Relationship between assets under management and alpha in South African equity mutual funds

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ABSTRACT

Academics and financial media are divided on whether the size of assets under management (AUM) influences returns. In an attempt to seek clarity in the local context, this study investigates the effect of the size of assets under management on alpha in South African equity mutual funds over the three-year period to 31 December 2015. The study is based on secondary quantitative data reported on the Bloomberg Professional service database that includes mutual fund and benchmark indices, unit prices and fund asset sizes. The research sample comprises 69 South African equity mutual funds that existed for the three-year period under review.

In this study, the relationship between AUM size and alpha is examined using the cross-sectional regression approach. No evidence of a linear relationship between AUM size and alpha was observed in the analysis based on the sample data. This finding is consistent with the semi-strong form efficient market hypothesis that securities reflect publicly available information.

This finding implies that the exponential growth in AUM experienced in South Africa over the past two decades has neither enhanced nor come at the cost of returns. There does not seem to be a size effect that new investors and fund managers should be aware of.

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CHAPTER 1

INTRODUCTION

1.1 Introduction

South African mutual funds[1] have rapidly grown to become significant participants in the financial intermediary arena of the South African economy. At the end of the year 2000, assets under management (AUM) by funds listed in the Association for Savings and Investment South Africa (ASISA) database amounted to R128 billion, growing exponentially to R1.9 trillion by 31 March 2016 (ASISA, 2000; ASISA, 2016). These figures point to the substantial amount of capital attracted by mutual funds with the trajectory expected to continue. As highlighted by Gompers and Metrick (2001) in the study of the relation between corporate governance and United States of America (US) equity prices, the exponential growth in assets managed by mutual funds commensurately increases the funds' role in price discovery. In light of the significant growth in assets managed by mutual funds and their prominence in the economy, an understanding of the relationship between AUM and performance within the South African context is of paramount importance to market participants.

This study is also relevant to investors in the assessment of alternative mutual funds and drivers of excess return, more so South African investors who have a poor savings rate. According to the South African Savings Institute (SASI), South Africa's national rate of savings as at 31 March 2016 was 15%, with the rate of household savings a mere 1.1% (SASI, 2016). These statistics, compared to the South African household debt as a percentage of disposable income of 76.6% (SASI, 2016), indicate a significant savings gap. The gap presents a shortcoming as well as an opportunity, with new investors emerging given the growing middle class and the savings incentives provided by the South African government to encourage discretionary non-retirement saving and investing. Rationally and as noted by Oldham and Kroeger (2005), to justify the costs of investing in actively managed mutual funds, investors expect larger returns relative to the market benchmark. South African investors are expected to pursue the same goal. This study attempts to establish whether the size of AUM is related to the achievement of such excess returns.

[1] Despite the difference in the incorporation of unit trusts and mutual funds investment vehicles, both are professionally managed collective investment schemes the names of which will be used interchangeably without distinction in this study. Unit trusts are set up as unincorporated mutual funds whereas mutual funds are set up under a company or corporation structure. The two represent collective investment vehicles that allow the pooling of funds from numerous investors with the aim of making investments.

Mutual funds growth, both in size and number of funds, in the economy has been accompanied by an increased focus on the predictability of fund performance as a topic in finance (Elton, Gruber & Blake, 2011). According to Elton, Gruber and Blake (2011), financial data service providers such as Morningstar, Thomson Reuters and Bloomberg have adapted and dedicated resources to meet the demand for mutual fund statistics. Certain authors (Elton, Gruber & Blake, 2011; Rao & Rao, 2009) believe that investors apply historic data to make inferences about future performance. The documented positive relationship between fund performance and capital flows (Berk & Green, 2002; Bogle 1997; Gruber 1996) supports the view that investors make inferences about future performance based on historic performance. The findings of this study are expected to increase the available literature to inform the decisions relating to the appropriate vehicles into which new and existing investors should direct their capital.

As the demand for investment alternatives increases, partially due to the tax saving incentives in South Africa, this study also expands the body of knowledge available to South African fund managers in the deliberations about the ideal fund size. More generally, the nature of the relationship potentially has implications for areas such as alignment of interest between investors and fund managers, optimal capital allocation, compensation structures and mutual funds' role in stock price determination (Beckers & Vaughn, 2001; Chen et al., 2004; Gompers & Metrick, 2001).

South African mutual funds invest in a diverse range of asset classes, including equity, interest-bearing securities, real estate, and multi-asset portfolios. As at 30 June 2016, funds invested in multi-asset classes accounted for 51% of all the South African funds, with equity-focused funds accounting for 21% (ASISA, 2016). Despite the relative significance of the multi-asset portfolios, the focus of this study is on the single-equity asset class in an attempt to limit the variability in return drivers and dynamics of the various security markets involved in multi-asset investments.

1.2 Background

The relationship between AUM and performance falls within the broad ambit of the well-researched field of market efficiencies and the related performance of actively managed funds relative to the market indices – more notably, the seminal work by Fama (1970) on the

efficiency of capital markets, which validated the Efficient Market Hypothesis (EMH), the core of which is that securities fully reflect all available information. The EMH implies that irrespective of size, actively managed mutual funds should not be able to achieve returns in excess of the market benchmark. Further, there is a vast body of literature (Berk, 2005; Berk & Green, 2004; Grinblatt & Titman, 1989; Gruber, 1996; Malkiel, 1995) documenting that on average actively managed mutual funds do not outperform index funds. This begs the question as to why actively managed mutual funds continue to grow and increase AUM. In this study, the particular focus is on the nature of the relationship between AUM and mutual fund excess performance relative to a comparable index.

In addition to the limited evidence of superior performance relative to market indices, performance persistence[2], as indicated by sustained outperformance in consecutive years, seems to be just as rare (Berk, 2005; Malkiel, 1995; Wilson et al., 2007). According to Berk (2005), advocates of the efficient markets hypothesis believe that actively managed mutual funds should not consistently outperform the market. Theoretically, if an actively managed mutual fund generated positive risk-adjusted excess returns over the market benchmark, capital from similar risk assets will flow into the outperforming mutual funds, resulting in excess supply of capital. The point where there is no excess supply or demand of capital would occur only when the mutual fund's expected return equals that of alternative investment opportunities available to the investor. The existence and growth in AUM of actively managed mutual funds indicates a violation of the efficient markets hypothesis. If securities indeed reflected all available information, actively managed mutual funds should not be expected to achieve superior returns relative to the market benchmark and thus capital should not continue to flow to these funds, increasing AUM.

Berk (2005) further indicates that a single year's outperformance by a mutual fund manager does not increase the likelihood of doing well in the subsequent year, thus past performance does not predict future performance. Given the competitiveness of capital markets as noted by Berk and Green (2004), rational investors would be expected to invest their funds in an index fund rather than actively managed funds if alpha[3] persistence is not likely.

[2] Sustained outperformance in consecutive years.
[3] Alpha in this study is defined as the average returns above the benchmark, consistent with definition used by Oldham and Kroeger (2005).

Despite the finding of no persistence in mutual fund performance, Berk (2005) found that fluctuations in AUM (i.e. inflows and outflows) are sensitive to historic mutual fund performance. The outperformance of a mutual fund is trailed by an inflow of capital to the fund up to the point that mutual fund alpha is zero. Underperformance is followed by capital withdrawal from the fund up to the point that alpha is equal to zero. In both instances the mutual fund is expected to achieve an alpha of zero in the long run, thus resulting in benchmark returns.

1.3 Nature of the relationship between AUM and alpha

Understanding the nature of the relationship between AUM and excess returns is critical in the discourse on the value of active management of mutual funds. There seem to exist both economies and diseconomies of scale. Some of the cited benefits of increasing AUM include overhead cost advantage due to their less than proportionate increase relative to AUM (Tufano & Sevick, 1997; Yan, 2008). The authors Tufano and Sevick (1997) concluded that mutual fund expense ratio's decline as the size of the fund increases. On the other end of the spectrum, Perold and Salomon (1991), Beckers and Vaughan (2001), Elton, Gruber and Blake (2011) and Chen et al. (2004) contend that there exist diseconomies of scale for funds with large assets. They find that large assets under management have a negative impact on performance and some of the reasons for this converse relationship include limitations associated with liquidity, the price impact of large trades, reduced flexibility and longer time frames in adjusting the portfolio as it grows larger.

Berk and Green (2004) and Reuter and Zitzewitz (2010) conclude that no significant relationship should exist between the size of assets under management and performance despite having decreasing returns to scale in their developed model; the impact of the diseconomies of scale is mitigated by competitive capital provision resulting in zero expected excess returns.

There also exists evidence of a non-linear relationship between AUM and mutual fund performance. For example, Perold and Salomon (1991) suggest that there is a minimum AUM size to achieve efficiencies and there is an optimal AUM size at which point the opportunity cost of not entering into a transaction equals the cost of additional trading. According to Perold and Salomon (1991), additional growth beyond the optimal AUM size results in a rise in unexecuted trades, thus increasing the opportunity costs and reducing percentage returns.

1.4 Problem Statement

Literature reviewed on the relationship between mutual fund AUM size and performance has revealed mixed findings. Some studies found a positive relationship, while others found a negative relationship; another group of authors concluded that there is no relationship between AUM and returns, and inconclusive findings were also documented. The contradictory findings of empirical research present a research gap on the nature of the relationship between AUM and mutual fund returns.

Further, while a significant amount of South African-specific literature on mutual fund performance persistence has been found, there are limited studies covering the relationship between AUM size and performance based on South African equity mutual funds. A research gap has arisen due to some of the following:

- The exponential growth in assets managed by South African mutual funds over the past two decades
- The pivotal role in price discovery played by South African mutual funds given the size of the assets under their management
- In response to South African policy stimulus to increase the level of saving, the emergence of new investors faced with decisions on whether to direct their savings into funds with large or small AUM
- The limited availability of South Africa-specific research on the relation between AUM and performance covering the past decade to 2015
- The mixed findings of global studies on the effect of AUM size on returns.

This study seeks to investigate the relationship between South African equity mutual funds' assets under management and outperformance relative to benchmark indices.

1.5 Research question

The research question that this study seeks to answer is as follows:

- Is there a linear relationship between assets under management and alpha in South African equity mutual funds?

1.6 Statement of research objective and hypothesis

Set out in this section are the research objective and the hypothesis developed therefrom. Despite there being mixed results and findings on historic studies, a theoretical expectation of the nature of the relationship between AUM and alpha in South African equity mutual funds has been formulated.

1.6.1 Research objective

The research objective is to investigate whether equity mutual fund assets under management are linearly related to alpha in South Africa.

1.6.2 Hypothesis

Stemming from the research objective stated above, the following hypothesis is the core subject of the regression analysis conducted in this study.

Null Hypothesis H_0: There is no linear relationship between AUM size and equity mutual fund alpha in South Africa.

- The null hypothesis implies that equity mutual fund AUM size has no effect on alpha in South Africa.

Alternate Hypothesis H_1: There is a linear relationship between AUM size and equity mutual fund alpha in South Africa.

- The alternative hypothesis implies that there is either a positive or a negative relationship between equity mutual fund AUM size and alpha in South Africa.

Thus:

$$H_0 : \beta_1 = 0$$
$$H_1 : \beta_1 \neq 0$$

where alpha is defined as the mutual fund excess return above the comparable fund benchmark return.

1.6.3 Theoretical expectation

Based on the literature reviewed, specifically relating to the efficiency of capital markets and the development of the South African mutual fund industry, no linear relationship between AUM size and equity mutual fund alpha in South Africa is expected.

1.7 Justification of the study

The outcome of this study is expected to contribute to the available literature on the optimal investment strategies for fund managers (i.e. passive vs. active management). This view is consistent with the conclusion by Pillay et al. (2010) in the study of the relationship between fund size and returns on the JSE, that large funds should convert to passive investment strategies and that small and medium firms must be cognizant of the effect of fund size on returns and cap their funds appropriately. In addition, the findings of this study will also be of specific importance to the mutual fund managers looking to expand their AUM as well as investors who are inclined to allocate their capital towards funds with large AUM.

The exponential growth achieved by mutual funds and the associated prominence in the South African economy warrants an investigation of the return drivers and the nature of the relationship between AUM size and alpha.

An understanding of the relationship between AUM and performance within the South African context will be invaluable to new and existing investors faced with decisions on whether to direct their savings into funds with large or small AUM. The nature of the relationship between AUM and fund performance potentially has implications for principal-agent relationships between the investors and fund managers and the necessary alignment of interest. The extent and net effect of the economies and/or diseconomies of scale within actively managed mutual funds could also influence the compensation structure between investors and fund managers, as indicated by Chen et al. (2004) and Becker and Vaughn (2001). Findings of this study can contribute to the body of knowledge available on optimal capital allocation to mutual funds to maximize investor wealth.

Further, the increasing role played by South African mutual funds in price discovery stemming from the size of assets under mutual fund control justifies the study (Gompers & Metrick 2001).

The more vast and diverse the study of the mutual fund industry, the more insights into the pros and cons of this growing market it provides.

Globally the nature of the relationship seems to have received some research focus; however, limited studies have been found covering the dynamic in the South African market. The study of the relationship between AUM and fund performance of South African equity mutual funds will contribute South Africa-specific research findings.

The results of this study go beyond the interest of investors and fund managers and extend to having academic consequences on the efficient market hypothesis. A finding of insufficient evidence to reject the null hypothesis, that there is no linear relationship between AUM size and equity mutual fund alpha in South Africa, is consistent with the EMH and implies that stock prices to some extent reflect available information.

1.8 Approach

This study has six distinct chapters. Chapter 1 introduces the study and provides brief context and background. Chapter 2 outlines the literature reviewed. Chapter 3 covers the research methodology of the study. Chapter 4 relates to the research analysis and findings. Chapter 5 presents the research conclusion. Recommendations for future research are noted in Chapter 6.

The study begins with an overview of the literature reviewed on the broader theme of market efficiency within which this study falls. This is followed by a review of studies on mutual fund performance relative to market benchmark and persistence. A review of the literature specifically focused on the relationship between AUM size and fund performance is conducted. Due to the growing focus on performance predictability and its tacit association with the relationship between AUM and alpha, literature covering this topic is also reviewed.

In this study, the relationship between AUM size and alpha is examined using the cross-sectional regression approach. As noted by Yan (2008), this method allows for the control for other fund characteristics that might be correlated with performance, thus explaining superior performance or alpha. The control variables applied in the cross-sectional regression incorporate the variables used by Yan (2008) and Chen et al. (2004), which include expense

ratio, fund age and lagged fund return. These additional variables are regressed in addition to AUM size against alpha.

The growing focus on performance predictability has accompanied the growth in mutual funds globally, with investors making inferences about future performance and capital allocation based on historic performance and information. Mixed results have been observed on predictability with more unpredictability observed. Any evidence of predictability would be contrary to the EMH.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

Set out below is an overview of the literature reviewed on mutual fund performance evaluation, persistence as well as the specific relationship between assets under management and returns. The study of the relationship between AUM and performance falls within the broader research field of market efficiencies. In this study, particular attention is drawn to the influential work of Fama (1970) on the Efficient Market Hypothesis (EMH) the core of which is that securities fully reflect all available information.

The vast majority of literature reviewed indicates that the average equity fund does not achieve superior performance relative to the stock market and very limited actively managed equity mutual funds can persistently perform better than the passive benchmark. Lack of performance persistence is consistent with the EMH.

In the limited empirical literature available on the relationship between AUM size and fund performance, there seem to exist both economies and diseconomies of scale.

2.2 Efficient Market Hypothesis

Understanding the nature of the relationship between AUM and excess return is critical in the discourse on the value of active management of mutual funds. The vast majority of literature reviewed indicates that on average, actively managed mutual funds do not outperform the respective market benchmark indices and performance persistence is limited or non-existent. The lack of persistence found in the analysis supporting the studies referred to above is consistent with the EMH developed by Fama (1970) in his seminal work reviewing the theory and empirical work on the efficiency of capital markets. The crux of the EMH is that securities fully reflect all available information (Fama 1970). In the study the author identified the following three information categories to which security prices adjust:

- Weak form efficiency – refers to price adjustment to historical information
- Semi-strong form efficiency – price adjustment to publicly available information

- Strong form efficiency – the efficiency with which prices adjust to private monopolistic information.

In this study, Fama (1970) validated the efficient markets model. In their textbook, Ross, Westerfield and Jaffe (2002, p. 353) explain that in markets that have semi-strong form efficiency, on average mutual fund returns will be the same as the market return. Findings that actively managed funds on average do not achieve positive alpha are consistent with weak form efficiency and semi-strong form efficiency.

As indicated by Grey (2005), the importance of performance persistence goes beyond the interest of mutual fund investors and extends to having academic consequences on the EMH. The EMH implies that mutual funds cannot be expected to consistently achieve superior performance relative to the market as stock prices should already reflect all historic and publicly available information (Grey 2005). Thus, any evidence of performance persistence and/or a linear relationship between AUM and returns found contradicts EMH.

2.3 Superior performance relative to benchmark and persistence

In the study of the effect of mutual fund size on behaviour in the United States of America (US) using data over the 1975 to 2000 period, Wilson et al. (2007) found that the average equity fund does not achieve superior performance to the stock market and very limited actively managed equity mutual funds can persistently perform better than the passive benchmark. Malkiel (1995), in the study of returns from investing in US equity mutual fund in the 1971 to 1991 period, reached the same conclusion that on aggregate, actively managed equity funds underperformed benchmark portfolios on a net and gross returns basis. In addition, Malkiel (1995) found no evidence of performance persistence in funds during the 1980s despite the presence thereof during the 1970s. However, Malkiel (1995) acknowledges that the findings of the 1970s could have been influenced by survivorship bias[4]. Rao and Rao (2009), in their investigation of the effect of fund size on performance in India for the three-year period to April 2009, echoed the finding that funds were unable to achieve superior returns relative to the market.

[4] Survivorship bias occurs when a sample only contains data from funds that have continued to exist through the collection date of the sample period (Chan et al. 2009).

There is limited literature with evidence of performance persistence; however, such conclusions have since been disputed by other authors on account of survivorship bias. Grinblatt and Titman (1992) document evidence of positive performance persistence between funds in their analysis of the relationship between mutual performance and past performance. The authors analysed data from 279 US mutual funds over the 10-year period ending December 1984. Grinblatt and Titman (1992) argue that the observed persistence is consistent with the persistent differences in fees and transaction costs between funds. The survivorship bias inherent in the study is acknowledged, although the authors maintain it had an insignificant effect on the results. Performance persistence in the short term has also been observed by Hendricks, Patel and Zeckhauser (1993) is the analysis of US data for the period starting 1974 and ending in 1988, consistent with the data period examined by Grinblatt and Titman (1992). The authors found that recent losers performed profoundly worse than the benchmarks and recent superior performers fared better, but not significantly so. Hendricks, Patel and Zeckhauser (1993) observed more sustained poor performers than good performers. Malkiel (1995) disputed the findings of Grinblatt and Titman (1992) and Hendricks, Patel and Zeckhauser (1993) due to the effects of survivorship bias. In the study noted above, Malkiel (1995) took survivorship bias into account and factored in the effects of transaction costs for US data covering 1974 to 1988 and beyond and found no performance persistence. Should performance persistence exist in the South African market based on the sample mutual fund data to be examined, this would indicate lack of efficiency in the local price formation mechanisms and thus a violation of the EMH. The explicit assessment of performance persistence and market efficiency is beyond the scope of this study.

It is evident that survivorship bias is an important factor to consider; however, this study is not affected by it as no funds in the sample ceased to exist during the sample period. Only funds that began their existence during the three-year sample period were excluded.

In the absence of outperformance or persistence, it is puzzling why capital flows to actively managed funds continue. Gruber (1996) hypothesises that one of the reasons why investors continue to allocate capital to actively managed mutual funds is that the assets are purchased and sold at net asset values, the pricing of which may not incorporate the value of fund manager skill. With management ability excluded from the pricing, Gruber (1996) believes that fund returns should be predictable, resulting in the predictability of capital flow into and out of funds. If investors act on the abovementioned predictors, Gruber (1996) concludes that returns on new

capital flows can be expected to exceed the average fund returns. As regards the question of why capital continues to flow to actively managed funds despite limited evidence of persistence, Gruber (1996) partially attributes this to the need by investors for the professional management services and stock selection function provided by active fund managers.

The South African literature has yielded mixed results. Oldham and Kroeger (2005), in their examination of 20 South African unit trusts covering diverse sectors for the 1998 to 2002 period, found that on average the funds did not generate consistent superior returns relative to the market benchmark index. Little evidence of performance persistence on an absolute and risk-adjusted basis in the short term was observed by Grey (2005) in the investigation of the market efficiency of the South African unit trust industry. In the long-run period of two to three years, the levels of persistence become even more insignificant (Grey, 2005). In conducting the test, the author employed a sample of 35 South African general equity unit trusts for the period starting 1 January 1998 and ending 31 December 2003. Consistent with Grey (2005), Meyer (1998) tested the persistence of selected South African unit trust performance for the period July 1985 to June 1995 and found evidence of limited performance persistence in the short term. However, the author notes that the observed performance persistence is not statistically significant and repeat losers were more persistent than repeat winners/outperformers. Oldham and Kroeger (2005) identified a potential bias in the research conducted by Meyer (1998) in that the JSE all-share index was not an appropriate benchmark, given that the portfolios studied were not diversified. To take into account the diversity of the funds assessed in the analysis of the current study, the benchmark employed and reported on the Bloomberg Professional service (Bloomberg) database by each mutual fund is applied.

In contrast, evidence of short and long-term performance persistence of South African unit trusts was found by Von Wielligh and Smit (2000) for the period from January 1988 to December 1997 using the Capital Asset Pricing Model and Arbitrage Pricing Theory models. The authors observed that the unit trusts with the worst returns were likely to maintain the bad performance trajectory over the long term whereas the average and best performers converged to each other, i.e. best to average and average to superior returns. Gilbertson and Vermaak (1982) also found evidence of superior performance relative to market benchmark indexes in the analysis of 11 South African mutual funds over the period 1974 to 1981 when risk-adjusted performance measures are applied. In violation of the efficient market hypothesis, Gilbertson and Vermaak (1982) found some evidence of performance persistence, implying the presence

of inefficiencies in the pricing mechanisms for JSE-listed shares. When analysing the mutual fund returns with no consideration of risk, the mutual funds assessed on average underperformed the indexes.

2.4 Literature on the relationship between AUM size and fund performance

Despite the abundance of literature on mutual fund performance appraisal, both globally and in South Africa, relatively few studies have been found that relate size of assets under management to performance. In the limited empirical literature available on the relationship between AUM size and fund performance, there seem to exist both economies and diseconomies of scale. Studies of the relationship reviewed indicate four distinct groups of findings, summarised as follows:

- The first group concludes that large AUM has a positive influence on fund returns due to economies of scale
- The second group finds a non-linear relationship between AUM and fund returns with an optimal asset size that maximizes investor wealth
- The third group finds that there is no relationship between AUM and fund performance
- The fourth group believes that the effect of diseconomies of scale is so significant that it erodes fund returns as AUM increase.

The literature on the relationship between fund size and performance in South Africa and other emerging markets is more scarce, with the findings consistent with the groups noted above.

2.4.1 Positive relation between AUM and returns

There are findings that support the view that "bigger is better", due to stability that comes with size, economies of scale, greater access to investment opportunities, and more extensive research capabilities. The economies of scale associated with growth in AUM have been well documented, for instance, Annaert, Van den Broeck and Van der Vennet (2003), in their examination of the correlation between fund size and efficiency[5] in the European mutual fund industry using a data sample from 1995-1997, identified a positive relationship between AUM

[5] In this context efficiency is "maximising expected return given portfolio risk ((variance of portfolio returns)" Annaert, Van den Broeck and Van den Vennet (2003, p.2).

size and returns; however, causation was not confirmed. The authors observed a relationship between fund efficiency, AUM size and historic returns, with larger funds generally associated with higher level of efficiency, thus implying the presence of economies of scale. Keswani (2011), in the evaluation of the impact of fund size on performance in India, observed that with sufficient scale, liquidity, stock selection and trade decision flexibility is gained. The author also highlights the advantage of reduced transaction costs associated with large transactions.

Furthermore, despite finding diseconomies of scale, Chen et al. (2004) in their research argue that growth in fund size results in additional resources being available for research, which could possibly improve the stock-picking ability of fund managers as well as lower the expense ratios. In arriving at their conclusion, Chen et al. (2004) examined 3 439 US equity mutual funds from 1962 to 1999 and applied cross-sectional variation to establish the effect of lagged fund size on performance. Consistent with Chen et al.'s (2004) finding of an inverse relationship between fund size and performance, Yan (2008) acknowledged other researchers' findings that AUM growth provides cost benefits as administration, overhead, research costs and brokerage commissions do not increase in direct proportion with fund size. The acknowledgment made by Yan (2008) came about in the examination of a broad sample of diversified US equity mutual funds for the ten-year period to 2002 to ascertain the relationship between fund size and performance. The claim of cost advantages provided by growth in AUM is evidenced by the finding of the decline in fund expense ratio with AUM size by Tufano and Sevick (1997), in their study of the effect of US mutual fund board structure on fees charged.

2.4.2 Non-linear relation between AUM and returns

The benefit to the investor of large funds includes reduced administration costs; however, the cost saving might come at the expense of performance. There are authors who identified a non-linear relationship between AUM and fund performance where the effect of growing AUM is initially positive up to a point and then turns negative. According to Beckers and Vaughan (2001), investors and the general industry see large AUM coupled with positive recent performance returns as positive, responding by directing additional capital flows to the outperforming large funds, leading to the eventual impairment of the fund returns. The authors' theory is that outperformance by fund managers attracts capital from investors looking to profit from value-adding strategies. As AUM increases from new capital, flexibility to effect portfolio

adjustments is lost and trades impact prices or take longer, ultimately impairing performance. They use the analogy of a goose that lays the golden egg becoming unhealthy and unproductive if fattened beyond a certain point. In arriving at their views and conclusion, Beckers and Vaughan (2001) used simulations of 250 equity shares that constituted the Australian All Ordinaries Index over the historic three-year period ending September 1999. Consistent with the golden egg-laying analogy, Indro et al. (1999), in a study of 683 actively managed US equity funds from 1993 to 1995, find evidence of a nonlinear relationship between AUM size and performance; initially mutual fund performance increases with fund size and then performance decreases. They found evidence that there is a minimum AUM size that actively managed funds need to reach to cover the cost of acquiring and trading information. Indro et al. (1999) believe that with uncontrolled mutual fund growth, costs that erode value become substantial. For example, transaction costs increase due to the size of the trades that have the unintended effect of aggravating the information asymmetry and liquidity concerns for market makers, thus increasing bid-ask spreads. In addition, given the amount of attention large funds attract, the ability of the fund manager to execute trades anonymously without signalling is reduced, hence increasing bid-ask spreads. As AUM grows the block size in which trades take place also increases, thus on trade execution, the bid-ask spreads widen due to the information being signalled or inferred by the market based on such trades. Indro et al. (1999) also cite the opportunity costs of not implementing trades, the costs of administrative requirements to manage larger funds and deviations from historic investment strategies in an attempt to seek additional returns given fund size. Chan et al. (2009), in the analysis of the interactions between transaction costs, fund size and returns using 34 Australian mutual funds, also identify exorbitant transaction costs beyond a certain AUM threshold as the driver of diseconomies of scale for large funds. Of the same view is Bogle (1997), who believes that from a fund manager's perspective, the optimal AUM size is the point just below the level that fund returns start to become negative relative to the index and their fees are maximized; in contrast, investors require highest returns at the most minimal assets. Bogle (1997) arrived at this conclusion after analysing approximately 10 000 transactions in the US market over the nine-month period to July 1996 with the objective of understanding the effect of trading costs on fund returns.

Additional evidence of the non-linear relationship between AUM and performance was found by Perold and Salomon (1991) in their article about the ideal amount of AUM involving the examination of about 1 200 US transaction observations collected during 1982. The authors identified declining marginal returns to information-gathering activities of mutual funds; AUM

size increased to the point where the marginal returns became negative when the funds' optimal AUM[6] size was exceeded. In their study, the authors also found there to be a minimum AUM size to achieve efficiencies of information activities. According to Perold and Salomon (1991), the diseconomies of scale they deem inherent in active mutual fund management are the result of the negative relationship between market impact[7] and transaction size. Mutual fund performance declines with AUM size as large transactions are more challenging to implement compared to small trades. With increasing AUM, position size increases, eroding the percentage portfolio return. Perold and Salomon (1991) point out that despite the decline in percentage return, the actual currency value of wealth created increases up to a point, which they term the wealth maximization point. This point is reached when the opportunity cost of not entering into a transaction equals the cost of additional trading. The authors conclude that beyond the wealth maximization point, additional growth in AUM results in a rise in unexecuted trades, thus increasing the opportunity costs and reducing percentage returns.

In this study alpha instead of wealth maximization is used as the measure of outperformance due to the following:

- It is widely accepted that actively managed funds strive to create wealth by achieving returns superior to passive benchmarks; alpha is a measure of their performance relative to the benchmark.
- Wealth created is a function of alpha, AUM and fund-specific characteristics (Perold & Salomon 1991). Wealth created for the investor is computed net of management fees whereas for the manager it equates to fees charged less operating expenses. The sum of the two determines total wealth. Given that fee structures[8] and operating costs vary across mutual funds, alpha is the more appropriate comparable measure of performance instead of relative wealth created.
- Alpha presents an objective measure of relative performance between funds. It is based on publicly available information, is easy to measure and verifiable.

If indeed the non-liner relationship between AUM and fund performance exists, the finding potentially has implications for the principal-agent relationship between the investor and fund

[6] "This is the wealth maximization point where the cost of additional trading exceeds the opportunity cost of not trading" (Perold and Salomon, 1991, p.31). This point is determined using a linear bid-ask schedule that approximates large cap spreads with assumptions made on the spreads for immediate execution for small and large blocks of shares, as well as pace of trading.
[7] Perold and Salomon (1991, p.32) define market impact as the "amount by which the transaction price differs from a "fair" price. – "fair price" being the midpoint of the bid-ask spread at the point in time that the decision to trade is being made.
[8] Management fees that are fixed percentages of AUM vs. performance fees.

manager and the necessary alignment of interests. According to Perold and Salomon (1991), in instances where the mutual fund management fee is a fixed percentage of assets, client wealth is reduced the more trades remain unexecuted, creating inconsistency between the interests of the investor and mutual fund manager. Where performance fees are applicable, the fund loses revenue when AUM exceeds the wealth maximization point, thus aligning investor and fund manager interest. Beckers and Vaughan (2001) share the view that performance-based fees are more appropriate for alignment of manager and investor interests.

Beckers and Vaughan (2001) argue that there is no optimal fund size; the diseconomies of scale take effect from the onset of fund development. These authors state that fund managers become less risk-efficient as AUM increases and that there are no substantial intrinsic transaction cost advantages related to fund size. Chan et al. (2009) dispute this view as the result of their analysis of daily trade of large and small funds indicates that large funds incur higher market impact costs compared to small funds.

2.4.3 Negative relation between AUM and returns

On the other end of the spectrum, there are authors that argue that diseconomies of scale weigh heavier on fund performance as AUM increases. Identified sources of the inverse relation include liquidity, hierarchy costs, increased trading costs, reduced flexibility and negative stock price impact.

Chen et al. (2004), in their study of the effect of lagged fund size on performance, found evidence that an increase in AUM erodes fund performance. Their evidence indicates that the inverse relation between AUM and returns is most significant in less liquid small-cap funds. These authors further observe the negative impact of hierarchy costs[9] on fund performance. Consistent with Chen et al. (2004), Yan (2008), in the analysis of the relation between fund size and return in the US economy over the 10-year period to 2002, found strong evidence of a converse relationship between fund performance and size of AUM. In the study, Yan (2008) consistently observes that smaller funds outperform larger funds. The author finds that the inverse relation is more prominent in growth and high turnover funds, indicating the

[9] Hierarchy costs refer to the negative impact of organizational structure hierarchy on managerial effort. This talks to the different levels of senior management that need to be convinced or approve stock selection.

significance of liquidity[10] in the erosion of performance as fund size increases. In research conducted by Yan (2008), the most liquid funds showed no evidence of the inverse relationship between AUM size and performance. Reuter and Zitzewitz (2010), in their analysis of the causal impact of AUM size on future performance, found insignificant evidence that AUM size erodes return. However, the authors note that the level of diseconomies of scale in the management of mutual funds has key repercussions for inferences about fund manager ability and the anticipated performance persistence.

Some of the explanations cited for the inverse relation between assets under management and fund size include increased trading costs, liquidity, reduced flexibility as it becomes more difficult to adjust trades and execution becomes slower, and/or impacts price moves, all of which reduce performance (Beckers & Vaughan 2001). Beckers and Vaughan (2001) reach the conclusion that small and nimble funds have a significant comparative advantage in achieving alpha. The authors attribute the difficulty of achieving alpha by fund managers as AUM increase to the loss of flexibility to implement ideas and protracted execution of large trades with opportunities disappearing with the passage of time. In addition, Beckers and Vaughan (2001) point out the increased challenge of maintaining a desired fund style profile as AUM grows, in particular for momentum-style strategies. The researchers, Perold and Solomon (1991), in their paper about the ideal amount of AUM, cite trading cost related to liquidity and price impact of large funds as sources of erosion in fund performance. To contain the impact of large trades in the market, Perold and Salomon (1991) find evidence of alteration of manager trade execution strategies; trades tend to be slower. Based on the simulation of JSE stocks conducted by Pillay et al. (2010) in the study of the impact of fund size on performance, the authors identified liquidity as the reason for the negative relationship identified for AUM size greater than R5bn.

The research concluded by Bogle (1997) in which approximately 10 000 US transactions in 1996 were examined to determine the effect of trading costs on fund returns, also demonstrates that trading costs erode a significant portion of fund total returns as AUM increases. In addition, Chan et al. (2009), in the analysis of the interactions between transaction costs, fund size and returns in the Australian economy, theorize that in an attempt to reduce market impact cost, fund managers adjust portfolios in ways they might not have if they had been smaller, thus

[10] For each fund portfolio, liquidity measures are based on "the quoted and effective spreads of all stocks held" and "functions of the stock's market capitalization as well as the relative holding size (shares held divided by average daily trading volume)" (Yan, 2008, p. 742).

creating an opportunity cost of AUM size. Beckers and Vaughan (2001) find that in the simulated Australian market over the three-year period to September 1999, large funds sacrifice alpha as they are unable to execute certain opportunistic trades as a result of the anticipated transaction costs. Berk (2005), in the study of selected myths of active portfolio management, corroborates the findings of diseconomies of scale. In arriving at his conclusion, Berk (2005) notes that superior returns can be achieved by fund managers if they identify undervalued securities and transact based on this knowledge without negative price impact. To achieve this, fund managers incur costs that reduce the fund returns; at some point, these costs (for example bid-ask spreads and research costs) increase disproportionately in scale, to the point where they erode expected returns to the benchmark.

Pollet and Wilson (2008), in their research on the effect of size on fund behaviour using a sample of US mutual fund data over the 1975 to 2000 period, find that as AUM increases, fund managers tend to increase the ownership share in shares already forming part of their portfolio instead of increasing the number of investments. The larger positions in existing stock held result in larger transaction costs that erode returns. These authors highlight the limits to scalability, referred to as ownership costs as a source of erosion of fund returns. The results of the study by Pollet and Wilson (2008) indicate that liquidity constraints are the reason why large funds diversify more slowly as AUM increases. In contrast to the model developed by Berk and Green (2004) that assumes fund managers will index incremental flows in rational markets, Reuter and Zitzewitz (2010) find evidence that incremental flows are applied to increase ownership interest in existing stocks; however, such practice does not seem to have a meaningful impact on fund performance.

Concerning the measurement of the transaction costs, Indro et al. (1999) – based on their analysis of a sample of US equity funds data from 1993 to 1995 – believe that mutual fund expense ratio and turnover do not reflect all the transaction costs of active fund management; the authors place more emphasis on research costs and costs associated with trading. According to the study on the relationship between fund size and returns in the US market based on a sample from 1999-2009 conducted by Elton, Gruber and Blake (2011), the presence of diseconomies of scale, irrespective of the cause, means that the fund manager skill intrinsic in historic mutual fund return disappears, and returns become unpredictable. In examining the existence of superior stock-picking abilities of fund managers using US data from 1974 to 1984, Grinblatt and Titman (1989) find that the superior mutual performance relative to market or

benchmark can only be observed when examining gross returns; once transaction costs, fees and other costs are taken into account, either negative returns or no outperformance is observed on average. They further find an inverse relation between fund size and outperformance measured as gross returns; however, on a net returns basis, they found no relation between returns and AUM.

Chan et al. (2009) observed that in the Australian economy, small funds have an advantage over funds with large AUM in that they can easily allocate their capital into the best investment opportunities, liquidity constraints inherent in large funds result in acceptance of relatively less profitable investments and larger than optimal positions being taken, thus eroding returns. Despite the exploratory nature of Chan et al.'s (2009) analysis into the nature of diseconomies of scale, these authors also cite hierarchy costs latent in large funds as a source of performance erosion. They identify these costs as costs associated with fund managers expending available resources in fighting (convincing different layers of the internal management hierarchy) to have their ideas implemented, especially as the ideas relate to soft information (for example insights gained from engaging with CEOs vs. quantitative data). Chen et al. (2004) also have similar findings based on the US economy on hierarchy costs, which in turn are consistent with the conclusion of Stein (2002) that small funds are better at local stock selection and are more likely to invest in local stocks compared to large funds due to the easier processing of soft information. Stein (2002) arrived at the above conclusion in the study of how organisations design influences capital allocation.

2.4.4 No significant relationship between AUM and performance

In the various studies reviewed, there have also been findings of no significant relationship between AUM and performance. Such authors include Berk and Green (2004), who conclude that no significant relationship should exist between the size of assets under management and performance; despite having decreasing returns to scale in their US economy developed model, the impact is negated by competitive capital provision resulting in zero expected excess returns. In reviewing the result of the model developed by Berk and Green (2004), Yan (2008) also concludes that there should not be any significant relationship between size of AUM and fund performance in the cross-section. Chan et al. (2009) also found no evidence that transaction costs increase with fund size in the Australian market. They further found no significant direct

evidence of the inverse relationship between size of AUM and expense ratio and predictability of returns. In their research to identify causal impact of AUM size on future returns applying monthly data covering mutual fund in operation between December 1996 and August 2009, Reuter and Zitzewitz (2010) also found minimal evidence that fund size reduces returns with little evidence of diseconomies of scale. Even when examining the funds based on investment objectives including large-cap equity funds, small cap equity funds, international equity funds, sector funds (where diseconomies would be expected due to limited investment pool) and bonds, they found little evidence of diseconomies of scale.

Selected research found covering South Africa and Zimbabwe also corroborate the finding of no observable impact of fund size on returns. In the study investigating the influence of pension fund asset on investment returns, Milburn (1984) applied South African data from a select group of pension funds that particpated in the investment performance survey (an arrangement established in 1971 whereby portfolio returns of privately administered pension funds could be consistently calculated and compared) and found that AUM has no effect on fund performance. The author regressed the annual returns of the 93 participating pension funds against their respective average AUM size over the seven-year period to 1982, finding no correlation between the two. Simbabrashe et al. (2014), in their empirical study of the effect of pension fund size on performance in Zimbabwe in the three-year period to 2013 post the multicurrency era, reach the same conclusion. Their study examined 20 standalone pension funds and nine fund-administered pension funds. Despite the consistency with Milburn's (1984) findings in South Africa, a fellow African developing country, in interpreting the findings of Simbabrashe et al. (2014), they were cognizant of the economic conditions prevalent in Zimbabwe during the period of study with the country operating in a liquidity crunch position. Thus these results, although insightful, might be invalid.

Moles (1981) in the analysis of the performance of South African Department of Trade unit trusts in the period from 1966 to 1975, found no significant relationship between size and performance. In the study, Moles (1981) acknowledges the negative price impact of large trades and also suggests the possible impact of feedback between the fund behaviour and investors.

Inconclusive findings have also been observed. Grinblatt and Titman (1989) found mixed results for the sample of US funds from 1974 to 1984 for which they examined the relation between fund returns and fund size. Using gross returns, the relationship was inverse; however,

net returns did not decline with fund size. Rao and Rao (2009), in their empirical study of the relationship between fund size and performance in the Indian context, also found inconclusive evidence of the effect of AUM size on equity mutual fund returns, irrespective of fund size. Keswani (2011), in the examination of the impact of fund size on performance in India applying analysis of variance and correlation coefficients, similarly found no conclusive evidence of a relationship between the size of AUM and performance irrespective of the actual fund size.

2.5 Performance Predictability

As observed by Elton, Gruber and Blake (2011) in the study of the relationship between fund size and returns in the US market, the growth in the significance of mutual funds in the economy has been accompanied by the growth in focus on predictability of fund performance as a topic in finance. According to Elton, Gruber and Blake (2011), participants in the financial data services industry (for example Morningstar, Bloomberg, Thompson Reuters) have adapted and dedicated resources to meet the demand for mutual fund statistics. These authors believe that one of the most important reasons for measuring fund performance is to inform investors and allow them to make inferences about future performance. Rao and Rao (2009) also believe that historic fund performance, despite its inability to guarantee future returns, often influences investors' investment decisions. The significant growth in the provision of performance data to the public as well as the documented positive relationship between fund performance and capital flows (Bogle 1997; Gruber 1996), support the authors' view that investors make inferences about future performance based on historic performance. Sirri and Tufano (1998), in their study of the capital flows into and from U.S. equity mutual funds, found that investment decisions of investors were based on past performance information with flows disproportionately directed to prior year outperformers.

Berk and Green (2004) are of the view that outperforming funds attract new cash flows and grow the size of AUM. However, Elton, Gruber and Blake (2011) believe that diseconomies of scale imply that skill embodied in past return disappears and returns are not predictable. Bogle (1997) reiterates the view that superior performance of small funds attracts investors who then allocate too much capital into the fund, trading costs go up and ultimately returns reduce. Berk and Green (2004) further suggest that the benefits of increased AUM flow to the fund managers rather than the investors as the financial benefits represent compensation for their ingenuity in generating the outperformance. Managers are incentivised to maximize AUM which equates to

fee maximization. However, to increase AUM fund managers' expected returns also need to increase if they are to attract capital flows. These authors believe that predictability of mutual fund returns signals lack of competition as they are of the view that if investors competed with each other for superior returns, none would exist. In the search for superior returns, investors apply all public historic information about the funds.

According to Berk (2005), a single year's outperformance by a mutual fund manager does not increase the likelihood of doing well in the subsequent year, thus past performance does not predict future performance. Yan (2008) notes that the findings of lack of persistence of mutual funds are widely regarded as an indication that fund performance is due to luck rather than fund and manager characteristics. This finding has also been interpreted as evidence for market efficiency. Despite the finding of no persistence in mutual fund performance, Berk (2005) found that fluctuations in assets under management (i.e. inflows and outflows) are sensitive to historic mutual fund performance. The outperformance of a mutual fund is trailed by inflow of capital to the fund up to the point that mutual fund alpha is zero. Underperformance is followed by capital withdrawals from the fund up to the point that alpha is equal to zero. In both instances the mutual fund is expected to achieve an alpha of zero in the long run, thus resulting in benchmark returns. This theory is also supported by Ross, Westerfield and Jaffe (2002, p. 353), who interpret the evidence that mutual funds in the long run do not outperform the market indices as consistently with the efficient market hypothesis. Berk and Green (2004) argue that hypothetically performance persistence should not exist given that capital flows into outperforming funds is countered by diseconomies of scale. In contrast, Elton, Gruber and Blake (2011) found evidence of performance predictability with a strong relationship between historic and future risk adjusted excess returns for holding periods of up to three years; the best performing funds achieved positive future alphas. However, the authors also found that AUM growth reduces the identified predictabililty.

2.6 Conclusion

The vast majority of literature reviewed does not provide evidence of performance persistence; however, South Africa-focused studies on the performance persistence have yielded mixed results, with some authors having found some evidence of return persistence and some not observing any performance persistence. Evidence of performance persistence is in violation of

the EMH indicating inefficiency in the adjustment of security prices to reflect publicly available information in the South African market.

In the limited empirical literature available on the relationship between AUM size and fund performance, various findings have been observed including linear, non-linear and no relationships between the two variables.

The growing focus on performance predictability has accompanied the growth in mutual funds globally, with investors making inferences about future performance and capital allocation based on historic performance and information. Mixed results have been observed on predictability with more unpredictability observed. Any evidence of predictability would be contrary to the EMH.

The mixed findings of global studies of the effect of AUM size on returns and the limited availability of South Africa-specific research on the relation between AUM and performance covering the past decade to 2015 presents a research gap.

CHAPTER 3

RESEARCH METHODOLOGY

3.1 Introduction

This section outlines the research methodology applied to test this study's null hypothesis that there is no linear relationship between AUM size and equity mutual fund alpha in South Africa. It also provides an overview of the data and sample applied as well as an outline of some of the limitations inherent in the study.

3.2 Methodology

Consistent with the study by Simbabrashe et al. (2014), the methodology of this study follows a deductive approach that allows the testing of hypotheses using data under controlled conditions. The population of this study has been identified as the universe of equity mutual funds in South Africa as at 31 December 2015.

A significant amount of the literature reviewed on the relationship between AUM size and performance has employed the regression analysis as a tool of analysis (Chan et al., 2009; Chen et al., 2004; Friss & Smit, 2004; Grinblatt & Titman, 1989; Indro et al., 1999; Milburn, 1984; Moles, 1981; Rao & Rao, 2009; Reuter & Zitzewitz, 2010; Simbabrashe et al., 2014; Yan, 2008). The appropriateness of regression analysis lies in its ability to evaluate the relationship between various dependent (variable to be forecast) and one or multiple independent variables that are believed to be related to the dependent variable (Keller, 2012, p.634).

The relationship between AUM size and alpha will be examined using a cross-sectional regression approach. The regression will be cross-sectional because data at a particular point in time will be examined. As noted by Yan (2008), this method allows for the control for other fund characteristics that might be correlated with performance, thus explaining superior performance or alpha. The control variables to be applied in the cross-sectional regression will be incorporating the variables used by Yan (2008) and Chen et al. (2004), which include expense ratio, fund age, fund strategy and lagged fund return. These additional variables will be regressed in addition to AUM size.

The three-year average of AUM and alpha will be used as the mutual fund characteristics are likely to change over a longer period, as observed by Moles (1981). In addition, a three-year time period takes into account funds with a year or two of lucky or poor performance, by the third year, returns can be reasonably expected to normalise. This expectation has not been corroborated by academic literature and is beyond the scope of this study. The three-year track record is consistent with the studies relating to mutual fund attributes by Elton, Gruber and Blake (2011), Keswani (2011), Rao and Rao (2009) and Simbabrashe et al. (2014). The lagged fund return will be calculated using the preceding year's two-year return.

The equation of the cross-sectional regression applied is as follows:

$$Alpha = \left(R_{f,t} - R_{index,t}\right) = a + \beta_1 \text{LogAUM}_{f,t} + \beta_2 \text{Exp}_{f,t} + \beta_3 \text{LogAge}_{f,t} + \beta_4 \text{LagFundret}_{f,t-1} + \beta_5 \text{Fundstrat}_{f,t} + e$$

where:

- $\left(R_{f,t} - R_{index,t}\right)$ denotes the dependent variable or the response variable
  - $R_{f,t}$ is the three-year rate of return of mutual fund f in time period t
  - $R_{index,t}$ is the three-year benchmark rate of return in time period t
  - $R_{f,t}$ and $R_{index,t}$ are computed using the following formula applied by Friss and Smit (2004) and Oldham and Kroeger (2005):

    $R_{f,t} = \left(p_t - p_{t-3}\right)/p_{t-3}$ and $R_{index,t} = \left(p_t - p_{t-3}\right)/p_{t-3}$

where p in both equations is the closing price of the mutual fund and benchmark index respectively.

- a is the intercept;
- LogAUM, Exp, LogAge, FundStrat LagFundret are the independent variables or predictor variables for each fund f in the sample at time period t. Time period t in all analysis in this study is 31 December 2015;
  - LogAUM is the logarithm of the three-year average fund assets under management
  - Exp is the fund's expense ratio
  - LogAGE is the logarithm of the fund's age
  - LagFundret is the one-year lagged fund return computed from the closing prices of the mutual funds at the end of each year
  - Fundstrat represents the fund strategy where the dummy indicator variable $\text{Fundstrat}_{f,t}$ equals:

- 1 if a mutual fund employs a growth strategy
- 2 if a mutual fund employs a value strategy
- 3 if a mutual fund employs a blend strategy

- β is the slope or coefficient of each of the predictor variables; and
- *e* represents the random error in the dependent variable (Keller,2012, p.636).

Consistent with Annaert, Van den Broeck and Van den Vennet (2003), the natural logarithms of the size and age variables are applied in an attempt to reduce the skewness thereof.
Alpha is the dependent variable that will be evaluated.

The regression coefficients are estimated using the least squares method in order to minimize the residual sum of squares and thus produce the best straight line (Keller, 2012). This is the most widely used method of estimating the coefficients providing statistical properties such as estimators that are linear functions of the dependent variable (Gujarati, 2011).

The goodness of fit of the regression model is tested by observing the R-squared and the F-statistic. The validity of the regression model is checked through testing the critical error variable conditions relating to normality, autocorrelation, heteroscedasticity and collinearity. The error variable is tested to ensure it is normally distributed through observing its distribution and more formally using the Shapiro-Wilk test. Heteroscedasticity is tested using the plot of the predicted values of the dependent variable, alpha, versus the residuals. More formally, the Breusch-Pagan/Cook-Weisberg test (Breusch-Pagan) is applied to test for heteroscedasticity. Collinearity is tested using the correlation matrix and the Stata statistical software calculated variance inflation factor. Autocorrelation is not a variable of interest given that cross-sectional data is being applied for the data analysis.

In addition, the correlation between fund size and return as well as between the control variables is computed to assess the extent or strength of the relationships if any. According to Keller (2012), the coefficient of correlation can also be used to test the linear relationship between two variables, in this case being AUM size and alpha. The covariance is also computed to establish how fund size and each of the selected independent variables move together.

The analysis is restricted to South African open-end equity mutual funds. A fund is included in the sample if it has at least three years' track record, reports its AUM, purchase prices, age,

expense ratio as well as the fund's portfolio's benchmark and the benchmark purchase price on the Bloomberg reporting platform providing real-time financial markets data and analytics. Mutual funds with AUM below the Rand equivalent of USD15 million are excluded in an attempt to limit upward bias of returns (Chen et al., 2004; Elton et al., 2011). Three-year average returns have been selected to take into account the likelihood of significant changes in fund characteristics over a period longer than three years (Moles, 1981).

The Bloomberg databases has been used as it provides real-time global financial markets data, analytics and trade execution capability available for public analysis by market participants.[11] This supports the accuracy and credibility of the data provided. Bloomberg and Thomson Reuters were cited in a news article by The Baron (24 March 2015)[12] as the leading global financial markets data providers. The source of the data used in the article was Burton-Taylor International, an information industry market research consultancy. The Thomson Reuters database is more tailored for institutional investors instead of retail investor providing limited mutual fund data relative to Bloomberg, for example AUM size and fund strategy are not available on Thomson Reuters. Thirty-two of the 69 sample mutual fund closing prices obtained from the Bloomberg database were cross-checked with the Thomson Reuters database with no discrepancies found. (Refer to Table 11 – Sample Data summary where an * (asterisks) denotes all mutual funds whose closing prices were cross-checked against the Thomson Reuters database.)

As noted by Chen et al. (2004), although certain observable fund characteristics can be controlled for, there could still be a host of other potential explanations for the relationship between AUM size and alpha.

In this study, consistent with Chen et al. (2004), no attempt is made to determine whether the relation between alpha and AUM size may be nonlinear.

[11] https://www.bloomberg.com/professional/products-solutions/

[12] http://www.thebaron.info/news/article/2015/03/24/bloomberg-increases-market-share-lead-over-thomson-reuters

3.3 Data

The secondary data on mutual funds used in the study is obtained from the Bloomberg database for the years from 31 December 2012 to 31 December 2015, a period in which mutual fund characteristics are not expected to significantly change (Moles, 1981). This study and thus the data are limited to the general equity asset class. The selection of a single asset class is an attempt to limit the variability in return drivers and dynamics of the various security markets. The significance of equity mutual funds is attested by the fact that the standalone equity asset class accounted for 21% of all the South African funds as 30 June 2016 trumped only by funds focused on interest-bearing securities (24%) (ASISA, 2016). More comparable benchmark indices for equity are more readily available than the multiple asset class mutual funds.

As at 8 July 2016, Bloomberg had a record of 241 equity mutual funds and unit trusts domiciled in South Africa with fund managers located in South Africa. Of the 241 identified mutual funds and unit trusts, 137 had identifiable corresponding benchmarks reported on Bloomberg against which performance will be measured.

3.4 Sample

The sample consists of all the South African equity mutual funds listed in the Bloomberg database as at 8 July 2016 that have at least three years of data and have over the Rand equivalent of USD 15 million AUM. Consistent with authors including Beckers and Vaughan (2001), Chen et al. (2004), Elton, Gruber and Blake (2011), Gilbertson and Vermaak (1982), Gruber (1996), Sirri and Tufano (1998), and Von Wielligh and Smit (2000), the sample is restricted to equity mutual funds; to arrive at this group all international funds, multi-asset funds, real estate funds, passive index funds and interest-bearing instrument funds were excluded with only South African-domiciled equity mutual funds and unit trusts with management located in South Africa selected. Chen et al. (2004) and Elton, Gruber and Blake (2011) note that a number of studies caution about the upward bias of returns of the funds with less than USD 15 million AUM. As such the Rand equivalent of USD 15 million based on a three-year average exchange rate of R11.35 per USD equates to R170.25 million, and all funds with AUM below this value as at 31 December 2015 were excluded from the sample. (Refer to Table 10 – Three-year average exchange rate in the Appendix for the three-year average Rand/USD exchange rate computation). These exclusions reduce the sample size to 69 mutual

funds out of the 137 identified above. The 69 mutual funds represent the sample of funds on which the research to establish the existence of a relationship between AUM size and alpha will be based.

Set out in Table 11 in the Appendix is the mutual fund sample data summary for total assets under management, return, strategy and expense variables. Consistent with Indro et al. (1999), the AUM variable is computed as a three-year average for analysis purposes; the AUM value as at 31 December has been included as a reference point to the three-year average in instances where the average AUM size is less than the R170.25 million exclusion level; the figure is not used in the regression analysis. The mutual fund and benchmark rates of return are computed as a change in their respective purchase prices.

The sample includes 69 South African equity mutual funds with an average total AUM of R3.1 billion with a standard deviation of R5.5 billion indicating a significant spread in AUM. The sample average expense ratio as a percentage of AUM is 151 basis points; contrary to the findings by Yan (2008), the expense ratio in the sample does not decline with fund size, the average expense ratio for funds with three-year average AUM size below R2 billion has a mean expense ratio below 1.5% relative to the 1.54% for funds above this size level. The average age of the mutual funds in the sample is 17 years. On average, the equity mutual funds have an excess rate return of 14% above the benchmark rate of return over the three-year period under consideration, with a standard deviation of 38% indicating a substantial spread in alpha. The sample is made up of 35 growth funds, 26 blend funds and eight value funds.[13]

The mean alpha implies that on average South African fund managers have the ability to achieve returns in excess of the market benchmark before taking into account management fees. This is consistent with the findings in the studies of Grinblatt and Titman (1989), Gruber (1996). Jensen (1968) and Malkiel (1995). However, since the statistical significance of the data in table 11 has not been determined, this is a general observation and not a conclusive interpretation.

[13] Growth funds seek stock of companies that can deliver higher than average earnings growth over a specific period. Value funds seek undervalued shares and Blended strategy applies a combination of both value and growth strategies.

3.4.1 Descriptive statistics

Set out below is an overview of the data sample descriptive statistics. Table 1 below outlines the following parameters for each of the dependent and independent variables: mean, standard deviation kurtosis and skewness. The mean indicates the central tendency of each variable. The standard deviation specifies the extent of variability around the mean or how close the data is to the mean. Skewness measures the symmetry of the distribution indicating whether the mean is at the centre of the distribution. A normal distribution has a skewness value of 0, with a negative value indicating a skew to the left and a positive value highlighting a skew to the right. Kurtosis is a measure of the shape (i.e. level of flatness or peak) of the probability distribution (Razali & Wah, 2011). A kurtosis value of 3 indicates normal distribution. A value greater than 3 indicates a sharp peak with heavy tails closer to the mean whereas a value lower than 3 indicates a flat-top shape. The review of the sample descriptive statistic provides an understanding of the data characteristics.

Table 1: Descriptive Statistics

Descriptive Statistics	3 year Avg AUM (R'm)	Fund age (Years)	Expense ratio	Lagged fund return	3yr Benchmark return	3yr Fund return	Alpha
Mean	3133.10	16.67	1.51	0.36	0.30	0.44	0.14
Standard Deviation	5585.58	9.81	0.52	0.19	0.20	0.36	0.38
Kurtosis	23.83	4.21	1.73	1.69	5.75	1.53	1.72
Skewness	4.38	1.82	0.69	0.30	-1.16	1.20	1.50
Minimum	147.80	3.25	0.42	-0.27	-0.54	-0.33	-0.45
Maximum	38289.23	49.44	3.35	0.88	0.78	1.43	1.24
Count	69	69	69	69	69	69	69

From the descriptive statistics in Table 1 above it can be observed that on average alpha is positive, indicating outperformance relative to the benchmark indices. However, the standard deviation of alpha is 38% indicating a substantial variability around the mean of 14%. The average three-year AUM size of the sample is R3.1 billion with a standard deviation of R5.6 billion indicating an extensive spread from the mean. The three-year average AUM size has a skew to the right indicating that the right tail of the distribution is longer than the left one. Alpha, fund age, expense ratio, lagged fund return are all slightly positively skewed. Milburn (1984) argued that the lack of normality of variables is only important when defining population governing parameters and should not be a concern in the simple determination of the relation between variables. The kurtosis of AUM and fund age are both over 3 indicating peaked distributions around the mean.

Further, to assess the characteristics of the funds with different AUM sizes, the sample is sorted into three categories of low, medium and high AUM. Table 2 below sets out the descriptive statistics of each of the three categories.

Table 2: Descriptive Statistics per size category

Descriptive Statistics	3 year Avg AUM (R'm)	Fund age (Years)	Expense ratio	Lagged fund return	Alpha
Small Funds: AUM < R1bn					
Mean	484.1108	12.5990	1.4138	0.3414	0.1571
Standard Deviation	235.5318	5.3348	0.4188	0.2257	0.3982
Kurtosis	-0.7355	-1.1480	-0.4241	1.3164	1.1671
Skewness	0.5610	-0.0156	-0.3526	-0.0758	1.3684
Count	29	29	29	29	29
Medium Funds: AUM > R1bn < R2bn					
Mean	1440.6042	17.9009	1.6350	0.4048	0.1845
Standard Deviation	281.9549	10.5199	0.7688	0.1655	0.3915
Kurtosis	-0.4992	5.0863	0.4736	-0.3027	0.9199
Skewness	0.3829	1.6398	0.5443	0.2181	1.262
Count	16	16	16	16	16
Large Funds: AUM > R2bn					
Mean	7462.2802	20.7659	1.5446	0.3388	0.0986
Standard Deviation	7856.4131	11.7459	0.4101	0.1696	0.3714
Kurtosis	10.3987	1.5573	0.1061	4.9248	5.2282
Skewness	2.9994	1.5520	1.0037	1.7882	2.1215
Count	24	24	24	24	24

As is observable from the table above, there is a significant spread in the size of AUM across and within the three categories. The mean AUM size for the small funds is R484 million relative to the medium funds mean AUM size of R1.4 billion and large funds at R7.5 billion.

Across the three categories of mutual funds based on AUM size, average alpha is positive with similar standard deviations in the range of 37% to 39.8% indicating a substantial variability around the respective mean. This is consistent with the descriptive statistics of the combined mutual fund sample. Medium funds achieved the highest alpha at 18.45% relative to 15.71% achieved by small funds and 9.86% realised by large funds. At face value, not taking into account the statistical significance of the data, medium-sized funds outperform small and large funds.

The mean expense ratio is highest in the medium funds and lowest in the small funds. On average large funds have a fund age of approximately 20 years with the Small funds having the shortest fund age.

Consistent with the consolidated mutual fund sample, the three-year average AUM size and alpha for all categories have a slight skew to the right. The kurtosis for all the small fund variables is below 3 indicating flat-shaped distributions around the mean. For the medium-sized funds, the age of the fund is the only variable with a kurtosis above 3 times, indicative of a peaked distribution. Both small and medium fund variables have a kurtosis close to 3 from which it is inferred near normal distribution. The kurtosis of large funds average AUM is significantly higher than 3 signalling non-normality.

The review of the descriptive statistics across the three categories points towards a non-linear relation between AUM size and alpha with the medium-sized funds in the sample achieving the highest alpha in the period under review. However, since the statistical significance of the data in the table above has not been determined, this is a general observation and not a conclusive interpretation.

3.5 Validity of regression model

According to Keller (2012), a critical component of the regression analysis is the error variable, the conditions of which can be used to test the validity of the regression model. Essentially, "the error variable must be normally distributed with a constant variance, and the errors must be independent of each other" (Keller, 2012, p.671). Set out below are the conditions used to test the model validity:

I. Normality: The error variable must be normally distributed.
II. Independence of the error variable: The errors must be independent of each other.
III. Heteroscedasticity: The variance of the error variable is required to be constant.
IV. Collinearity: Predictor/independent variables should not be highly collinear.

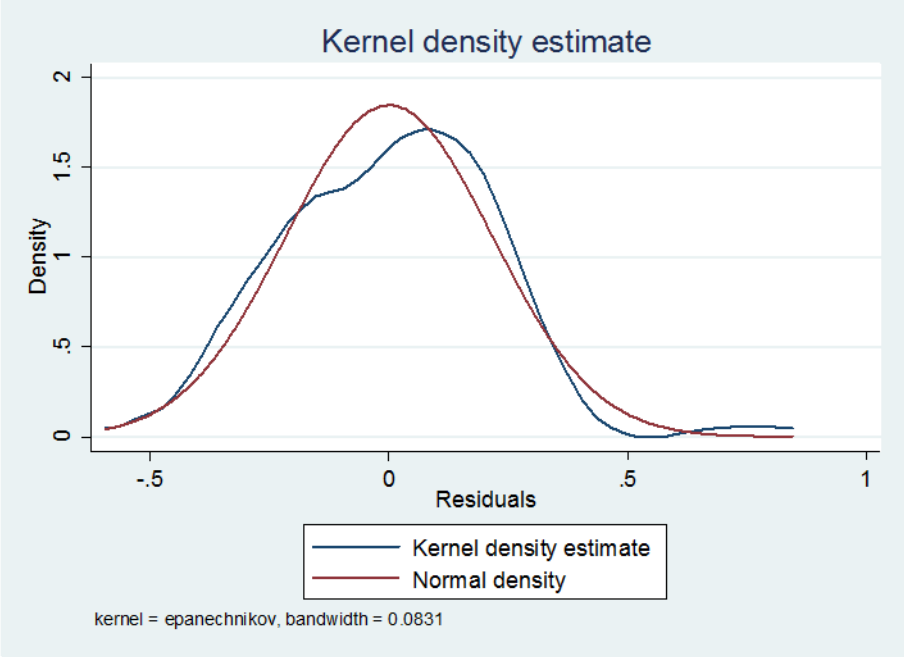
Set out below is an analysis to determine if these conditions are satisfied.

Normality

The normality of the error variable is determined by observing the distribution thereof, with specific focus on the skewness and kurtosis. Normality is graphically tested using the Kernel density plot and formally tested applying the Shapiro-Wilk test. Razali and Wah (2011) in the investigation of the power comparisons of Shapiro-Wilk, Kolmogorov-Smirnov, Lilliefors and Anderson-Darling tests for normality, concluded that the Shapiro-Wilk test is the most powerful test for all types of distribution and sample sizes. The finding by Razali and Wah (2011) corroborated the conclusion made by Mendes and Pala (2003) after running 100 000 simulations for various departures from normality in the test of the most powerful normality test. Royston (1992), in the approximation of the Shapiro-Wilk W-Test for non-normality, also noted the power of the test.

Set out below is the Kernel density estimate plot (blue line):

Figure 1: Kernel density estimate plot



It can be observed from the Kernel density estimate plot above that the residuals follow roughly a normal distribution (red line).

Set out below in Table 3 is the outcome of the formal normality tests using the Shapiro-Wilk test run through the Stata statistical software package (Bruin, 2006).

Table 3: Shapiro-Wilk test

```
. swilk e

                    Shapiro-Wilk W test for normal data

    Variable |   Obs        W           V          z       Prob>z
-------------+--------------------------------------------------
           e |    69     0.97150      1.734      1.196     0.11591
```

The null hypothesis tested by the Shapiro-Wilk test is that residuals are normally distributed. As the p-value is > than 0.05, we fail to reject the null hypothesis that the error variable *e* is normally distributed at the 5% significance level. Further, according to Razali and Wah (2011), within the W range from zero to one, values closer to zero lead to the rejection of normality whereas a W value close to one indicates normality of the data. It can be seen in the Table 3 above that the value of W is close to 1, indicating normality of the data.

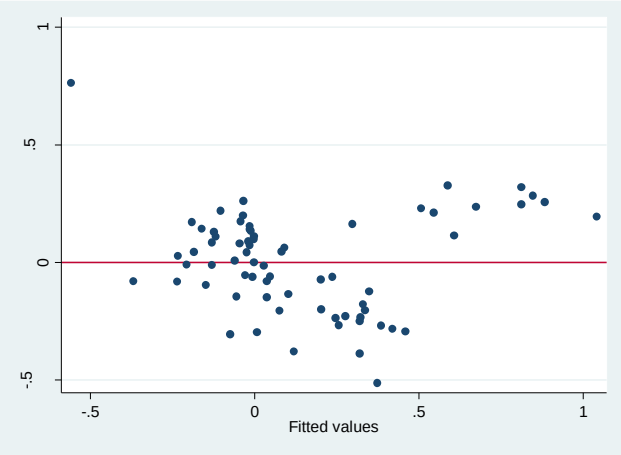
Independence of the error variable

Autocorrelation is not a variable of interest given that time series data is not being used.

Heteroscedasticity

Heteroscedasticity is tested using the plot of the predicted values of the dependent variable, alpha, versus the residuals. More formally, the Breusch-Pagan/Cook-Weisberg test (Breusch-Pagan) test is applied to test for heteroscedasticity. Set out below is the graphical test for heteroscedasticity:

Figure 2: Graphical test for heteroscedasticity



No pattern is observable in the chart above, indicating no evidence of heteroscedasticity.

Set out below are the results of the formal non-graphical test for heteroscedasticity using the Breusch-Pagan test.

Table 4: Breusch-Pagan test

```
. estat hettest

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance
         Variables: fitted values of alpha

         chi2(1)      =     0.07
         Prob > chi2  =   0.7969
```

The null hypothesis tested by the Breusch-Pagan test is that standard errors have constant variance. As the p-value > than 0.05 we fail to reject null hypothesis at the 5% significance level. Both tests do not indicate presence of heteroscedasticity and thus the variance of the error variable can be deemed to be constant.

Collinearity

An important condition for the validity of the regression model is that independent variables are not highly collinear. Each variable should not be a linear function of another. With collinearity the error variables may be inflated. Collinearity is tested using the correlation matrix and the Stata software calculated variance inflation factor ('vif').

Set out below is the correlation matrix:

Table 5: Correlation matrix

Correlation Matrix	*Log AUM*	*Expense ratio (% per year)*	*Fund Strategy*	*Log Age*	*Lagged fund return (%)*	*Alpha (%)*
Log AUM	1					
Expense ratio (% per year)	0.131566613	1				
Fund Strategy	0.245805732	0.127167574	1			
Log Age	0.37290704	-0.16165168	0.150062215	1		
Lagged fund return (%)	0.064913037	0.265596284	0.07603216	0.173177359	1	
Alpha (%)	-0.02641519	0.451403905	0.040208637	-0.15771434	0.745642198	1

As can be observed in the correlation matrix above, correlation between the independent variables is not high, with most of the correlation coefficients significantly smaller than 1. The highest correlation is between lagged fund return and alpha, however, the coefficient is still below 1.

Set out below is the vif for all the variables as a check for collinearity:

Table 6: Variance inflation factor

```
. estat vif

    Variable |       VIF       1/VIF
-------------+----------------------
      logaum |      1.30    0.770946
    expratio |      1.20    0.831594
    fundtype |
           2 |      1.17    0.857659
           3 |      1.17    0.851336
      logage |      1.31    0.764074
lagreturnf~d |      1.16    0.863955
-------------+----------------------
    Mean VIF |      1.22
```

A vif > 10 signals the presence of collinearity. From the table above it is observable that no collinearity exists as all vif < 10.

From the tests above, the regression model is deemed valid and fits well.

3.5.1 Limitations

Limitations due to the evaluation model employed include the following:

I. Despite the best straight line produced by the least squares method, the relation between the variables might in fact be non-linear or not exist at all. As such it is crucial to test how well the linear model fits the data. There are several methods that can be used; however, in this study, the three methods identified by Keller (2012, p.650), notably the standard error of estimate, the *t*-test of the slope, and the coefficient of determination are used to establish the appropriateness of the use of the linear model. In addition, the validity of the model was confirmed by testing the critical conditions of the error variables, namely, normality, heteroscedasticity and collinearity, all of which indicated the appropriateness of the regression model.

II. Even where there is evidence of a linear relationship, we cannot infer a causal relationship from statistics alone. Causality is beyond the scope of this study.

III. The use of a sample instead of the entire population of the mutual funds and unit trusts in the South African economy may result in a sampling error; ASISA contains the most comprehensive list of South African equity mutual funds; however, the data provided does not include all the variables of interest for this study.

IV. The use of a cross-sectional regression model does not account for changes over time, which may also result in sampling errors. The use of three-year averages for some of

the variables accounts to some extent for the changes over the short period of time, thus reducing sampling errors.

V. The analysis may be subject to selection bias if the Bloomberg database applied does not capture a significant part of the target mutual fund population in South Africa; the data from the Bloomberg database was cross-checked against the Thomson Reuters database; Bloomberg database provided more comprehensive data on South African mutual funds than Thomson Reuters.

CHAPTER 4

RESEARCH ANALYSIS AND FINDINGS

4.1 Research Analysis

This section sets out the findings of the data analysis to investigate the relation between South African equity mutual fund alpha and AUM size using the correlation matrix, covariance matrix and linear regression.

The analysis of the hypothesis that AUM has no linear relation to performance commences with the review of the correlation and covariance matrix followed by the more comprehensive regression analysis.

Set out below is the correlation matrix of the dependent and independent variables.

Table 7: Correlation Matrix

Correlation Matrix	*Log AUM*	*Expense ratio (% per year)*	*Fund Strategy*	*Log Age*	*Lagged fund return (%)*	*Alpha (%)*
Log AUM	1					
Expense ratio (% per year)	0.131566613	1				
Fund Strategy	0.245805732	0.127167574	1			
Log Age	0.37290704	-0.16165168	0.150062215	1		
Lagged fund return (%)	0.064913037	0.265596284	0.07603216	0.173177359	1	
Alpha (%)	-0.02641519	0.451403905	0.040208637	-0.15771434	0.745642198	1

The table above depicts the correlation between each of fund size, the expense ratio, fund strategy, fund age, lagged fund return and alpha. The strongest relationship is between the lagged fund return and alpha at 75%. The correlation between alpha and the expense ratio is the second strongest at 45%, followed by the relationship between AUM and fund age at 37%. A small but negative correlation between AUM and alpha is observed from the correlation matrix above. AUM size is inversely (negligible extent) related to excess returns above the benchmark. The observation of the correlation coefficient between AUM and alpha is consistent with the insignificant correlation coefficients found by Keswani (2011).

Set out below is the covariance matrix of the dependent and independent variables.

Table 8: Covariance Matrix

Covariance Matrix	*Log AUM*	*Expense ratio (% per year)*	*Fund Strategy*	*Log Age*	*Lagged fund return (%)*	*Alpha (%)*
Log AUM	1.53180089					
Expense ratio (% per year)	0.0836094	0.26364314				
Fund Strategy	0.2832787	0.06080025	0.86704474			
Log Age	0.26028323	-0.04680938	0.07880188	0.31804524		
Lagged fund return (%)	0.01544644	0.02621956	0.01361173	0.0187772	0.03696497	
Alpha (%)	-0.01244049	0.08819747	0.01424698	-0.03384529	0.0545517	0.14479888

The table above illustrates how alpha and each of the selected independent variables move together. Notably AUM and alpha move in opposite directions in relation to each other. When AUM increases, alpha decreases although very slightly to the extent that such change is negligible.

Set out below is the regression summary output.

Table 9: Regression summary

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.826175373
R Square	0.682565748
Adjusted R Square	0.657372553
Standard Error	0.224369471
Observations	69

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	5	6.819598074	1.363919615	27.093259	1.62834E-14
Residual	63	3.171524537	0.050341659		
Total	68	9.991122611			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	-0.151293975	0.192909948	-0.784272539	0.435819206	-0.536793746	0.234205796	-0.536793746	0.234205796
Log AUM	-0.003307191	0.024516022	-0.134899184	0.893121655	-0.052298553	0.045684170	-0.052298553	0.045684170
Expense ratio (% per year)	0.162931848	0.057643728	2.826532108	0.0062981	0.047740049	0.278123647	0.047740049	0.278123647
Fund Strategy	-0.001644012	0.030201094	-0.054435506	0.95676045	-0.061996082	0.058708059	-0.061996082	0.058708059
Log Age	-0.164684216	0.054743013	-3.008314818	0.003772739	-0.274079397	-0.055289034	-0.274079397	-0.055289034
Lagged fund return (%)	1.445840812	0.149999346	9.638980777	5.15504E-14	1.146091038	1.745590586	1.146091038	1.745590586

Based on the regression summary output in Table 9 above, the regression model is estimated by the following equation:

Alpha = - 0.15 - 0.00 LogAUM + 0.16 Exp - 0.0 Fundstrat - 0.16 LogAge + 1.45 LagFundret

As outlined in Keller (2012), the model is assessed in three ways: the standard error of estimate, the coefficient of determination and the t-test of the analysis of variance.

I. The standard error of 0.22 in Table 9 above is quite small relative to the mean of alpha of 0.14 reported in Table 1: Descriptive Statistics.

II. The coefficient of determination R^2 = 0.682565748 meaning 68% of the total variation in alpha is explained by the variation in the five independent variables, while 32% remains unexplained. This is an indication that the model is a good fit.

III. The ANOVA table in the regression summary output above summarises the calculation of the test statistic. A large F value indicates that most of the variation in the dependent variable, alpha, is explained by the regression equation and affirms the validity of the model.

According to Keller (2012, p. 666), to determine if the F-statistic is large enough to imply some validity in the model, the rejection region as defined by the following formula is applied:

$$F > F_{\alpha,k,n-k-1}$$

where α is the probability, k is the number of independent variables in the regression equation and n is the number of observations.

Assuming α = 0.05, and using the F-Distribution Table 6(d) (Keller 2012, Appendix B-18), the rejection region is $F > F_{\alpha,k,n-k-1} = F_{.05,5,63} \approx 2.37$

As observable in the ANOVA table in Table 9 above, $F = 27.09$ with a p-value of 0.00 indicating that the model is a good fit.

Based on the analysis above, it is evident that the model fits the data well and that the required conditions are satisfied.

4.2 Interpretation of the coefficients

The coefficients of the independent variables, Log AUM, Expense ratio, Fund Strategy, Log Age and Lagged fund return describe the relationship between each of the independent variables and the dependent variable, alpha, in the sample. To draw conclusions about the population of equity mutual funds in South Africa, inferential methods will be applied. Set out below is the interpretation of the coefficients of the independent variables:

- **Log AUM** – The relationship between alpha and AUM is described by b_1 = -0.00 in this sample. The coefficient of Log AUM is negative and very close to zero with a test statistic

t = -0.13 and a p-value of 0.89. Assuming all the other independent variables in model are held constant, AUM has no effect on alpha. At the 5% significance level, there is insufficient evidence to reject the null hypothesis that there is no linear relationship between AUM size and alpha in South African equity mutual funds. There is little or no evidence to infer that there is a linear relationship between alpha and AUM. The test is statistically not significant at the 5% significance level.

- **Expense ratio** – The relationship between alpha and the expense ratio in this sample is described by b_2 = 0.16. Assuming that the other independent variables are held constant, this implies that alpha increases by 0.16 for every percentage change in the expense ratio. The observation of a positive coefficient is inconsistent with the finding of Chen et al. (2004), who identified a negative coefficient. Further, this contradicts general perception that larger funds have lower expense ratios. The test statistic t= 2.83 and the p-value is 0.01. At the 5% significance level, there is strong evidence to infer that there is a linear relationship between alpha and the expense ratio in equity mutual funds in South Africa based on this model. The test is statistically significant at the 5% significance level.
- **Fund Strategy** – The relationship between alpha and the fund strategy in this sample is described by b_3 = -0.00. Holding all the other independent variables constant, mutual fund strategy has no effect or does not explain any variation is alpha. The test statistic t =-0.05 and a p-value of 0.96. At the 5% significance level, there is little or no evidence to reject the null hypothesis that here is no linear relationship between fund strategy and alpha in South African equity mutual funds. The test is statistically not significant at the 5% significance level.
- **Log Age** – The relationship between alpha and the fund age in this sample is described by b_4 = - 0.16. Assuming that the other independent variables are held constant, this implies that alpha decreases by 0.16 for every 1-year change in the mutual fund age. The test statistic t = -3.01 and a p-value of 0.00. At the 5% significance level, there is strong evidence to infer that there is a linear relationship between alpha and the expense ratio in equity mutual funds in South Africa based on this model. The test is statistically significant at the 5% significance level.
- **Lagged fund return** – The relationship between alpha and the lagged fund return in this sample is described by b_5 = 1.45. Assuming that the other independent variables are held constant, this implies that alpha increases by 1.45 for every percentage change in the lagged fund return. Consistent with the observation by Chen et al (2004), a significant coefficient in front of lagged fund return implies the existence of some performance fund return

persistence in the short term. Two-year average returns explain some of the +ve variation in alpha based on three-year returns. The test statistic t = 9.64 and a p-value of 0.00. At the 5% significance level, there is overwhelming evidence to infer that there is a linear relationship between alpha and the lagged fund return of equity mutual funds in South Africa based on this model. The test is statistically significant at the 5% significance level.

Irrespective of the results of the regression analysis, cognizance should be taken of the near impossible task of isolating the pure impact of AUM size on returns as there are no funds that are exactly the same besides in size. This view echoes the conclusion by Beckers and Vaughan (2001) that the variability in mutual fund characteristics results in different outcomes in addition to those attributable to AUM size.

4.3 Findings

In the investigation of the relationship between AUM and alpha in South African equity mutual funds the correlation and covariance matrices were studied and a linear regression analysis completed. The findings of the examination and analysis are set out in the section below. Further tests for normality (Kernel density estimate and Shapiro-Wilk test), heteroscedasticity (graphical plot of residuals and Breusch-Pagan) and collinearity were performed on the error variable to ensure the validity of the regression analysis model.

The independent variables used in the regression include AUM, the expense ratio, fund strategy, fund age and the lagged fund return. The analysis output from regressing the dependent variables against the alpha are outlined in Table 9 – Regression summary. The model is a good fit as can be observed from the F – statistic and has good explanatory power as indicated by the R-squared of 68%.

At the 5% significance level, the expense ratio is positive and significant; the fund age (Log Age) is negative and significant; the lagged fund return is also positive and significant. The test statistic of fund strategy is not statistically significant at the 5% significance level, indicating no evidence to reject the null hypothesis that there is no linear relationship between fund strategy and alpha in South African equity mutual funds. At the 5% significance level, there is strong evidence to infer that there is a linear relationship between alpha and the expense ratio

in equity mutual funds in South Africa based on this model. The test is statistically significant at the 5% significance level.

The data analysis indicates that there is no linear relationship between AUM and alpha in South African equity mutual funds based on the sample data covering the 3-year period to 31 December 2015. At the 5% significance level, there is insufficient evidence to reject the null hypothesis that here is no linear relationship between AUM size and alpha in South African equity mutual funds. This finding is consistent with the conclusions of Milburn (1984) and Moles (1981) based on South African data from the 1980s. The result is also consistent with the findings of Berk and Green (2004), Chan et al. (2009), Keswani (2011), Reuter and Zitzewitz (2010) and Simbabrashe et al. (2014) that AUM size has no effect on returns. The corroborating studies are from markets at diverse stages of development including Australia, India and Zimbabwe.

CHAPTER 5

CONCLUSION AND RECOMMENDATION

5.1 Conclusion

This study set out to establish whether a linear relationship exists between assets under management and alpha in South African equity mutual funds. The literature reviewed revealed four distinct groups of research findings. The first group concludes that large AUM has a positive influence on fund returns due to economies of scale. The second group finds a non-linear relationship between AUM and fund returns where performance increases up to a point and then declines. The third group finds that there is no relationship between AUM and fund performance. The fourth group believes that the effect of diseconomies of scale is so significant that it erodes fund returns as AUM increase. Since there is varying evidence, this study set out to investigate which of these findings is relevant within the South African context.

Through running a regression analysis of data from a sample comprised of 69 South African equity mutual funds over the three-year period to 31 December 2015, no linear relationship is found between the size of AUM and alpha. The finding of no linear relationship between AUM size and equity mutual fund alpha was theoretically expected and is consistent with historic South Africa-focused studies by Milburn (1984) and Moles (1981).

This finding implies that the exponential growth in AUM experienced in South Africa over the past two decades has neither enhanced nor come at the cost of returns. There does not seem to be a size effect that new investors and fund managers should be aware of. Academically, the results are consistent with the weak and semi-strong form efficient market hypothesis implying that stock prices to some extent reflect available public information.

5.2 Recommendations, limitations and areas for future research

Set out below is an overview of the recommendations based on the findings of this study, inherent limitations and areas for future research.

5.2.1 Recommendations

Despite the finding of no linear relationship between South African equity mutual fund alpha and AUM size, investors and fund managers should be cognizant of the effects of economies and diseconomies of scale associated with changing AUM size. Over the period under review, the net effect is not a concern; however, continuous tests of the relationship are recommended as fund sizes grow.

Given the overwhelming evidence to infer that there is a linear relationship between alpha and the lagged fund return of equity mutual funds in South Africa based on the regression model applied, investors need to give due consideration to historic short-term performance. In doing so, the findings of Berk (2005) that a single year's outperformance by a mutual fund manager does not increase the likelihood of doing well in the subsequent year should be taken into account.

A positive linear relationship between alpha and the expense ratio was not theoretically expected and represents another area of focus for investors when making capital allocation decisions.

5.2.2 Limitations

The study has the following limitations, which do not, however, significantly impact the interpretation of the findings:

- As highlighted by Beckers and Vaughan (2001), there exist numerous factors that could possibly explain investment performance. It is practically impossible to isolate the pure impact of fund size on mutual fund performance. The unique fund characteristics such as fund style (for example value, momentum, balanced), trading efficiencies, liquidity, capital flows could lead to varying outcomes outside those attributable to the size of assets under management.
- As noted by Chen et al. (2004), fund size could possibly be correlated with other fund characteristics that are in fact explaining the fund returns.
- The study does not focus on the reasons for the nature of the relationships observed.

5.2.3 Areas of future research

Set out below are identified areas of future research:

- An investigation of whether the relationship between alpha and equity mutual fund AUM size in South African may be nonlinear.
- The assessment of performance persistence in the South African equities market.
- The study of market efficiency and the validity of the efficient market hypothesis in the South African market.
- The study of the nature of the relationship between alpha and other South African mutual fund asset classes including multi-asset classes, real estate and interest-bearing securities.
- An investigation of whether liquidity has any effect of on South African mutual fund performance.

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APPENDIX

Table 10: Three-year average ZAR/USD exchange rate

Name	SOUTH AFRICAN RAND TO US DOLLAR
12/31/2012	8.64
12/31/2013	10.37
12/31/2014	11.46
12/31/2015	14.93
3 year Average	**11.35**

Source: Thomson Reuters Datastream

Table 11: Sample Data summary

Fund Name	Fund Benchmark	Fund Strategy	AUM Dec'15 (R'm)	3 year Avg AUM (R'm)	Fund age (Years)	Expense ratio (% per year)	Lagged fund return (%)	3yr Benchmark return (%)	3yr Fund return (%)	Alpha (%)
Small Funds: AUM < R1bn										
MERGENCE EQUITY PRESC FND-A1*	JSHRAL	Blend	237	148	5.13	0.81	0.38	0.32	0.49	0.174925
27FOUR SHAR ACT EQU PRESC-A1	JSHRALTR	Growth	228	154	7.31	1.89	0.40	0.44	0.56	0.117
INVEST SOL GLOBAL EQTY FEEDR	MXWO	Value	230	181	11.78	2.12	0.78	0.24	1.38	1.139919
FNB MOMENTUM GROWTH FUND-A	JALSH	Blend	272	267	13.03	1.6	0.27	0.29	0.28	-0.01225
SANLAM FINANCIAL FUND	JFINX	Growth	278	271	15.42	1.74	0.41	0.39	0.38	-0.01076
PRESCIENT EQUITY QUANT FU-A1	JALSH	Growth	285	283	12.51	0.59	0.25	0.29	0.30	0.005803
OLD MUTUAL GOLD FUND-R*	JGOLD	Growth	295	291	3.25	1.18	-0.27	-0.54	-0.33	0.204035
OLD MUTUAL SYMM EQUITY FOF	JSHRAL	Growth	288	294	14.58	1.16	0.25	0.32	0.26	-0.05297
MOMENTUM TOP 40 INDEX FUND	TOP40TR	Growth	291	311	19.55	0.62	0.26	0.44	0.30	-0.13908
ABSA GLOBAL VAL FEED FND- R*	MXWO	Blend	469	339	21.18	1.71	0.68	0.24	1.16	0.915545
EFFICIENT BCI EQUITY FUND*	JALSHTR	Blend	251	344	10.80	1.49	0.28	0.42	0.28	-0.1305
TRUFFLE MET GENERAL EQUITY-A	JALSHTR	Blend	570	359	5.12	1.49	0.37	0.42	0.55	0.131937
AYLETT EQUITY PRESCIENT-A3*	JALSH	Blend	550	401	9.50	1.75	0.37	0.29	0.34	0.048559
CORONATION FINANCIAL FUND-A*	JFINX	Growth	475	428	17.51	1.45	0.50	0.39	0.48	0.088013
MOMENTUM FINANCIALS FUND-A	JFINX	Growth	442	440	17.51	1.43	0.42	0.39	0.40	0.002646
STANLIB SHARI'AH EQUITY F-A*	J143	Growth	425	448	8.34	1.88	0.14	-0.17	-0.04	0.124081
MOMENTUM TOP 25 FUND-A*	JALSH	Growth	492	464	18.76	1.43	0.36	0.29	0.45	0.153532
OLD MUTUAL UMBONO RAFI 40-A	JR40	Growth	637	519	8.26	0.9	0.18	0.05	0.04	-0.00971
IMARA MET EQUITY FUND- A	JALSHTR	Growth	624	519	7.61	1.76	0.37	0.42	0.48	0.067853
MOMENTUM SMALL/MID-CAP FUND	JSHRAL	Growth	300	551	15.69	1.74	-0.02	0.32	-0.13	-0.44864
OLD MUT GL FTSE RAFI IN FD-A*	FRAW3	Growth	544	592	5.06	1.16	0.74	0.13	1.19	1.058092
OLD MUTUAL TOP 40 FUND-A	TOP40TR	Growth	608	600	14.92	0.71	0.26	0.44	0.30	-0.14125
OLD MUTUAL FINANCIAL SERVC-R*	JFINX	Growth	711	696	18.26	1.16	0.39	0.39	0.36	-0.03354
STANLIB CAPITAL GROWTH-A*	JALSH	Growth	713	785	20.18	1.71	0.11	0.29	-0.03	-0.31744
CATALYST SA PROPERTY EQUI-A*	JSAPY	Growth	1025	810	10.92	1.15	0.25	0.23	0.37	0.139664
MOMENTUM AFRICA EQTY FUND-A*	MXFEM	Growth	597	813	6.59	2.15	0.51	-0.16	0.56	0.720656
SANLAM GLOBAL EQUITY-R*	MXWO	Blend	819	881	20.93	1.35	0.78	0.24	1.15	0.909485
ANALYTICS ADVANTAGE MANAG-A	JALSH	Growth	801	889	14.34	1.46	0.25	0.29	0.22	-0.06719
MOMENTUM PROPERTY FUND	JPCAP	Blend	999	964	11.34	1.41	0.22	0.40	0.32	-0.08353
Small Funds Average			**499**	**484**	**12.60**	**1.41**	**0.34**	**0.26**	**0.42**	**0.15707**
Medium Funds: AUM > R1bn < R2bn										
STANLIB GLOBAL BALAN FEED F	MXWO	Blend	1289	1,006	14.92	2.67	0.51	0.24	1.00	0.757598
OLD MUTUAL SMALL COMPANIES-R	JSMLC	Growth	969	1,042	18.68	1.16	0.32	0.30	0.29	-0.0025
INVESTEC ACTIVE QUANTS-R	JALSH	Growth	1074	1,154	20.76	0.42	0.33	0.29	0.25	-0.04539
STANLIB INDUSTRIAL FUND-A*	JASIN	Blend	1303	1,263	23.71	1.7	0.38	0.69	0.43	-0.25954
STANLIB VALUE FUND-A*	JALSH	Blend	1073	1,309	15.32	1.68	0.08	0.29	0.09	-0.20613
CORONATION INDUSTRIAL FUND A*	JASIN	Growth	1655	1,311	17.51	1.16	0.63	0.69	0.85	0.164313
ABSA PROPERTY EQUITY FD-A*	JSAPY	Blend	2963	1,334	9.39	1.75	0.39	0.23	0.70	0.462298
OLD MUTUAL-GLBL EM MARKETS-A	MXEF	Growth	1323	1,383	4.38	2.56	0.35	-0.25	0.49	0.736178
INVESTEC GL FRANCHISE FEED-C	MXWO	Growth	2503	1,402	19.68	3.35	0.67	0.24	1.37	1.130659
OLD MUTUAL INDUSTRIAL-R*	FINDI30	Growth	1522	1,448	8.94	1.17	0.46	0.70	0.63	-0.06718
STANLIB ALSI 40 FD-A*	TOP40	Blend	1510	1,468	15.81	0.49	0.25	0.32	0.30	-0.01924
SIM INDUSTRIAL FUND-*	INDI25	Growth	1961	1,636	49.44	1.14	0.68	0.78	1.00	0.224862
OLD MUTUAL GROWTH FUND-R*	JSHRAL	Growth	1631	1,646	22.76	1.33	0.31	0.32	0.34	0.019514
OLD MUTUAL ALBARAKA EQTY FD	JALSH	Blend	2020	1,811	23.60	1.77	0.27	0.29	0.35	0.058493
PSG EQUITY FUND A	JALSH	Blend	2170	1,864	18.01	1.8	0.54	0.29	0.43	0.136398
PPS EQUITY FUND-A	JSHR40	Growth	1903	1,972	3.50	2.01	0.30	0.35	0.21	-0.13866
Funds Average Average			**1,679**	**1,441**	**17.90**	**1.64**	**0.40**	**0.36**	**0.55**	**0.18448**
Large Funds: AUM > R2bn										
OLD MUTUAL TOP COMPANIES-R*	JALSH	Blend	2054	2,086	24.18	1.16	0.32	0.29	0.33	0.033622
DISCOVERY EQUITY FUND-A	JALSH	Value	1570	2,177	8.16	1.8	0.02	0.29	0.07	-0.2176
CORONATION PROPERTY EQUIT-A	JSAPY	Value	2593	2,439	15.12	1.43	0.28	0.23	0.33	0.096167
PRUDENTIAL EQUITY FUND-A	JALSH	Blend	2871	2,766	16.42	2.48	0.39	0.29	0.44	0.151039
MOMENTUM EQUITY FUND CLASS-R	JALSH	Growth	2805	2,896	28.14	1.12	0.27	0.29	0.27	-0.01755
OLD MUTUAL HIGH YIELD OPP A*	JALSH	Blend	2533	2,929	17.17	1.44	0.25	0.29	0.09	-0.19983
MARRIOTT DIVIDEND GROWTH	FINDI30	Value	4572	3,377	27.43	1.15	0.33	0.70	0.32	-0.38003
SIM VALUE FUND	JALSH	Value	2981	3,438	17.26	1.71	0.29	0.29	0.18	-0.11057
STANLIB EQUITY FUND - A	JALSH	Blend	3990	3,785	46.02	1.79	0.33	0.29	0.42	0.132952
INVESTMENT SOLUTIONS PROP*	JSAPY	Value	3909	4,385	11.26	1.48	0.23	0.23	0.30	0.070547
INVESTEC VALUE FUND R	JALSH	Value	3557	4,609	18.25	1.41	0.20	0.29	0.05	-0.24456
SIM PROPERTY FUND-A	JSAPY	Growth	5193	4,776	11.76	1.74	0.23	0.23	0.25	0.014278
INVESTEC PROPERTY EQTY FD-A*	JSAPY	Value	5845	5,317	11.59	1.45	0.24	0.23	0.34	0.107956
OLD MUTUAL SA QUOTED PROP-A*	JPRUT	Blend	5804	5,393	12.26	1.44	0.24	0.22	0.34	0.126481
SIM GENERAL EQUITY FUND-R*	JALSH	Blend	7495	5,802	48.55	1.15	0.37	0.29	0.41	0.116175
OASIS CRESCENT EQUITY FD-D*	JALSH	Growth	6060	6,225	17.40	1.62	0.29	0.29	0.25	-0.04478
NEDGROUP INV GLB EQU FEED-A	MXWO	Growth	8905	6,737	14.26	2.16	0.75	0.24	1.37	1.131509
INVESTEC EQUITY FUND-R	JALSH	Blend	9145	7,023	28.18	1.15	0.35	0.29	0.52	0.226603
CORONATION EQUITY FUND-R*	JALSH	Blend	7017	7,128	19.72	1.28	0.38	0.29	0.42	0.128122
FOORD EQUITY FUND-R	JALSH	Growth	12543	10,134	13.35	1.17	0.43	0.29	0.42	0.128663
OLD MUTUAL INVESTORS FUND-R	JSHRAL	Growth	14455	13,262	48.62	1.16	0.41	0.32	0.48	0.163458
ALLAN GRAY-ORBIS GL EQU -A	FTWIWRLD	Blend	16303	14,463	10.76	2.15	0.88	0.19	1.43	1.235386
CORONATION TOP 20 FUND-A*	TOP40TR	Blend	16779	19,660	15.26	1.23	0.31	0.44	0.15	-0.29092
ALLAN GRAY EQUITY FUND-A*	JALSHTR	Blend	37907	38,289	17.26	2.4	0.35	0.42	0.43	0.009694
Large Funds average			7,787	7,462	20.77	1.54	0.34	0.30	0.40	**0.09862**
Sample average		**35 Growth, 26**	**3,307**	**3,133**	**17**	**1.51**	**0.36**	**0.30**	**0.44**	**0.14**
Standard Deviation		**Blend, 8 value**	**5,641**	**5,586**	**10**	**0.52**	**0.19**	**0.20**	**0.36**	**0.38**