%	2.67%	1	0.349
General	Bci Enhanced Equity Fund	2.04%	3.97%	6	1.232
General	Bci SA Equity Fund	1.06%	2.64%	1	0.225
General	Bci Select Equity Fund	1.10%	2.59%	1	0.285
General	Capstone Bci Equity Fund	0.74%	3.91%	6	0.237
General	Colourfield Bci Equity Fund 1	-0.04%	1.98%	1	1.247
General	Cratos Bci Equity Fund Class	-0.70%	2.94%	2	0.881
General	Efficient General Equity Fund	-0.17%	6.59%	4	0.349
General	Harvard House Bci Equity Fund	0.88%	4.01%	6	0.133
General	Nefg Bci Equity Fund	0.52%	4.23%	6	0.323
General	Optimum Bci Equity Fund	1.02%	4.72%	6	0.624
General	Visio Bci General Equity Fund	0.60%	2.66%	1	0.329
General	Cadiz Mastermind Fund	0.67%	4.32%	6	0.247
General	Analytics Ci Managed Eq. Fund	0.22%	2.93%	1	0.687
General	NFB Ci Equity Fund	0.70%	2.44%	1	0.407
General	Community Growth Fund	0.68%	3.87%	6	0.295
General	Coronation Equity Fund	1.01%	4.03%	6	0.211
General	Coronation SS Equity Fund	-0.44%	6.09%	4	0.737
General	Coronation Top 20 Fund	0.94%	4.27%	6	0.183
General	Discovery Dynamic Equity Fund	0.90%	3.19%	1	0.396
General	Discovery Equity Fund	0.54%	4.19%	6	0.288
General	Element Earth Equity Fund	0.30%	3.56%	6	0.775
General	Element Islamic Equity Fund	0.44%	3.60%	6	0.655
General	Fedgroup General Equity Fund	-4.47%	0.53%	5	-
General	Foord Equity Fund	1.02%	3.79%	6	0.393
General	Gtc Active Equity Fund	0.74%	0.12%	3	1.463

Initial Category	Fund Name	Return	Std Deviation	K-means Cluster	Distance
General	Grindrod Equity Income Growth	0.91%	3.34%	1	0.539
General	Gryphon All Share Tracker Fund	0.85%	4.37%	6	0.240
General	Investec Active Quants Fund	0.82%	4.37%	6	0.242
General	Investec Equity Fund	0.87%	3.97%	6	0.165
General	Investec Value Fund	0.61%	4.98%	6	0.881
General	Investec Wealth & Inv. Dynamic	-1.20%	0.00%	3	0.571
General	Emperor IP Momentum Equity	1.29%	3.28%	1	0.622
General	Flagship IP Equity Fund	0.04%	3.46%	2	0.611
General	Focus IP Wealth Fund	1.44%	2.30%	1	0.737
General	IP Equity Fund	0.03%	3.48%	2	0.595
General	Mi Plan IP Beta Equity Fund	0.69%	3.66%	6	0.491
General	Mi Plan IP Beta Equity Fund	0.68%	3.76%	6	0.394
General	Mitonoptimal IP High Conviction Eq. Fund	0.90%	2.91%	1	0.115
General	Miton Optimal IP Smart Eq. Fund	0.61%	3.25%	1	0.533
General	Trillian IP Fcf Equity Fund	0.96%	1.76%	1	1.041
General	Kagiso Equity Alpha Fund	0.94%	3.85%	6	0.305
General	Kagiso Islamic Equity Fund	0.58%	2.81%	1	0.321
General	Marriott Dividend Growth Fund	0.84%	3.36%	1	0.562
General	36one Met Equity Fund	1.23%	3.18%	1	0.510
General	Cannon Met Equity Fund	0.42%	4.23%	6	0.412
General	Contego B6 Met Value Eq. Fund	0.81%	4.09%	6	0.040
General	Contego B7 Met Growth Eq. Fund	1.02%	2.84%	1	0.126
General	Counterpoint Met High Yield Eq. Fund	0.69%	2.12%	1	0.707
General	Counterpoint Met Value Fund	0.72%	4.15%	6	0.107
General	Imara Met Equity Fund	1.14%	3.49%	6	0.715
General	Lion of Africa Met Equity Fund	0.27%	4.02%	6	0.566
General	Met General Equity Fund	0.85%	4.17%	6	0.050
General	Perpetua Met Equity Fund	-1.16%	3.92%	2	0.703
General	Sasfin Met Equity Fund	0.48%	2.50%	1	0.515
General	Seed Equity Fund	0.74%	3.67%	6	0.469
General	Truffle Met General Equity Fund	1.28%	2.84%	1	0.384
General	Warwick Met Equity Fund	-0.71%	3.45%	2	0.416
General	Warwick Met Intl. Managed Feeder Fund	2.83%	2.18%	1	2.023
General	Ampersand Momentum Equity Fund	0.44%	2.85%	1	0.461
General	FNB Growth Fund	0.76%	4.00%	6	0.142
General	Momentum Best Blend Sp. Equity Fund	0.85%	3.77%	6	0.361
General	Momentum Equity Fund	0.77%	4.10%	6	0.056
General	Momentum MOM Opportunistic Eq. Fund	0.69%	2.72%	1	0.223
General	Momentum MOM Specialist Equ.	-0.63%	3.65%	2	0.217
General	Momentum Value Fund	0.35%	4.99%	6	0.982
General	Nedgroup Inv. Growth Fund	0.77%	3.71%	6	0.427
General	Nedgroup Inv. Quants Core Eq.	0.68%	3.99%	6	0.202
General	Nedgroup Inv. Rainmaker Fund	0.90%	3.71%	6	0.426
General	Nedgroup Inv. Value Fund	0.80%	3.89%	6	0.238
General	Bettabeta Green ETF	0.26%	4.00%	6	0.581
General	Newfunds NewSA Index Port.	1.00%	3.52%	6	0.640
General	Newfunds S&P Givi SA Top 50 ETF	0.86%	4.17%	6	0.057
General	Oasis Crescent Equity Fund	0.74%	3.55%	6	0.588
General	Oasis General Equity Fund	0.72%	3.72%	6	0.421
General	Old Mutual Active Quant. Fund	0.94%	3.95%	6	0.215
General	Old Mutual Albaraka Equity Fund	0.72%	3.80%	6	0.344
General	Old Mutual Growth Fund	0.83%	4.13%	6	0.004
General	Old Mutual High Yield Opp. Fund	0.38%	4.13%	6	0.439

Initial Category	Fund Name	Return	Std Deviation	K-means Cluster	Distance
General	Old Mutual Investors Fund	0.89%	4.22%	6	0.114
General	Old Mutual Prem. Equity Fund	0.81%	2.99%	1	0.212
General	Old Mutual Top Companies Fund	0.77%	4.05%	6	0.097
General	Old Mutual Umbono Rafi 40 Fund	0.41%	4.77%	6	0.764
General	Personal Trust Sa Equity Fund	0.53%	2.73%	1	0.376
General	PPS Equity Fund	0.68%	4.28%	6	0.210
General	27Four Shariah Active Equity	1.05%	3.60%	6	0.574
General	3laws Climate Change Equity	0.08%	2.73%	1	0.821
General	Abax Equity Prescient Fund	1.15%	3.37%	1	0.624
General	Aeon Enhanced Equity Prescient Fund	1.10%	3.00%	1	0.286
General	Afena Equity Prescient Fund	0.68%	3.08%	1	0.360
General	African Allian. Equity Prescient	-0.26%	3.75%	2	0.215
General	African Allian. SA S&P Givi Fund	-0.60%	3.58%	2	0.250
General	Aylett Equity Prescient Fund	0.98%	2.97%	1	0.195
General	Bateleur Equity Prescient Fund	0.07%	3.53%	2	0.601
General	Clucasgray Equilibrium Prescient Fund	0.70%	2.28%	1	0.556
General	Clucasgray Equity Prescient Fund	0.98%	2.58%	1	0.234
General	Fairtree Equity Prescient Fund	1.38%	3.18%	1	0.614
General	Huysamer Equity Prescient Fund	0.67%	4.10%	6	0.157
General	Laurium Equity Prescient Fund	-0.06%	3.29%	2	0.650
General	Maestro Equity Prescient Fund	0.79%	4.08%	6	0.062
General	Mergence Equity Prescient Fund	1.10%	2.88%	1	0.216
General	Nedbank Itf Balondolozi Absolute Return F	-0.04%	1.07%	3	1.021
General	Prescient Equity Fund	0.74%	4.10%	6	0.089
General	Prescient Equity Income Fund	0.76%	3.00%	1	0.247
General	Seed Equity Fund	0.72%	3.74%	6	0.399
General	Tower Capital Equity Prescient Fund	0.97%	2.17%	1	0.635
General	Hollard Prime Equity Fund	0.86%	2.52%	1	0.282
General	Mazi Capital Prime Equity Fund	1.40%	4.04%	6	0.581
General	Prime Equity Fund Of Funds	0.91%	1.77%	1	1.029
General	Prime SA Equity Fund	-0.48%	3.63%	2	0.162
General	Prudential Dividend Maximiser Fund	1.05%	3.27%	1	0.500
General	Prudential Equity Fund	0.91%	3.76%	6	0.376
General	Psg Equity Fund	0.90%	4.27%	6	0.159
General	Psg SA Equity Fund	0.00%	3.72%	2	0.475
General	Recm Flexible Equity Fund	0.70%	2.06%	1	0.758
General	Rezco Equity Fund	0.75%	2.49%	1	0.342
General	First Avenue Sanlam Equity	1.17%	3.01%	1	0.344
General	Sim General Equity Fund	-0.23%	3.65%	2	0.283
General	Sim Top Choice Equity Fund	1.04%	4.24%	6	0.248
General	Sim Value Fund	-1.34%	3.79%	2	0.865
General	Spi Equity Fund	1.09%	2.91%	1	0.220
General	Satrix Alsi Index Fund	0.26%	2.97%	1	0.662
General	Satrix Dividend Plus Portfolio	0.39%	4.55%	6	0.602
General	Satrix Dividend+ Index Fund	-1.07%	3.97%	2	0.625
General	Satrix Momentum Index Fund	1.14%	3.18%	1	0.451
General	Satrix Quality Index Fund	-1.83%	5.48%	2	2.166
General	Satrix Rafi 40 Total Return ETF	-2.35%	0.00%	3	1.661
General	Melville Douglas Stanlib Alpha	1.30%	2.78%	1	0.402
General	Stanlib Equity Fund	0.81%	4.12%	6	0.019
General	Stanlib Growth Fund	0.50%	4.85%	6	0.792
General	Stanlib Index Fund	0.86%	4.44%	6	0.308
General	Stanlib Multi Mgr Equity Fund	0.70%	3.61%	6	0.536

Initial Category	Fund Name	Return	Std Deviation	K-means Cluster	Distance
General	Stanlib SA Equity Fund	0.64%	4.52%	6	0.433
General	Stanlib Shariah Equity Fund	0.03%	4.06%	2	0.568
General	Stanlib Value Fund	0.72%	4.12%	6	0.102
General	Sygnia Active Equity Fund	0.63%	2.56%	1	0.353
General	Sygnia Divi Index Fund	-0.33%	3.78%	2	0.140
General	Sygnia Equity Fund	1.06%	2.52%	1	0.320
General	Sygnia Swix Index Fund	0.54%	2.73%	1	0.362
General	Sygnia Value Fund	0.69%	2.91%	1	0.236
Industrial	Coronation Industrial Fund	1.43%	3.84%	6	0.670
Industrial	Momentum Industrial Fund	1.13%	3.63%	6	0.583
Industrial	Newfunds S&P SA Industrial ETF	1.63%	3.18%	1	0.829
Industrial	Old Mutual Industrial Fund	1.03%	4.23%	6	0.226
Industrial	Sim Industrial Fund	1.45%	3.79%	6	0.717
Industrial	Satrix Indi Portfolio	1.48%	4.36%	6	0.700
Industrial	Stanlib Industrial Fund	1.19%	4.01%	6	0.386
Large Cap	Absa Rand Protector Fund	1.09%	4.39%	6	0.375
Large Cap	Kagiso Top 40 Tracker Fund	0.90%	3.52%	6	0.616
Large Cap	Saffron Met Top 20 Fund	0.71%	3.01%	1	0.283
Large Cap	Momentum Top 25 Fund	1.40%	3.53%	6	0.831
Large Cap	Momentum Top 40 Index Fund	0.82%	4.60%	6	0.466
Large Cap	Betta Beta Eq. Weighted Top 40	0.73%	3.49%	6	0.643
Large Cap	Newfunds Equity Momentum ETF	1.31%	3.84%	6	0.569
Large Cap	Newfunds Shariah Index ETF	0.35%	4.99%	6	0.983
Large Cap	Newfunds Swix 40 Etf Portfolio	1.29%	3.38%	1	0.702
Large Cap	Oldmutual Top 40 Fund	0.83%	4.64%	6	0.514
Large Cap	Integre Large Cap Prescient Fund	0.48%	3.12%	1	0.526
Large Cap	Prescient Equity Top 40 Fund	0.52%	4.96%	6	0.882
Large Cap	Rmb Top 40 ETF	1.04%	3.45%	1	0.668
Large Cap	Satrix 40 Portfolio	0.49%	3.00%	1	0.455
Large Cap	Satrix Eq. Weighted Top 40 Index Fund	0.03%	3.18%	2	0.793
Large Cap	Satrix Rafi 40 Index Fund	-0.35%	4.19%	2	0.413
Large Cap	Satrix Swix Top 40 Index Fund	0.89%	4.50%	6	0.371
Large Cap	Satrix Top 40 Index	0.50%	3.00%	1	0.450
Large Cap	Stanlib ALSI 40 Fund	0.82%	4.57%	6	0.440
Large Cap	Sygnia Top 40 Index Tracker Fund	0.49%	2.81%	1	0.409
Mid & Small Cap	Coronation Smaller Comp. Fund	0.67%	3.83%	6	0.331
Mid & Small Cap	Investec Emerging Comp. Fund	0.96%	4.22%	6	0.167
Mid & Small Cap	Momentum Small Midcap Fund	0.80%	3.93%	6	0.196
Mid & Small Cap	Nedgroup Inv. Entrepr. Fund	1.16%	4.10%	6	0.335
Mid & Small Cap	Old Mutual Small Comp. Fund	0.55%	3.92%	6	0.348
Mid & Small Cap	RMB Midcap Fund	0.56%	3.32%	1	0.626
Mid & Small Cap	Sim Small Cap Fund	0.97%	2.29%	1	0.508
Resources	Coronation Resources Fund	0.32%	6.41%	4	0.174
Resources	Investec Commodity Fund	0.53%	6.25%	4	0.441
Resources	Momentum Resources Fund	0.33%	6.73%	4	0.282
Resources	Nedgroup Inv. Mining & Res. Fund	0.49%	5.98%	4	0.611
Resources	Newfunds S&P Givi SA Res. ETF	0.44%	5.96%	4	0.608
Resources	Oldmutual Gold Fund	0.05%	7.64%	4	1.151
Resources	Old Mutual Mining & Res. Fund	0.40%	6.44%	4	0.238
Resources	Sim Resources Fund	-0.02%	6.01%	4	0.521
Resources	Satrix Resi Portfolio	-0.06%	7.27%	4	0.801
Resources	Stanlib Resources Fund	0.14%	6.62%	4	0.122