DEPARTMENT OF ECONOMICS
UNIVERSITY OF STELLENBOSCH

TESTING FOR PERSISTENT OUTPERFORMANCE AMONG SOUTH AFRICAN UNIT TRUSTS

by

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Research assignment presented in partial fulfilment of the requirements for the degree of Bachelors of Economic and Management Sciences with Honours at the University of Stellenbosch.

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March 2015

Declaration

I, the undersigned, hereby declare that:

(i) the work contained in this assignment is my own work; and

(ii) in the instance where my research assignment is based on previously submitted work, I have provided detailed information:

(a) regarding the nature, substance and origin of the overlap in the space below and throughout my research assignment (using standard referencing conventions or footnotes),

(b) regarding content that has been added to the previous submission,

(c) and that I understand that the evaluation of my research assignment will be primarily based on the new work.

Signature: …………………….........................

Date: ……………………….........................

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Research Question

Are investors in actively managed South African unit trusts rational?

Investors tend to chase past performance, the rationality of this depends on the extent to which there is persistence in terms of outperformance over time. This study will thus directly test for the presence, or not, of persistent outperformance for active unit trust managers in South Africa.

Abstract

The existence of persistence in unit trust returns and persistent outperformance in particular, are thoroughly researched topics with most of the credible literature pointing toward the existence of short term persistence only. This paper makes use of a South African data set that is relatively free of survivorship bias and uses of Sharpe Ratios in order to adjust for risk. Thereafter, the potential for outperformance is assessed before using the so-called 'Recursive Portfolio Approach' to test for persistence. Though the prospects benchmark outperformance look marginal, this paper's results are largely in line with what is seen in the literature as short term persistence is found for balanced, equity and fixed-income funds but not for property funds or 'other' funds. Though persistence is seen to diminish over longer investment horizons, it is consistently found to emerge as a more modern phenomenon among each asset class, arising as a significant feature since the early 2000s.

Introduction

South Africa has observed rapid growth in both the number and value of its unit trusts since the first two funds were born in 1965 (Financial Mail, 2013). Since then, the industry has undergone rapid expansion, seeing the total number of unit trusts reach 1025 by 2013 with a combined worth of R1.43 trillion (Money Marketing, 2013). As the vast majority of unit trusts are actively managed, the rationality of investors over this period of expansion hinges on the premise that actively managed funds persistently outperform passive funds in South Africa. Therefore, in order to assess the rationality of investors, this study directly tests for persistence in unit trust returns through the so-called 'Recursive Portfolio Approach' after adjusting unit trust returns for risk through Sharpe Ratios, and assessing the potential for outperformance relative to various benchmarks.

Literature Review

Literature regarding the persistence of unit trust returns appears to have begun with a paper by Michael Jensen in 1968, during an era in which the Efficient Market Hypothesis overshadowed all other investment theories (Malkiel, 1995: 550). Jensen did not find evidence of persistence and concluded that holding a market portfolio would be more profitable, on average, than any investments in active portfolios would be over time; due to the additional transaction costs and brokerage fees that active management requires beyond those incurred in the initial share purchase (Jensen, 1968: 415). Subsequently, studies of American unit trusts and mutual funds that were conducted during 1970s concluded that long term persistence of both outperforming and underperforming funds was a definite reality that could be exploited by active investors (Malkiel, 1995: 571). The mid 1980s saw the end of favourable findings concerning long term persistence as it was only detected over shorter periods of time if detected at all, usually periods of less than a year (Malkiel, 1995: 549). Recent studies in developing countries such as India (Muruganandan & Shivaprasad, 2010), Hungary (Filip, 2011) and the Czech Republic (Filip, 2013) find short term persistence by employing the same methodology as those early studies, but most find far greater evidence of persistence in underperformance rather than in excess return. This underperforming trend in persistence weakens the proposition that persistence can be used to formulate an investment strategy capable of consistently outperforming the market, indicating irrationality among active investors. Additionally, more modern research has indicated that the earlier studies were riddled with methodological errors and that these led to the spurious detection of significant persistence; thereby challenging the existence of persistence in unit trust returns for any country, over any time period (Metallín-Sáez *et al.* 2014: 2).

Initial Findings

In terms of methodology, time-period and data; the American studies by Brown & Goetzmann (1995) and Malkiel (1995) are similar and unsurprisingly lead to analogous results. Both studies found persistence in outperformance and underperformance at certain times during the 1970s, though persistence became weaker and was found over shorter periods in the 1980s. Additionally, they found that persistence was more common for underperforming funds than for those realising excess returns and found that unit trusts underperformed the market, on average, over their entire sample period. (Malkiel 1995: 571; Brown & Goetzmann, 1995: 697). Brown & Goetzmann used raw returns in their analysis as opposed to risk-adjusted returns, and consequently advised against investment strategies based on persistence as they hypothesized that increased risk was associated with the funds that performed best (Brown & Goetzmann, 1995: 696). Likewise, Malkiel concluded that investors would have been better off investing in passive indices and avoiding management costs, rather than attempting to earn excess returns though the notion of persistence.

Adjusting Performance for Risk

Brown & Goetzmann's caution against using raw returns in order to draw inferences about persistence and consequently develop investment strategies based on past returns are not unique to their 1995 study. Additionally, in the majority of studies conducted on persistence in unit trust returns, it was found that using gross returns instead of net returns greatly increased the chance of finding both outperformance and persistence (Metallín-Sáez *et al.* 2014: 1); however, net return is considered the better measure theoretically, and therefore persistence may not be as common as some studies suggest.

There has been much debate in the literature as to which measure of risk-adjusted unit trust performance is appropriate. The earliest studies, including the influential papers by Sharpe in 1966 and Jensen in 1968, make use of simpler risk-adjustment models such as the Sharpe Ratio (Sharpe, 1966: 122) and Capital Asset Pricing Model (CAPM), respectively for equity funds. The Sharpe Ratio uses an individual fund's standard deviation and therefore its historical volatility as a measure to adjust excess returns for risk, while the CAPM model regresses individual fund returns on the variation between that fund's return and return for the market, finding a covariate coefficient and an intercept. The coefficient is represented by the Greek beta symbol and its value indicates the propensity of the fund to vary in returns from the market, estimating systemic risk. The intercept is represented by a Greek alpha symbol and indicates return in relation to the market based on the risk profile of the asset. These Sharpe and CAPM measurements of risk-adjusted performance quickly became standard in empirical financial literature as the benefits of adjusting returns for risk in order to eliminate the problems associated with inference based on raw returns – as faced by Brown & Goetzmann in 1995 – became clear. The Sharpe Ratio and CAPM models continued to serve as the leading measures of risk-adjusted return at the forefront of financial research until Fama & French's acclaimed Three Factor Model was developed in 1992 (Fama & French, 1992: 464). Fama & French found constantly significant relationships between small capitalisation stocks and risk as well as between growth stocks and risk; thereafter extending the CAPM framework in order to include these size and style factors into the CAPM model in addition to the CAPM beta or alpha – the initial factor – in order to construct their famous Three-Factor Model (Fama & French, 1992: 452). Beta is a measure of expected change in the return of an asset following a change in market return whereas alpha estimates return in excess of a market benchmark. The Fama & French Three-Factor Model became the foundation of many subsequent models such as Carhart's prominent Four-Factor model, formulated in 1997, using the Three-Factor Model as a base onto which a factor for a one-year momentum effect was included. This momentum factor was used to control for the slow pricing adjustments that Carhart observed following the introduction of new public information concerning the underlying assets of unit trusts and the dynamic market environments that affect them (Carhart, 1997: 61). Fama & French later developed a Five-Factor Model in 2014, adding an expected-future-profitability factor and an individual firm-level investment return factor to their original Three-Factor Model (Fama & French, 2014: 5). Many other multi-factor models have also been devised from the Three-Factor Model within the literature, with varying levels of success and degrees of adoption within subsequent studies. However, despite their prominence and the consensus that they most accurately account for risk when considering risk-adjusted returns, CAPM models require much cross-sectional data in order to account for the size, style, momentum, expected profitability, firm-level returns and other factors when calculating CAPM betas and alphas. Additionally, CAPM models compare the risk of an individual asset with that found in the market and can therefore only be constructed when equity is the only asset class under consideration, thereby limiting the scope of investigations such as this.

When applied to studies for persistence in unit trust returns, many different risk-adjustment models are used in the literature. Among modern international studies, the Carhart Four-Factor Model is the most prominent, indicating that more modern persistence authors place value on Carhart's one year momentum effect and are of the opinion that it needs to be included as a control variable for unit trust pricing rigidities rather than being interpreted as short term persistence in itself. On the other hand, most South African studies make use of the Sharpe Ratio and CAPM return models regardless of when the study was conducted, though publications such as Scher and Muller's 2005 paper and Nana's 2012 paper apply various models from the Sharpe Ratio to numerous multi-factor CAPM models in order to assess the robustness of their results. Applying numerous models as tests for robustness is common practice in both the international literature and that specific to South Africa, though it seems that simpler measures such as the Sharpe Ratio display persistence most easily while more complex measures such as the Carhart Four-Factor Model are less inclined to do so (Busse *et al.*, 2010: 778; Nana, 2012: 158).

Establishing Persistence

In addition to various performance measures, many methodologies have also been developed in the literature to test for the existence of persistence in performance. Three methods have been commonly used:

1. The Contingency Table Approach;
2. The Recursive Portfolio Approach; and

3. The Time Series Regression Approach.

These are discussed in more detail below:

The Contingency Table Approach

The method that was used by Jensen (1968), Malkiel (1995), Brown & Goetzmann (1995) as well as many others to test for persistence was the so-called 'Contingency Table' Approach. The Contingency Table Approach involves splitting funds at the median return into "winner" and "loser" funds; the returns are then tested for statistical significance either against the median fund or a market benchmark (Brown & Goetzmann, 1995: 680) such as Standard & Poor's top 500 shares (S&P500) or the Johannesburg Stock Exchange's All-Share Index (JSE ALSI). Since investments in these indices are passive, it was assumed that they earned zero excess return and could therefore be regarded as a measurement against which to assess outperformance.

Period $_t$	**Period $_{t+1}$**	
	Winner	**Loser**
Winner	WW	WL
Loser	LW	LL

Contingency Table (Muruganandan & Shivaprasad, 2010: 22)

Muruganandan & Shivaprasad (2010) later used this approach in order to assess persistence in Indian Funds of Mutual Funds (Muruganandan and Shivaprasad, 2010: 21). Though slight evidence of persistence was found, it was primarily from underperforming funds; a conclusion consistent with those of Malkiel (1995) and Brown & Goetzmann (1995). This kind of underperforming persistence is also seen in Bu and Lacey's (2014) study which – like Malkiel (1995) and Brown & Goetzmann (1995) – also examined American equity unit trusts but between 1998 and 2012. Though Bu and Lacey's study focussed on determining whether the cause of outperformance was through increased risk or manager skill, and not focussed on direct tests for persistence, they made a valuable critique on the traditional methodology. They found that the objective of a fund tended to change with fund age, that younger funds were seen to take on greater risk and that the modal age for a fund to be dissolved was three years. These risk factors are characteristics that should probably be included in any analysis of fund performance in the form of risk-adjusted returns (Bu and Lacey, 2014: 3).

The Recursive Portfolio Approach

The second approach, the approach preferred by Metallín-Sáez *et al.* (2014), Bollen & Busse (2004), Busse *et al.* (2010), Kosowski *et al.* (2006), Hendricks *et al.* (1993) as well as Grinblatt and Titman (1993 & 1995) among others; is the so-called 'Recursive Portfolio Approach' which assesses persistence through analysing portfolios that invest based on past unit trust performance (Metallín-Sáez *et al.* 2014: 14). Firstly, performance is estimated for each fund, these funds are then split into groups based on fund style in order to control for differences in returns that are associated with style (Metallín-Sáez *et al.* 2014: 15; Bollen & Busse, 2004: 571). Secondly, they are ranked according to performance and divided into quantiles within each style group; Metallín-Sáez *et al.* use quintiles (2014: 15) while Busse *et al.* use deciles (2010: 78). Thirdly, each quantile, or portfolio, in the next period is constructed from the same funds that correspond to its rank in the previous period. Fourthly, this process is repeated in order to create time series of both rebalanced and actual returns for each quantile within each style group, which are compared to each other (Busse *et al.* 2010: 778; Carhart. 1997: 63; Metallín-Sáez *et al.* 2014: 15). Fifthly, in order to test for persistence either simple t-statistics (Busse *et al.* 2010: 787), p-values (Metallín-Sáez *et al.* 2014: 17) and F-statistics (Grinblatt & Titman, 1993:65) are used, usually through Spearman Rank Correlation; or the new time-series of rebalanced returns is tested for autocorrelation (Droms & Walker, 2001: 458).

The Recursive Portfolio Approach did not indicate any significant persistence in unit trust returns for Metallín-Sáez *et al.*(2014), who actually found some evidence in favour of mean reversion (2014: 17); Hendricks *et al.* (1993: 122) found persistence in underperformance only; Bollen and Busse (2004: 595) and Carhart (1997: 80) found very weak evidence of persistence; Kosowski *et al.* (2006: 2594) found evidence for growth-oriented funds only; Busse *et al.* (2010: 788) found persistence that is dependent on which performance measure is used; and though Grinblatt and Titman (1993: 67) do find fairly strong evidence of short term persistence; persistent outperformance is thought to be negligible, if at all existent, after transaction fees, brokerage and commissions to fund managers.

The Time-Series Regression Approach

An alternative approach that appears in much of the literature and is used by Droms & Walker (2001), Nana (2012), Collinet & Firer (2003), Oldham & Kroeger (2005), Hallahan (1999), Meyer (1998) and Grinblatt & Titman (1995), among others; is that of time-series regression. Under the Time-Series Regression Approach, performance in a chosen holding period is regressed on performance in a preceding formation period. As persistence tends to be heavily reliant on the time period chosen (Brown & Goetzmann, 1995: 697), many formation and holding periods are used.

After running regressions for each unit trust over each combination of formation and holding periods, persistence is detected through the proportion of unit trusts that display positive, statistically significant beta coefficients (Nana, 2012: 178). A weakness of this approach, however, is that there is no recognised threshold at which the proportion of significantly positive coefficients would allow a researcher to infer that persistence is present across the entire sample. Regressions rely heavily on large samples in order to reduce bias through asymptotics, leading some researchers such as Nana (2012) and Busse *et al.* (2010,: 782) to use overlapping formation and holding periods in order to increase their sample sizes. While this adjustment is more accurate in detecting persistence over a particular period, any result from an overlapping period regression cannot be used to formulate an investment strategy as the decision in which funds to invest needs to occur during the investment holding period (Nana, 2012: 178).

In general, the Time-Series Regression Approach was consistent with the contingency table and recursive portfolio approaches as the majority of studies in which it was employed failed to detect significant persistence. In studies that used a combination of approaches such as Droms & Walker (2001), Meyer (1998), Nana (2012) and Metallín-Sáez (2014); parallel results were generally drawn between each method although Busse *et al.* (2010) and certain other studies provided exceptions.

Survivorship Bias

Unlike Muruganandan & Shivaprasad (2010), Filip (2011) and Filip (2013); both Malkiel (1995) and Brown & Goetzmann (1995) set about resolving the issue of survivorship bias before conducting any empirical work. Survivorship bias is an upward distortion of fund returns due to the exclusion of funds that were either absorbed into other funds or were simply terminated during the period of study. This survivorship distortion is upward because the funds that didn't survive the entire period are more likely to have performed poorly, causing their disappearance (Brown and Goetzmann 1995: 680). Pawley (2006: 25) conducted a study into the extent of survivorship bias in South African unit trust returns and highlighted its importance by concluding that such bias could cause data to overstate real annualised returns by as much as 47% over a 20 year period. In order to correct for survivorship bias, both the studies by Malkiel (1995) and Brown & Goetzmann (1995) included funds that were absorbed by other funds in their samples over their respective periods of study; however, further bias is thought to exist due to the exclusion of funds that were discontinued (Malkiel, 1995: 571). Strangely, many later studies did not attempt to control for survivorship bias while these two earlier studies did, though access to bias-free data seems to be limited, especially in developing countries.

Another issue that arises with regards to survivorship bias is that of ‘incubator funds’. Malkiel (1995: 552) suggests that unit trust management companies often create hypothetical funds and then choose the more successful ones to be released publically after a period of time in which these hypothetical funds are compared to the actual market. If persistence is present, then these ‘incubator funds’ create survivorship bias as only the successful funds will be marketed, potentially distorting average returns (Malkiel, 1995: 552). Additionally, survivorship bias of this form cannot be remedied as a complete data set of hypothetical funds from every unit trust manager, and from every aspiring manager, over the entire time period of the sample would be required.

Methodological Recommendations

The Contingency Table Approach that was used by all of these earlier studies is thought, by Metallín-Sáez *et al.* (2014), to find evidence of persistence far too easily. Their study of American equity unit trusts between 2001 and 2011 begins with that same approach and then compares it to the ‘Recursive Portfolio Approach’ (Metallín-Sáez *et al.* 2014: 1). Though survivorship bias was recognised in their study, only funds with data spanning the entire period were included, potentially distorting the results. Their contingency table method found no evidence of persistence once net returns, fund size and fund style were controlled for (Metallín-Sáez *et al.* 2014: 18). Net returns refer to gross returns after all management and brokerage fees have been included, while style differentiates between growth, blend and value funds. Unit trust returns from the Contingency Table Approach show some significant persistence for gross returns and some persistence to a lesser degree for net returns, especially for funds that underperform persistently (Metallín-Sáez *et al.*, 2014: 14). Metallín-Sáez *et al.* also find persistence in certain passively managed funds despite no active management, (2014: 12) and subsequently conclude that it may be the lack of a robust methodology as well as persistence in management fees that cause what little persistence is evident in unit trust returns, and not managerial skill. It may therefore be wise to use a more robust method as well as net returns, as the results from tests on gross returns are more likely to display persistence. Style is also relevant because average return tends to differ between style groups; therefore, any persistence in excess returns may be as a result of net versus gross returns, fund size and fund style; as opposed to managerial skill (Metallín-Sáez *et al.* 2014: 2). Growth funds refer to unit trusts that are concerned with the long term potential of particular companies while value funds are more interested in whether or not a company is undervalued or overvalued relative to company fundamentals; blended funds are combinations of the two (Investopedia, 2014).

South African Studies

Various papers surrounding tests for persistence in South African unit trusts have been undertaken as well, the traditional contingency table and time-series regression approaches being particularly prevalent. In comparison to many developed countries, unit trusts are a relatively new instrument for South Africa and much of the South African persistence research has therefore been conducted in very small samples of only a few unit trusts (Firer *et al.*, 2001: 1). The first 2 unit trusts were born in the mid-1960s and by 1975 only 12 were in existence (Firer *et al.*, 2001: 1); however, the industry has grown considerably since then, boasting 271 funds by the beginning of 2000 (Firer *et al.*, 2001: 1) and 1025 by September 2013 (Financial Mail, 2013).

The earliest research into South African unit trust returns was conducted by Gilbertson & Vermaak (1982: 42), Meyer (1998: 107) and Smith & Van der Merwe (1999: 47); all of whom made use of the Contingency Table Approach and concluded that persistence was a short term phenomenon, if existent at all. Smith & Van der Merwe's evidence went so far as to suggest a contrarian strategy over a strategy based on past performance for holding periods of under four years (Smith & Van der Merwe, 1999: 44). Studies by Oldfield & Page (1997: 40) as well as Mibiola (2013: 54) concluded that even in the event of persistent outperformance, return in excess of a passive benchmark is insufficient to warrant the management and brokerage fees that are required by active investment instruments – like unit trusts – on average.

More recent literature such as Firer (2001), Collinet & Firer (2003), Oldham & Kroeger (2005), Scher & Muller (2005) and Nana (2012) make use of the Recursive Portfolio Approach or the Time-Series Regression Approach, either alone or in combination with the Contingency Table Approach, but generally come to similar conclusions.

Literature Review – Conclusion

In general, both domestic and international literature concerning the existence of persistence in unit trust returns has reached similar conclusions; if persistence exists, then it is a short term phenomenon and that as a result of both management and brokerage fees, an investment strategy based on past performance is unlikely to realise returns in excess of a passive benchmark over a sustained period of time. The scepticism of an investment strategy that is based on chasing past performance as seen in the literature therefore points to irrationality among active investors in unit trusts.

Methodology

Data

The data for this paper were obtained through Bloomberg by means of its Microsoft Excel add-in and consist of 996 unit trusts and mutual funds, 708 of which are active and 288 of which are extinct. The presence of these extinct funds helps to relieve survivorship bias, a source of many criticisms from within the persistence literature (Pawley, 2006: 2). However, the inclusion of extinct unit trusts cannot be said to alleviate survivorship bias completely, as these are limited to those on the Bloomberg database which is unlikely to form a complete list of extinct funds. Additionally, data pertaining to incubator funds, as described by Malkiel (1995: 552), is impossible to obtain.

The scope of funds is limited to those that originate from within South Africa and includes a wide variety of asset classes; including equity, fixed-income, property and balanced funds. These funds vary in their start dates with most beginning around 2006 and the oldest fund, Old Mutual's Investors Fund, dating back to July 1986.

Calculating Performance

Adjusted monthly closing price data was used as an initial performance measure, where closing prices were adjusted for distributions such as dividends, interest payments as well as any other transactions that affected the investor return over the fund's lifespan. These adjusted closing prices were used in order to form a total return series as seen in *Equation 1*.

$$Return_{annual}\ (\%) = \left(\frac{Adjusted\ Price_t}{Adjusted\ Price_{t-12}}\right) - 1 \qquad (1)$$

Once the 996 total return series were calculated, these were adjusted for risk by means of the Sharpe Ratio (*Equation 2*):

$$Sharpe\ Ratio = \frac{Return_{i,t} - Return_{rf,t}}{\sigma_i} \qquad (2)$$

This requires a proxy for the risk free rate. Traditionally, the R157 bond has been the most prominent choice as a risk-free rate proxy among South African market practitioners. However, in recent years the R186 has overtaken the R157 in popularity and was used by 20% of professionals in 2012, as opposed to the 14% who used the R157 (PWC, 2012: 34).

Because this price-data series extends back in time beyond the lifespans of both the R186 and R157 bonds, the risk-free rate was compiled through three separate sources. The first is a combined bond-yield series that includes all South African government bonds and is used between 1986 and 1991, the second is the R157 bond which is used between 1991 and 1998 and the third is the R186 which is used post-1998. Data for the combined government bond yield was acquired from the OECD's Main Economic Indicators database (OECD, 2014) while Bloomberg was used to source data for the R157 and R186 government bonds; these are illustrated in *Figure 1*.

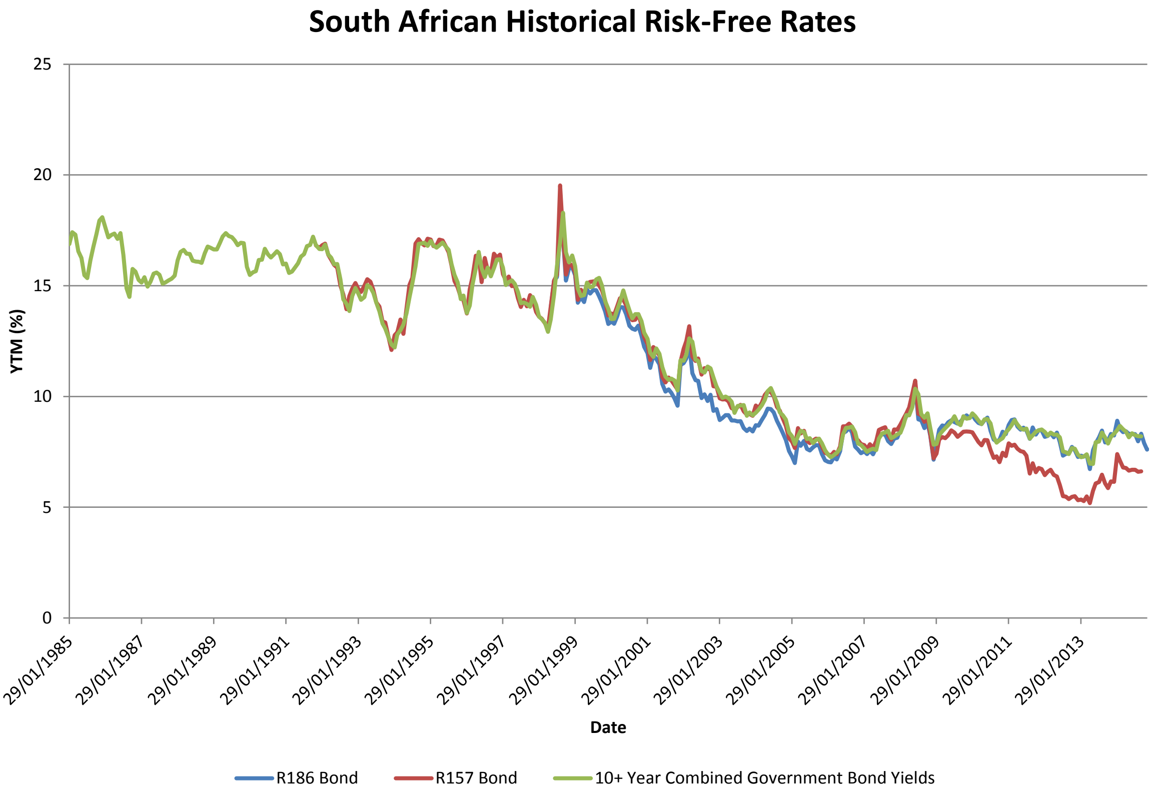

Figure 1: Compound Risk-Free Rate Series

Additionally, in order to obtain a smoother estimate of the risk-free rate, an *n* month moving average was used in the calculation of the Sharpe Ratio.

Sharpe Ratios were calculated as shown in *equation 3*:

$$Sharpe\ Ratio = \frac{\left(\left(\left(\frac{Adjusted\ Price_t}{Adjusted\ Price_{t-n}}\right)-1\right)-n\ Month\ Average\ Risk\ Free\ Rate\right)}{(Standard\ Deviation\ of\ n\ Monthly\ Returns)(\sqrt{n})} \tag{3}$$

Where *n* = number of months in the rolling period = 6, 12, 24 and 60 months.

To clarify, the denominator was calculated using the standard deviation of the monthly returns in the rolling period which was then annualised by multiplying the result by the square root of *n*.

Rolling periods were used in order to compare the variation in returns to the actual period in which these returns occur, thereby providing a more time-specific estimate of risk than would be obtained from Sharpe Ratio calculations if they had been based on standard deviations calculated over a fund's entire lifetime.

Though the majority of the literature points towards using multifactor CAPM models to adjust for risk, such as Carhart's four-factor model (1997), these models are impossible to construct where non-equity funds are used. This is because certain elements of these models cannot be measured for non-equity funds as these require elements that relate to a stock market, such as beta. Non-equity funds are, however, vital in the analysis of unit trusts as many South African funds do not restrict themselves to investments in equity alone. This problem requires the use of an alternative method for risk-adjustment. Though simplistic and requiring certain assumptions such as persistence in volatility, the Sharpe Ratio is used as a risk-adjustment instrument in much of the persistence literature and therefore acts as the best alternative to multifactor CAPM models in efforts to obtain more general inferences; and not restrict the analysis to equity funds alone (Nana, 2012: 97; Colinet & Firer, 2003: 526).

Though this paper focuses on testing for persistence, assessing investor rationality with regards to active management in unit trusts depends on outperformance of passive benchmarks. Each asset class requires its own benchmark because comparisons across asset classes are likely to either penalise or favour an entire class unfairly. The benchmarks that are used are CPI+5% for balanced funds, the JSE's All Share Index (ALSI) for equity funds, the JSE's All Bond Index (ALBI) for fixed-income funds and the JSE's South African Listed Property Index (J253-SAPY) for property funds. For balanced funds, CPI+5% is a common benchmark as it reflects a medium risk-appetite which is usually the mandate for balanced funds such as Rand Merchant Bank's Protected Flexible Fund (RMB, 2014). The asset class for 'other' funds is only compared to zero as it makes little sense to relate it to any benchmark or combination of benchmarks that consist of other asset classes; this is equivalent to setting the benchmark for 'other' funds as the risk-free rate. The Sharpe Ratios for each benchmark were calculated in exactly the same manner as those for the unit trusts.

In order to assess whether outperformance is plausible for unit trusts, benchmarks are subtracted from fund Sharpe ratios in order to calculate excess fund return relative to their respective benchmarks. The lifetime averages of these excess return series are then plotted in order to assess outperformance. Bar graphs are constructed for each asset class across four investments horizons – 6, 12, 24 and 60 months – in order to be consistent with the investment horizons that are used in the Recursive Portfolio Approach to testing persistence.

Testing For Persistence

Once risk-adjusted returns have been obtained through Sharpe Ratios, tests for persistence can begin. The Recursive Portfolio Approach is used in order to test for persistence due to its prominence in the literature as well as the preference for it that is shown by Grinblatt & Titman (1993), Busse *et al.* (2010) and Metallín-Sáez *et al*. (2014) among others. The consensus seen in the literature appears to be that the Contingency Table Approach displays persistence too easily and that the Time-Series Regression Approach does not allow for detailed enough inference, leaving the Recursive Portfolio Approach as the best available alternative.

In order to test for persistence through the Recursive Portfolio Approach, firstly – in accordance with Metallín-Sáez *et al*. (2014: 15) and Bollen & Busse (2004: 571) who split funds into groups based on style – the funds are divided into groups based on asset class. This is done because in the same way that different equity fund styles are likely to intrinsically differ in returns, so are different asset classes. For example, it is known that fixed-income instruments incur less investment risk than other asset classes and are used as a risk hedge, especially in times of uncertainty which results in lower raw returns. Groups that are usually found in the literature are based on both the unit trust's style as well as its market capitalisation. Market capitalisation data is unavailable to this paper and therefore these groups are composed of asset classes alone. Unit trusts are therefore grouped into balanced funds, equity funds, fixed-income funds, property funds and 'other' funds.

Secondly, the funds are ranked by risk-adjusted performance – through Sharpe Ratios – over distinct time periods by means of Microsoft Excel's RANK.AVG command. Instead of using quantiles, a total ranking list is used. However, due to the missing values which are caused by the different time periods in which particular unit trusts exist, this ranking technique produces errors. In order to solve this problem these errors are preserved and Excel's RANDBETWEEN command is used within its IFERROR command in order to generate random numbers and thereby obtain columns of the same length, regardless of whether or not the fund existed at a particular time period. Excel's RANDBETWEEN command allowed random integers to be generated between 1 and the number of funds in each asset class, in a uniform distribution; thereby adding 'noise' to the rankings in order to equalize column lengths but preserving the mean of the rebalanced rankings within each period (DataPig Technologies, 2014). Finally, the rankings for each period are then compared to those of the preceding period through Spearman Rank Correlation and subsequent t-statistics and p-values. The p-values are then graphed in order to describe periods in which significant persistence exists for a particular style and duration.

$$t_{stat} = \frac{\rho}{s.e.(\rho)} = \frac{\rho}{\sqrt{\frac{(1-\rho^2)}{n-2}}} \tag{4}$$

(Wooldridge, 2009: 122)

$$P\text{-}Value = TDIST(t_{stat}, DF, 2) \tag{5}$$

Much of the literature finds persistence over 6 month investment horizons and therefore semi-annual periods are used as short term indicators (Malkiel, 1995: 549). Despite finding persistence over 6 month periods, persistence usually disappears over the course of 2 years, leaving an obvious choice for a medium term indicator (Malkiel, 1995: 549). Finally, for the sake of thoroughness, a 5 year period is used as a long term indicator. 5 Year periods were chosen due to the relatively young nature of South Africa's unit trust sector and due to the high attrition rate for unit trusts that result in missing data problems for analyses over longer periods. Consequently, the above process is repeated 15 times; the 5 asset classes each analysed over the 3 investment durations.

Results

Assessing Outperformance

In order to obtain an overview of performance and the plausibility of benchmark outperformance, average excess lifetime Sharpe Ratios for each unit trust were plotted over 6 month, 12 month, 24 month and 60 month investment horizons as seen in *figures 2* to *11*.

Balanced Funds

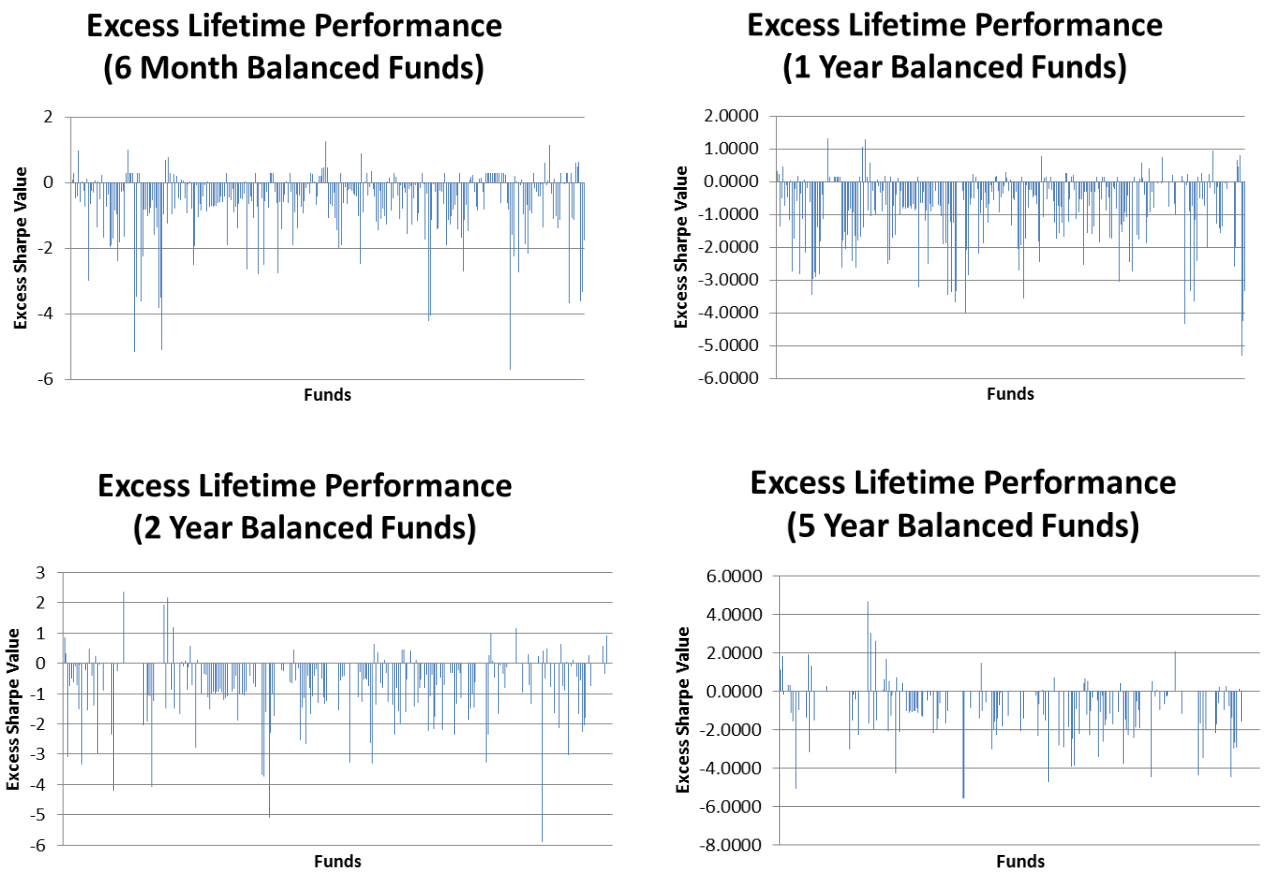

Figure 2

Performance Summary (Balanced Funds)				
	6 Months	12 Months	24 Months	60 Months
Number of Funds	314	314	314	314
Outperforming Funds	16.24%	19.13%	11.78%	9.24%
Average Fund Lifespan (Months)	54.06	54.06	54.06	54.06
Maximum Outperformance	1.26	1.34	2.36	4.68
Maximum Underperformance	-5.70	-5.31	-5.91	-5.58

Figure 3

Of the 314 balanced funds that were considered in this data set, between 9.24% and 19.13% outperform their CPI+5% benchmark over the course of their entire lifespans, depending on the length of the investment horizon that is utilised. In general, longer investment horizons see a smaller percentage of balanced funds outperforming their benchmarks than over shorter intervals, though the one year period sees a greater proportion of balanced funds beating their CPI+5% benchmark than over a 6 month horizon.

Equity Funds

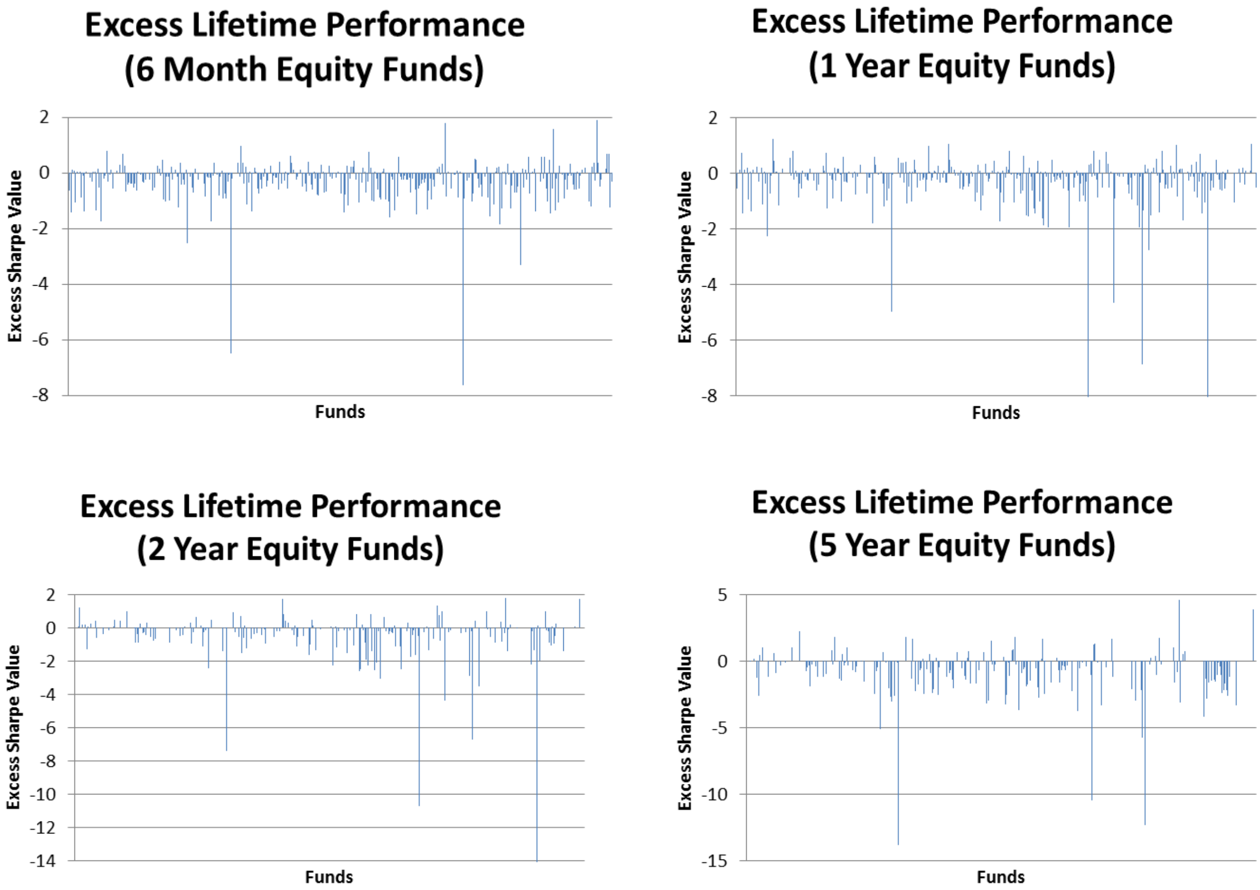

Figure 4

Performance Summary (Equity Funds)				
	6 Months	12 Months	24 Months	60 Months
Number of Funds	365	365	365	365
Outperforming Funds	26.30%	28.77%	13.97%	10.68%
Average Fund Lifespan (Months)	61.61	61.61	61.61	61.61
Maximum Outperformance	1.91	3.06	1.81	4.63
Maximum Underperformance	-7.63	-29.97	-14.48	-13.82

Figure 5

The same trend is seen for the 365 equity funds, where between 10.68% and 26.77% of funds outperform the JSE ALSI over their respective investment horizons. As with the balanced funds, it is the 1 year horizon that yields the most prevalent proportion of outperformers but the general trend of diminishing outperformance with increasing holding-periods remains.

Fixed-Income Funds

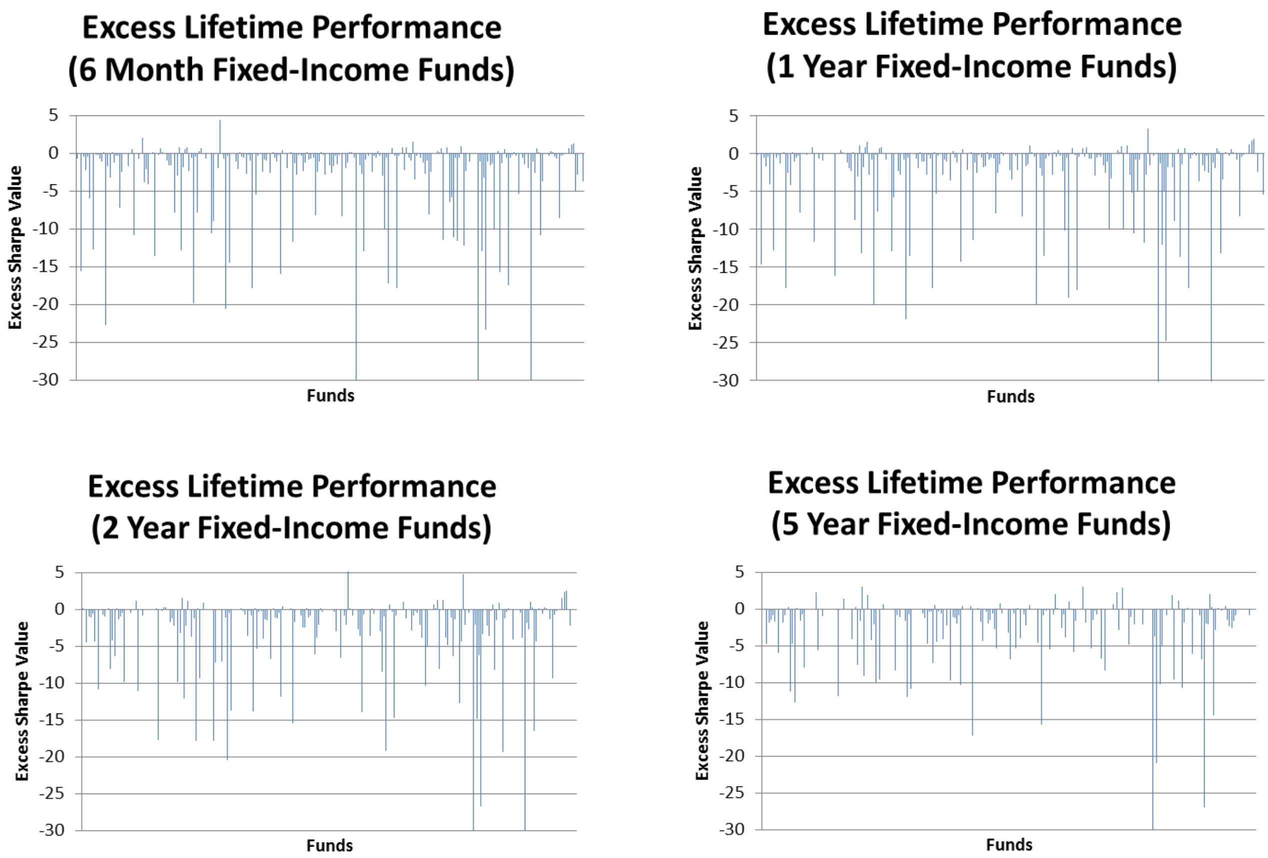

Figure 6

Performance Summary (Fixed-Income Funds)				
	6 Months	12 Months	24 Months	60 Months
Number of Funds	250	250	250	250
Outperforming Funds	16.40%	16.40%	15.60%	11.60%
Average Fund Lifespan (Months)	65.48	65.48	65.48	65.48
Maximum Outperformance	4.48	3.33	6.16	3.06
Maximum Underperformance	-55.74	-57.68	-38.40	-29.97

Figure 7

Again, fixed-income funds display the same pattern of outperformance though investment horizons do not seem to have as great an effect on the proportion of outperforming funds as was the case for both balanced and equity funds. While 6 month holding-periods observe 16.40% of outperforming fixed-income funds, 5 year horizons to not see a dramatic decrease and yield a proportion of 11.60%. Additionally, it is seen that lesser proportions of fixed-income funds outperform the JSE ALBI than do balanced funds and equity funds with their own respective benchmarks.

Property Funds

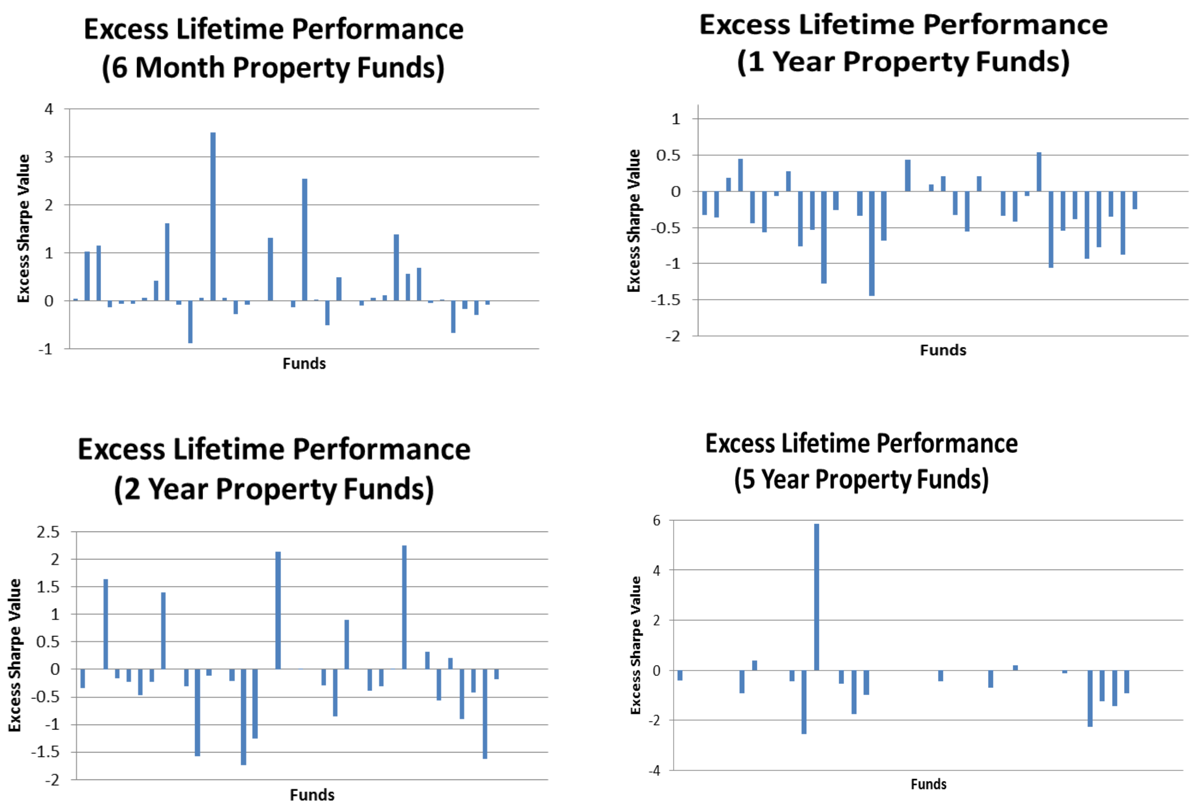

Figure 8

Performance Summary (Property Funds)				
	6 Months	12 Months	24 Months	60 Months
Number of Funds	41	41	41	41
Outperforming Funds	46.34%	19.51%	21.95%	7.32%
Average Fund Lifespan (Months)	49.82	49.82	49.82	49.82
Maximum Outperformance	3.51	0.54	2.24	5.85
Maximum Underperformance	-0.88	-1.45	0.22	-2.56

Figure 9

Contrary to what is seen from the results for fixed-income funds, the 41 property funds witness pronounced investment horizon effects as the proportion of outperforming funds begins at 46.34%, over 6 month periods, and decreases to 7.32% over 5 year durations.

Other Funds

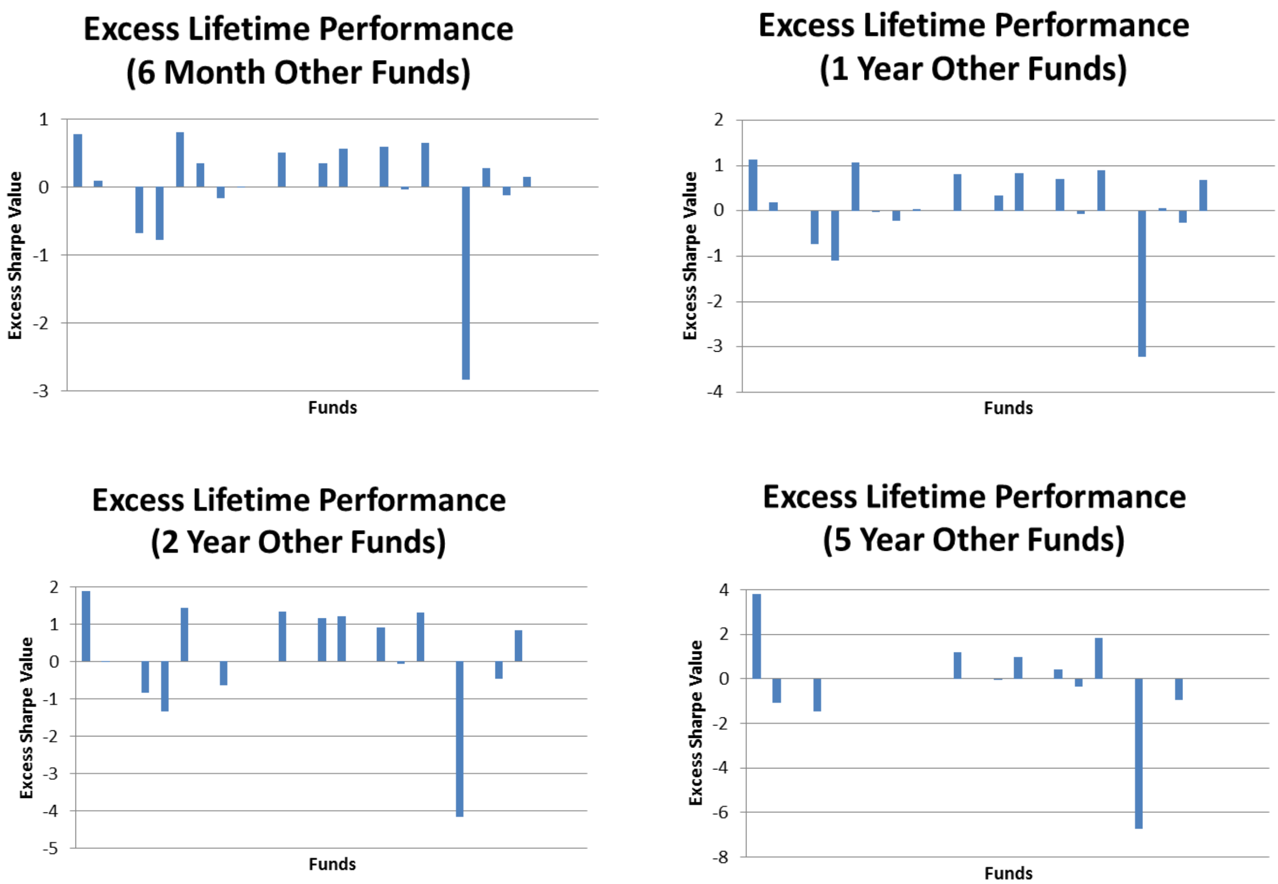

Figure 10

Performance Summary (Other Funds)				
	6 Months	12 Months	24 Months	60 Months
Number of Funds	26	26	26	26
Outperforming Funds	42.31%	42.26%	30.77%	19.23%
Average Fund Lifespan (Months)	49.92	49.92	49.92	49.92
Maximum Outperformance	0.80	1.14	1.90	3.81
Minimum Underperformance	-2.84	-3.22	-4.17	-6.74

Figure 11

As mentioned previously, ‘other’ funds consist of multiple asset classes and it would therefore be undesirable to compare their performance to any other asset’s benchmark. Consequently, the results depicted in *figures 10* and *11* are returns in excess of the risk-free rate and therefore straightforward Sharpe Ratios, causing the proportions of outperforming funds to be biased upward. Nevertheless, the duration of holding periods seems to have a large impact on the proportion of funds that outperform their benchmarks, with the six month horizons showing 42.31% of funds to have outperformed the risk-free rate while 19.23% did so over 5 year periods.

One problem with the above results is that the average lifespans for balanced funds, property funds and 'other' funds are less than 60 months, the duration of the long term holding period. This means that the proportion of outperforming funds over that time span is likely to be downward biased due to missing values.

What is noticeable for all of the above graphics is that there are many funds with what look to be incredibly low excess Sharpe values. Such low ratios invite interpretations of incredibly poor performance; however, this is not necessarily the case. Funds like Sanlam's Alternative Income Fund which is listed as conservative, has an exceptionally low standard deviation in accordance with that mandate (Sanlam, 2014). Though it has earned consistently positive returns since its inception in May 2007, these returns have largely fallen below that of this paper's compound risk-free rate series and the fund has thereby incurred negative excess returns (Sanlam, 2014). When negative excess returns are used in the calculation of a Sharpe Ratio, these ratios can be misleading (Alenius, 2008: 10). A fund with a lower standard deviation but with the same negative excess return will yield a lower Sharpe Ratio; therefore, risk adjustments penalise consistent funds and reward volatile funds when excess returns are negative. As Sharpe Ratios that are subject to negative returns have the opposite effect on funds after risk adjustment, they cannot be interpreted in the same way as positive ratios and very negative values should not be considered an indication of exceptionally poor performance.

The above results show that small but significant proportions unit trusts do indeed outperform their benchmarks, particularly over shorter investment horizons. However, what can be seen in the above graphics is that when outperformance does occur it is minimal, that benchmarks are not generally beaten by a large degree. Additionally, this paper does not account for the costs of active management and therefore such marginal outperformance is likely to diminish after transaction fees and brokerage are taken into account. Therefore, despite finding small but significant proportions of outperforming funds across all asset classes, these results do not necessarily contradict those found within the literature. The aim of this paper is twofold and establishing that small but significant proportions of unit trusts outperform their benchmarks is insufficient to conclude for rationality in active investment among unit trusts. Therefore, the Recursive Portfolio Approach is used to test for persistence, the results of which are outlined below.

Recursive Portfolio Approach

In line with the persistence literature and Metallin-Saez *et al*. (2014) in particular, tests for persistence are based on 6 month, 2 year and 5 year rolling investment periods for each of the balanced fund, equity fund, fixed-income fund, property fund and 'other' fund asset classes. The following graphs show the p-values that were derived from the t-statistics of periodic Spearman Rank Correlations which are available in the appendix.

These p-values show the probability of the calculated t-statistics exceeding their critical t-statistics; in other words, they present the probability against accepting the null hypothesis that there is no persistence in unit trust returns. The horizontal red lines in the graphics that follow indicate a threshold level of 95% confidence; therefore, any p-values exceeding this line indicate that there is no persistence in unit trust returns while any p-values that lie below the line indicate that significant persistence exists.

Balanced Funds

Figure 12 shows the p-values for semi-annual persistence among balanced funds and shows it to exist significantly from approximately the year 2000 until now. Therefore, a significant proportion of unit trusts that performed relatively well over a 6 month period in 2000 are still performing well at present, while a significant proportion that did not perform well at that time are still performing poorly or have ceased to exist. However, before 2000, no discernable pattern in unit trust returns was evident and investors that invested based on past performance did not experience significantly high returns, on average.

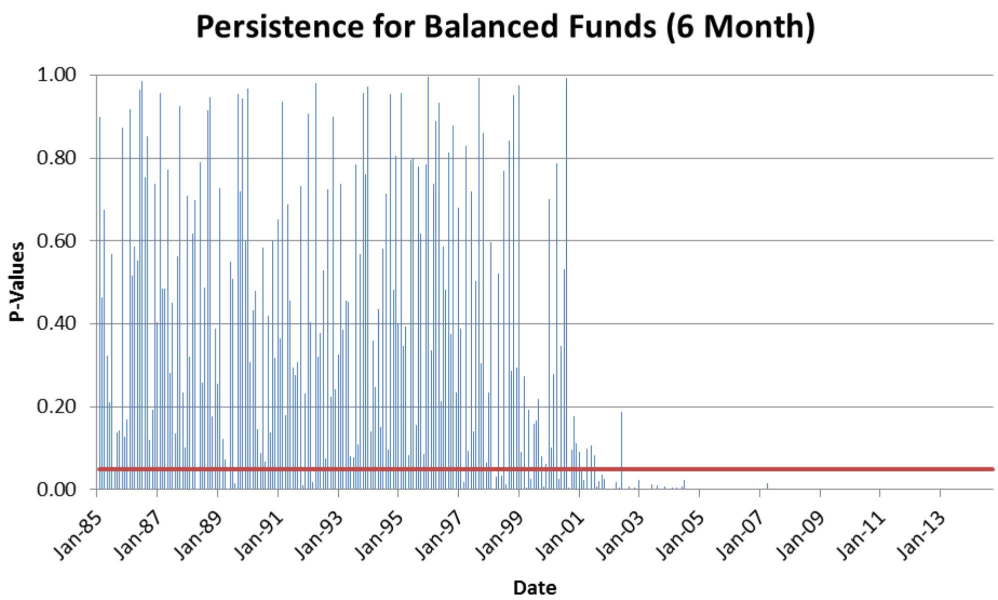

Figure 12: P-Values for Balanced Funds over 6 Months

Figure 13 shows similar results to *figure 12* in that persistence exists for balanced funds that are used for investments over two year durations but from about 2005; indicating that an investment strategy based on past performance for medium term investors would have been profitable for a significant proportion of investors since 2005.

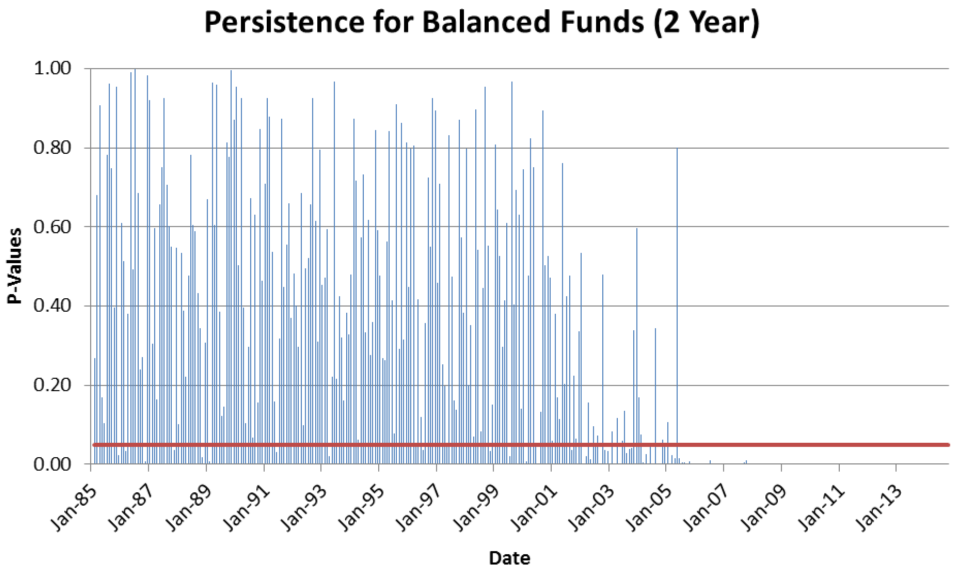

Figure 13: P-Values for Balanced Funds over 2 Years

The congruent results for investors in balanced funds over 6 month and 2 year horizons is clearly shared with those that invest over 5 year time horizons, but only from around 2009. Therefore, only very recently has it been profitable to pick lucrative funds from the pool of successful past performers over longer time horizons for balanced funds.

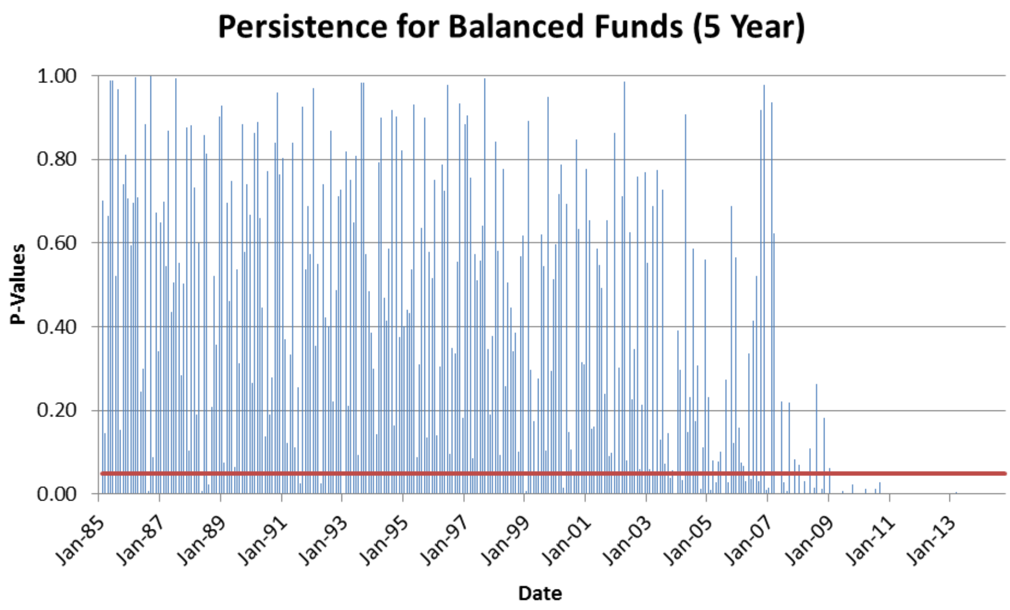

Figure 14: P-Values for Balanced Funds over 5 Years

Equity Funds

As with the semi-annual balanced funds, persistence seems to exist in the latter stages of the data for equity funds too, as they tend to show persistence over 6 month periods as well. Investment strategies that are based on past performance for equity funds can be seen to have been profitable even earlier than for balanced funds over the same investment duration. This is seen in the semi-annual persistence which is evident since about 1999.

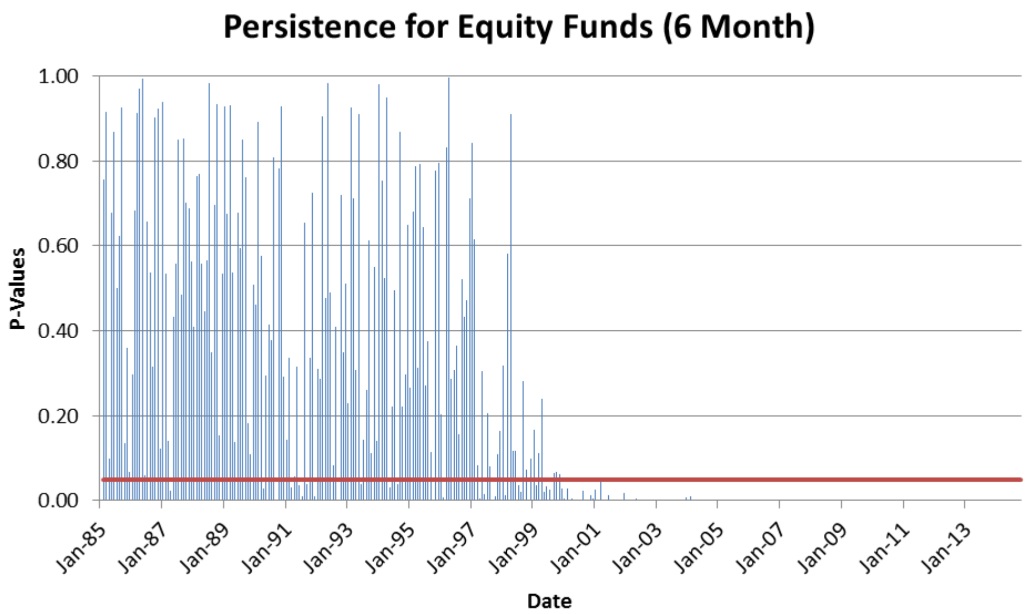

Figure 15: P-Values for Equity Funds over 6 Months

Bi-annual persistence is again seen for equity funds since approximately 2001, which is even earlier than for balanced funds.

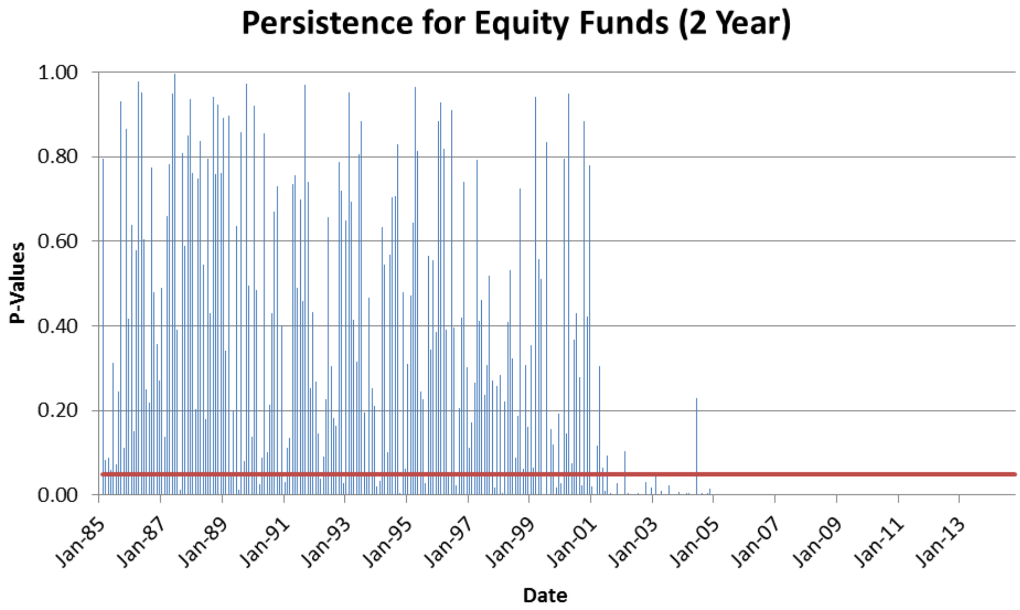

Figure 16: P-Values for Equity Funds over 2 Years

Like balanced funds, where the pattern of emerging persistence only appeared in 2009 for 5 year investment horizons, equity funds react similarly over this period as persistence is seen to emerge from around 2008. Overall, for each investment horizon under consideration, equity funds display the same pattern as do balanced funds with persistence being a recent phenomenon. The only difference between the two asset classes is that equity funds seem to have begun displaying persistence two or three years earlier than balanced funds.

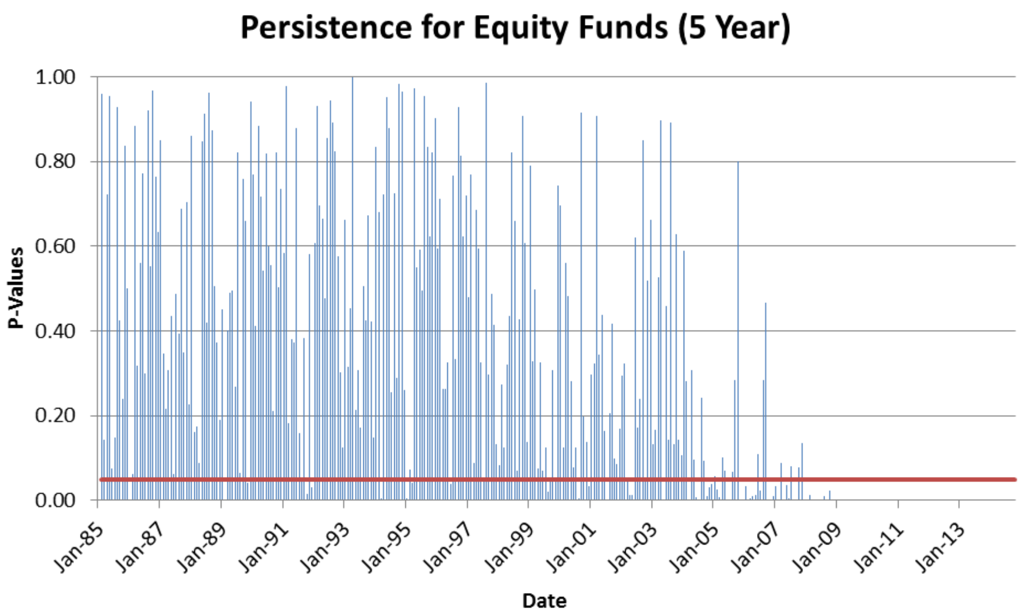

Figure 17: P-Values for Equity Funds over 5 Years

Fixed-Income Funds

Fixed-income funds also look to imitate both balanced funds and equity funds with regards to the patterns in persistence that they exhibit. Like both balanced funds and equity funds, persistence emerges as a significant feature over time for each investment horizon and does so later in time as that investment horizon increases. For fixed-income funds, semi-annual persistence appears around 2002, bi-annual persistence emerges around 2004 and 5 year persistence arises around 2009.

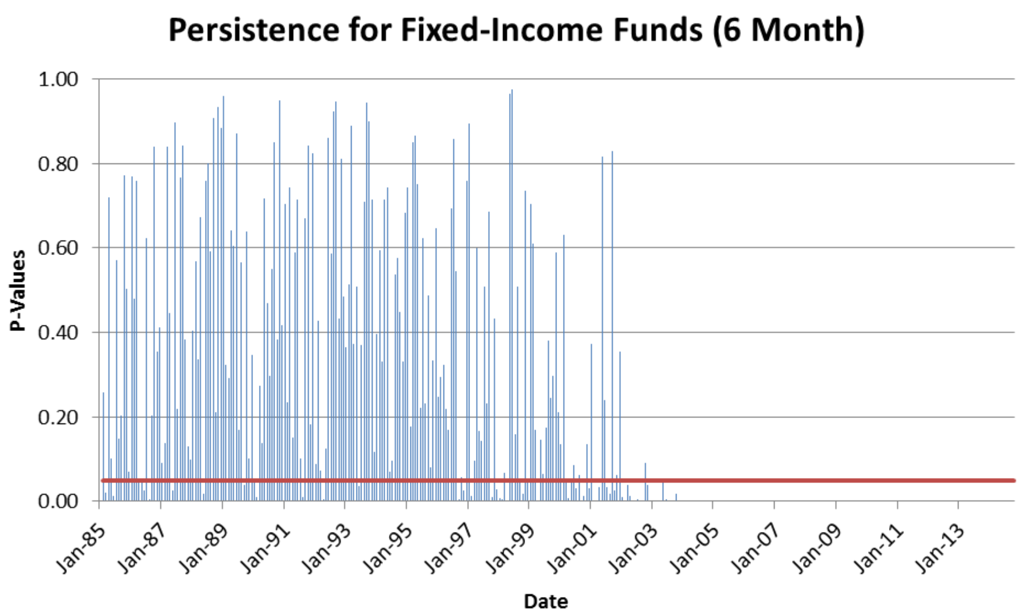

Figure 18: P-Values for Fixed-Income Funds over 6 Months

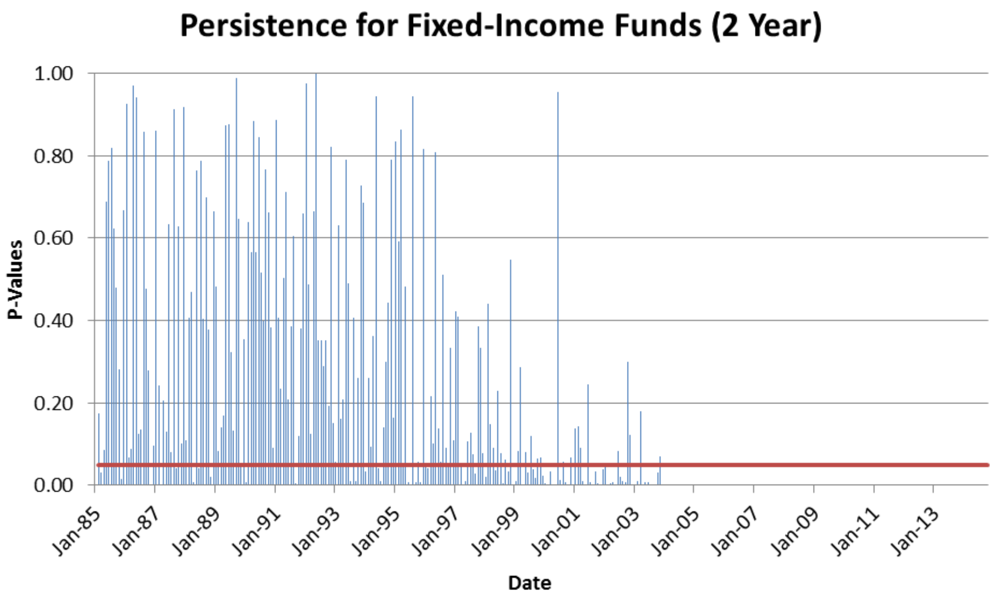

Figure 19: P-Values for Fixed-Income Funds over 2 Years

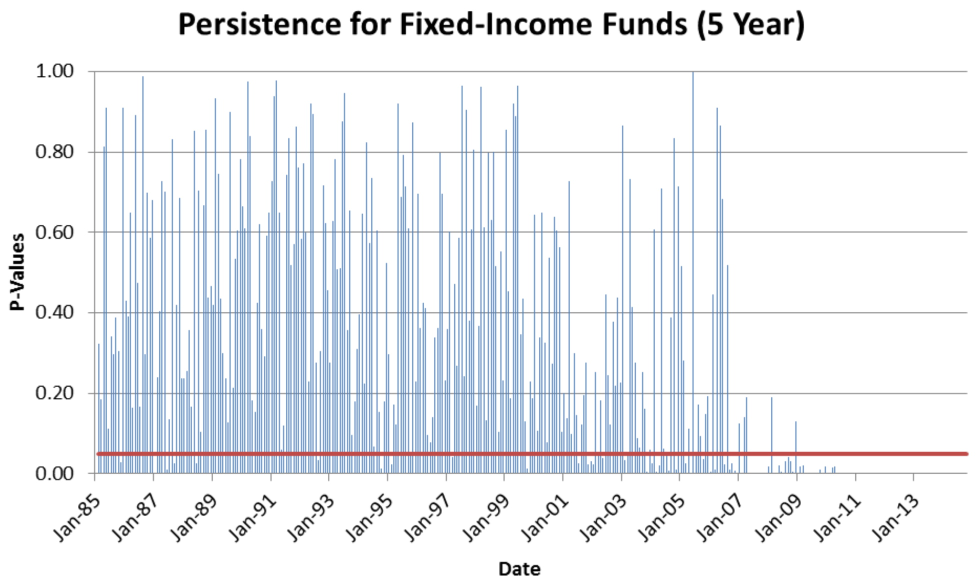

Figure 20: P-Values for Fixed-Income Funds over 5 Years

Property Funds

While very similar patterns of persistence are seen for balanced, equity funds, and fixed-income funds; property funds yield results that are entirely different. No significant persistence is seen in returns over any investment horizon for property unit trusts. However, this may be due to a problem pertaining to sample selection. While the balanced, equity and fixed-income asset classes consist of

314, 365 and 250 funds respectively, there are only 41 property funds in the data set and therefore this small subsample may have hidden persistence for South African property unit trusts since the mid-2000s.

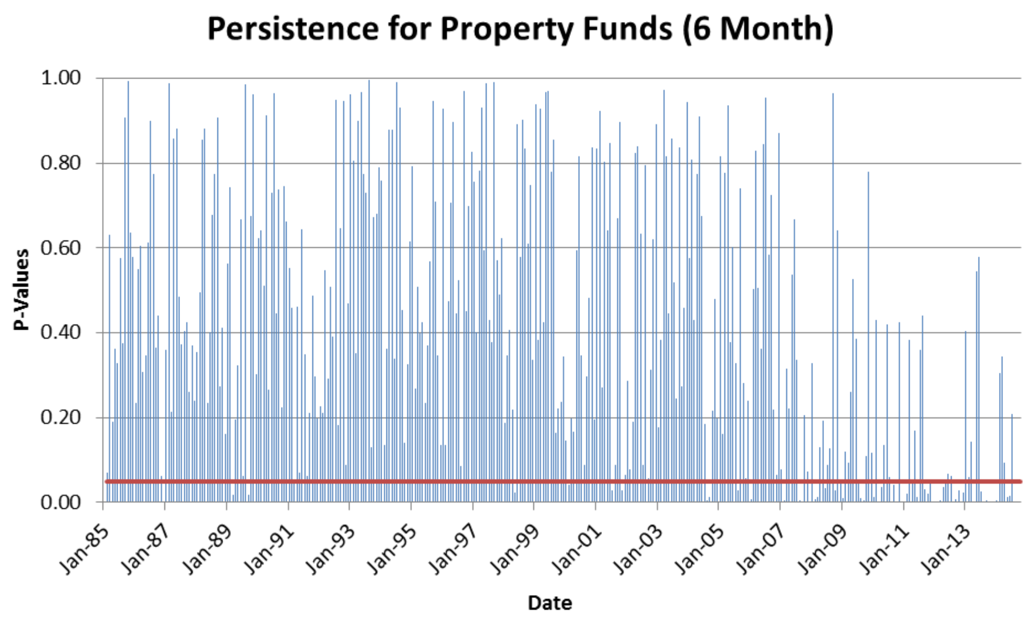

Figure 21: P-Values for Property Funds over 6 Months

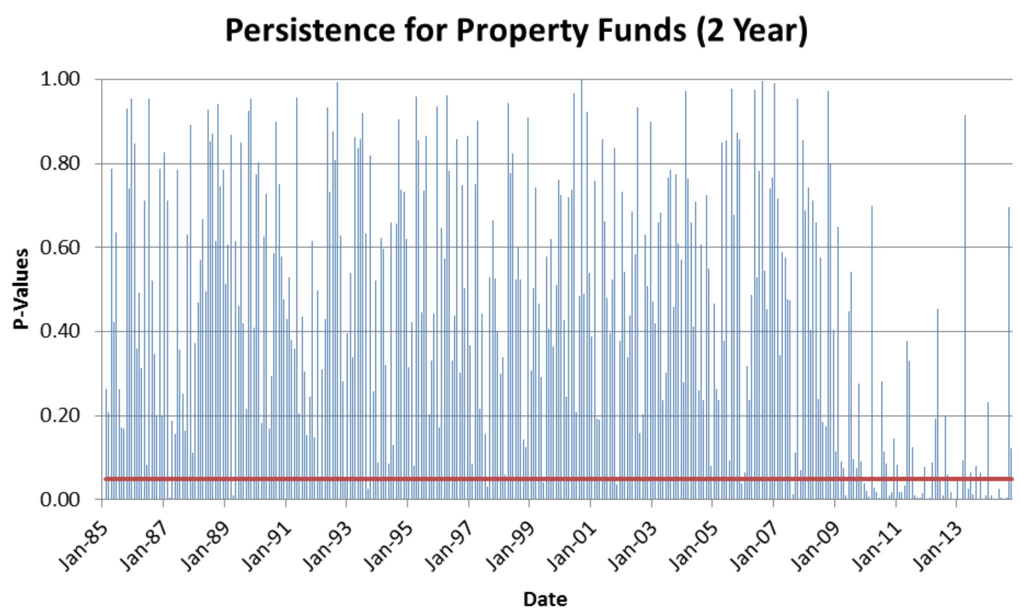

Figure 22: P-Values for Property Funds over 2 Years

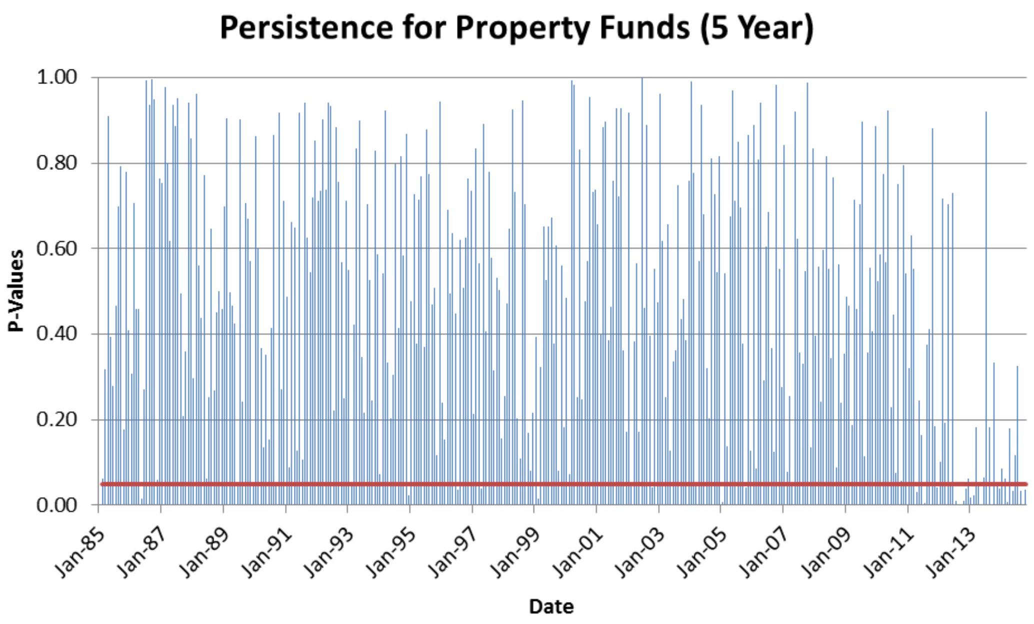

Figure 23: P-Values for Property Funds over 5 Years

Other Funds

Like property funds, 'other' funds are also susceptible to small sample problems as there are only 26 funds listed within this category; and as with property funds, no evidence of persistence is displayed over any of the semi-annual, bi-annual and half-decade investment horizons.

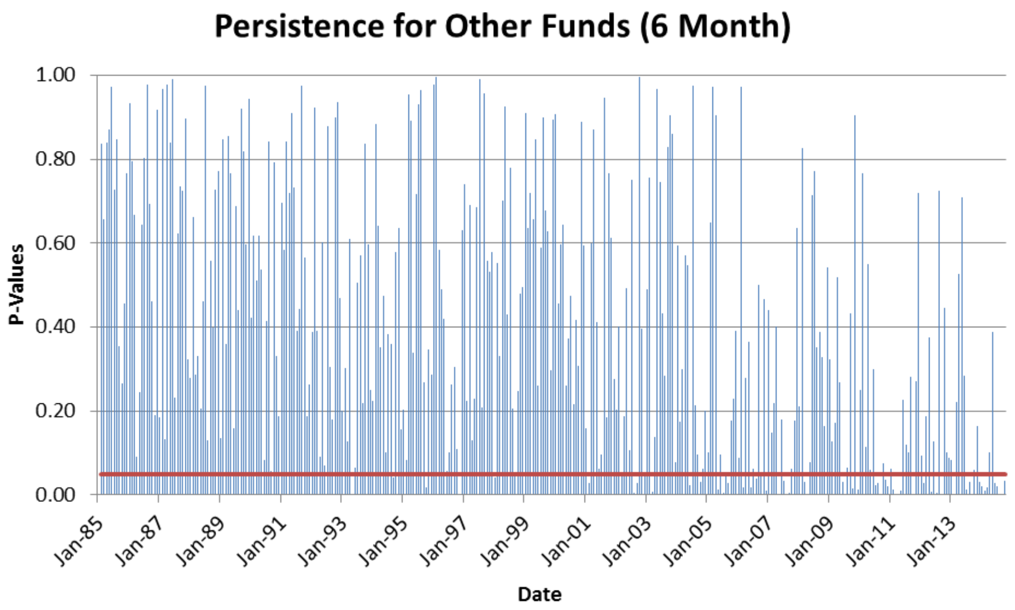

Figure 24: P-Values for Other Funds over 6 Months

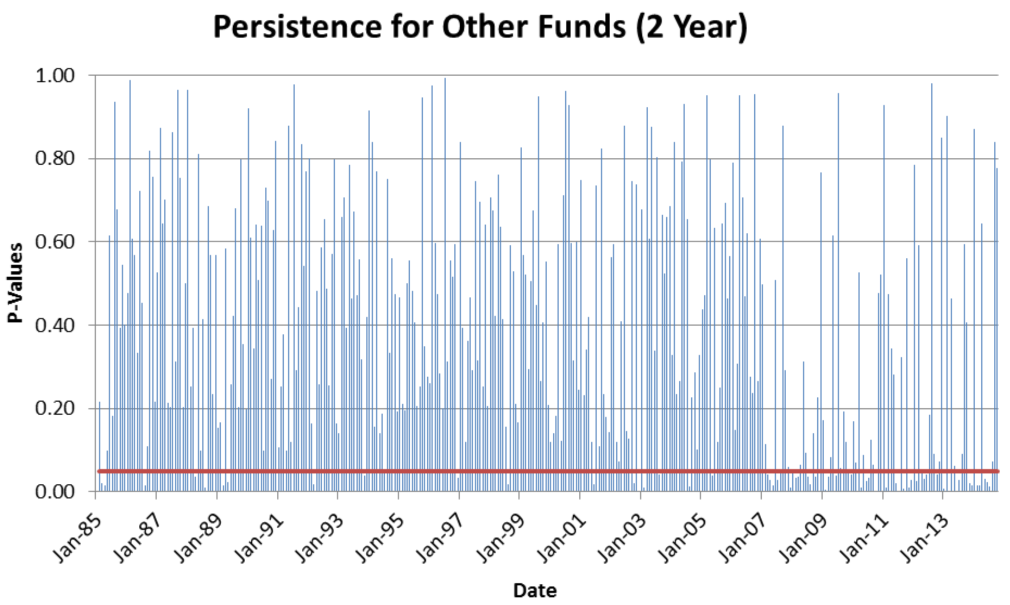

Figure 25: P-Values for Other Funds over 2 Years

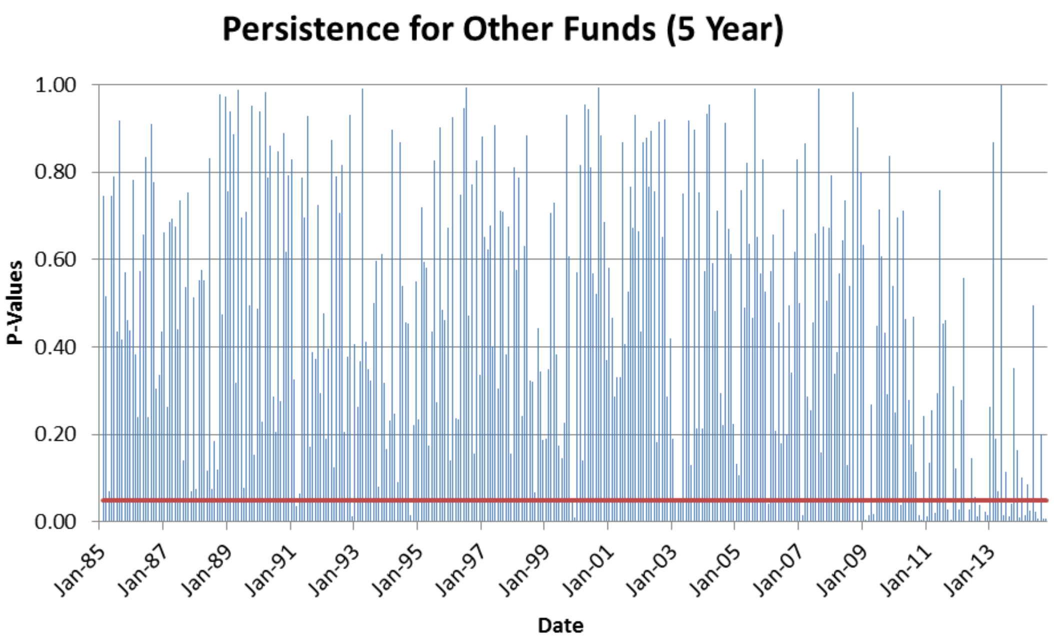

Figure 26: P-Values for Other Funds over 5 Years

The results that were obtained through the recursive portfolio tests for persistence share certain characteristics with the outcomes that were seen in the literature as well as some that are new to this study. Consistent with the literature is the result that persistence is not seen in earlier times, when many of these studies were carried out. Additionally, the prevalence of persistence seems to decrease as investment horizons increase, much like the literature which concludes that only short term persistence is a reality. The outcome that was not shared with the literature was that persistence for balanced funds, equity funds and fixed-income funds would emerge throughout the 2000s for all investment horizons. This result indicates that an investment strategy based on past performance has resulted in persistent returns over the last five to fifteen years, depending on asset class and investment horizon.

Though these results are fairly consistent among asset classes and share certain consistencies within the unit trust literature as a whole, certain caveats must be made. Firstly, the use of Sharpe Ratios as a risk-adjustment measure is seen as an unsophisticated strategy that displays persistence in unit trust returns more readily than do complex multi-factor CAPM models (Busse et al., 2010: 778; Nana, 2012: 158). Consequently, though some persistence – especially short term persistence – was found from the early 2000s, it has not necessarily been rational for investors to adopt an investment strategy in unit trusts that is based on past performance over this period. For future study into the topic it is suggested that equity funds be tested for persistence in isolation by means of more sophisticated risk-adjustment techniques, and then compared to the results that are found for other asset classes as well as the Sharpe Ratio results for equity funds themselves.

Secondly, the absence of cost data resulted in this analysis being conducted through gross returns and not net returns as advocated by the literature. Net returns tend to reduce both the potential for outperformance and persistence and therefore the above results may overestimate the extent of persistence that has actually been displayed over the last ten to fifteen years.

Thirdly, Bu and Lacey's 2014 study (2014:3) suggested adjusting for risk based on the age of a unit trust, concluding that younger funds tend to take on more risk than older funds, an adjustment that was not made in this paper.

Finally, the effect of survivorship bias has been shown to be vast, causing unit trust returns to be, on average, far higher than initially thought. Though this paper recognises the problem of survivorship bias and includes all available extinct funds into its data set, Bloomberg does not offer a complete set of extinct funds. It is therefore recommended that any future research obtain a more complete set of extinct fund data, as it would lead to more accurate estimates of average return and show a lesser proportion of funds to beat the benchmark.

Conclusion

Though persistence literature is widespread and thoroughly researched internationally, South Africa's unit trust sector is relatively new and has only recently yielded sufficient data in order to conduct a sound analysis as to the rationality of investors that chase past performance. This rationality depends on persistent outperformance in unit trust returns as a lack in persistent outperformance does not allow active investors in unit trusts to profit from such a strategy. International literature highlighted the importance of factors such as survivorship bias, risk-adjustment and the use of net returns instead of gross returns. Though survivorship bias was partially controlled for through the inclusion of all available extinct funds and risk-adjustment was conducted in the form of Sharpe Ratios, cost data was not available and therefore net returns could be used.

The literature produced three chief methods for conducting analysis into persistence; the Contingency Table Approach, the Recursive Portfolio Approach and the Time-Series Regression Approach. The Contingency Table Approach was described to yield persistence far too easily while the time-series approach did not offer much insight into its largely uninterpretable results; these factors, in addition to the clear preference for it in the literature, lead to the use of the Recursive Portfolio Approach.

Descriptive statistics then found small but significant proportions of funds to outperform their respective benchmarks on a risk-adjusted basis. However, the extent of this outperformance was minimal and in the absence of cost data it is likely that few of these funds actually do outperform their benchmarks net of costs.

Congruent to the results that were largely described in the literature, persistence was found over 6 month investment horizons for balanced, equity and fixed-income funds, and gradually faded as these investment horizons increased. Though no persistence was found under any investment horizon for property and other funds, their small sample sizes were postulated to have been the cause. One result unique to this study is that all evidence for persistence found in this paper has occurred since the early 2000s, indicating that although investors may have been irrational in chasing past performance for years gone by, their actions may have been justified over the last ten to fifteen years as far as unit trusts are concerned. However, certain caveats and the failure to detect persistence in conjunction with strong outperformance for unit trusts with reference to their benchmarks, point toward investor irrationality being more likely than not. Though a small percentage of fund managers have been able to beat their benchmarks, and persistently so in recent times, more profitable risk-adjusted returns could have been earned on average by investing in passive indices, regardless of persistence among unit trust returns.

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Appendix

Equation 1

$$Return\ (\%) = \left(\frac{Adjusted\ Price_t - Adjusted\ Price_{t-1}}{Adjusted\ Price_{t-1}}\right) * 100$$

Equation 2

$$Sharpe\ Ratio = \frac{Return_{i,t} - Return_{rf,t}}{\sigma_i}$$

Where:

- i refers to each individual fund.
- t refers to the time period in question.
- rf refers to the risk-free rate.
- σ refers to standard deviation.

Equation 3

$$Sharpe\ Ratio = \frac{\left(\left(\left(\frac{Adjusted\ Price_t}{Adjusted\ Price_{t-12}}\right) - 1\right) - 12\ Month\ Average\ Risk\ Free\ Rate\right)}{(12\ Month\ Standard\ Deviation)(\sqrt{12})}$$

Equation 4

$$t_{stat} = \frac{\rho}{s.e.(\rho)} = \frac{\rho}{\sqrt{\frac{(1-\rho^2)}{n-2}}}$$

Where:

- ρ refers to Spearman Rank Correlation
- $s.e.$ refers to standard error
- n refers to the number of unit trusts for a particular fund style

Equation 5

$$P\text{-}Value = TDIST(t_{stat}, DF, 2)$$

Where:

- t_{stat} refers to the calculated t-statistis
- DF refers to degrees of freedom
- 2 is used to signify that these t-statistics are calculated from a two-tailed hypothesis test

Table 1

Balanced Funds (6 Months)				
Date	**Spearman Rank Correlation**	**Standard Error**	**t-statistic**	**P-Value**
Oct-14	0.4290	0.0511	8.3895	0.0000
Sep-14	0.4901	0.0493	9.9327	0.0000
Aug-14	0.4244	0.0513	8.2779	0.0000
Jul-14	0.4082	0.0517	7.8994	0.0000
Jun-14	0.3666	0.0527	6.9592	0.0000
May-14	0.3418	0.0532	6.4235	0.0000
Apr-14	0.4301	0.0511	8.4145	0.0000
Mar-14	0.4043	0.0518	7.8083	0.0000
Feb-14	0.3744	0.0525	7.1317	0.0000
Jan-14	0.4029	0.0518	7.7756	0.0000
Dec-13	0.3588	0.0528	6.7899	0.0000
Nov-13	0.4190	0.0514	8.1499	0.0000
Oct-13	0.3528	0.0530	6.6607	0.0000
:	:	:	:	:
Apr-85	-0.0238	0.0566	-0.4199	0.6748
Mar-85	-0.0416	0.0566	-0.7352	0.4628
Feb-85	0.0072	0.0566	0.1264	0.8995

Table 2

Balanced Funds (2 Year)				
Date	**Spearman Rank Correlation**	**Standard Error**	**t-statistic**	**P-Value**
Oct-14	0.4201	0.0514	8.1768	0.0000
Sep-14	0.3407	0.0532	6.4007	0.0000
Aug-14	0.4360	0.0509	8.5583	0.0000
Jul-14	0.2626	0.0546	4.8064	0.0000
Jun-14	0.2907	0.0542	5.3668	0.0000
May-14	0.4164	0.0515	8.0890	0.0000
Apr-14	0.3650	0.0527	6.9257	0.0000
Mar-14	0.2554	0.0547	4.6652	0.0000
Feb-14	0.3406	0.0532	6.3986	0.0000
Jan-14	0.2229	0.0552	4.0381	0.0001
Dec-13	0.3864	0.0522	7.3989	0.0000
Nov-13	0.4160	0.0515	8.0803	0.0000
Oct-13	0.3435	0.0532	6.4601	0.0000
:	:	:	:	:
Apr-85	-0.0066	0.0566	-0.1170	0.9070
Mar-85	0.0233	0.0566	0.4120	0.6806
Feb-85	-0.0626	0.0565	-1.1081	0.2687

Table 3

Balanced Funds (5 Year)				
Date	**Spearman Rank Correlation**	**Standard Error**	**t-statistic**	**P-Value**
Oct-14	0.3815	0.0523	7.2896	0.0000
Sep-14	0.2613	0.0546	4.7812	0.0000
Aug-14	0.2793	0.0544	5.1384	0.0000
Jul-14	0.2455	0.0549	4.4726	0.0000
Jun-14	0.3420	0.0532	6.4283	0.0000
May-14	0.2298	0.0551	4.1716	0.0000
Apr-14	0.2512	0.0548	4.5848	0.0000
Mar-14	0.2685	0.0545	4.9241	0.0000
Feb-14	0.2473	0.0549	4.5086	0.0000
Jan-14	0.2878	0.0542	5.3075	0.0000
Dec-13	0.3623	0.0528	6.8651	0.0000
Nov-13	0.2872	0.0542	5.2971	0.0000
Oct-13	0.2642	0.0546	4.8377	0.0000
:	:	:	:	:
Apr-85	0.0246	0.0566	0.4341	0.6645
Mar-85	0.0824	0.0564	1.4599	0.1453
Feb-85	0.0217	0.0566	0.3841	0.7012

Table 4

Equity Funds (6 Month)				
Date	**Spearman Rank Correlation**	**Standard Error**	**t-statistic**	**P-Value**
Oct-14	0.3618	0.0490	7.3833	0.0000
Sep-14	0.3336	0.0495	6.7332	0.0000
Aug-14	0.2718	0.0506	5.3727	0.0000
Jul-14	0.3090	0.0500	6.1808	0.0000
Jun-14	0.3736	0.0488	7.6638	0.0000
May-14	0.3815	0.0486	7.8518	0.0000
Apr-14	0.4150	0.0478	8.6776	0.0000
Mar-14	0.3805	0.0486	7.8295	0.0000
Feb-14	0.3187	0.0498	6.3983	0.0000
Jan-14	0.4098	0.0479	8.5465	0.0000
Dec-13	0.4418	0.0472	9.3700	0.0000
Nov-13	0.3644	0.0489	7.4450	0.0000
Oct-13	0.3335	0.0495	6.7311	0.0000
:	:	:	:	:
Apr-85	-0.0869	0.0524	-1.6588	0.0980
Mar-85	0.0056	0.0526	0.1064	0.9153
Feb-85	-0.0162	0.0526	-0.3091	0.7574

Table 5

Equity Funds (2 Year)				
Date	Spearman Rank Correlation	Standard Error	t-statistic	P-Value
Oct-14	0.4247	0.0476	8.9257	0.0000
Sep-14	0.2944	0.0502	5.8612	0.0000
Aug-14	0.4263	0.0475	8.9657	0.0000
Jul-14	0.4033	0.0481	8.3860	0.0000
Jun-14	0.3819	0.0486	7.8623	0.0000
May-14	0.3143	0.0499	6.2991	0.0000
Apr-14	0.4560	0.0468	9.7488	0.0000
Mar-14	0.3034	0.0501	6.0582	0.0000
Feb-14	0.3554	0.0491	7.2346	0.0000
Jan-14	0.3759	0.0487	7.7175	0.0000
Dec-13	0.3516	0.0492	7.1463	0.0000
Nov-13	0.3672	0.0489	7.5114	0.0000
Oct-13	0.3755	0.0487	7.7074	0.0000
:	:	:	:	:
Apr-85	0.0892	0.0523	1.7032	0.0894
Mar-85	-0.0908	0.0523	-1.7350	0.0836
Feb-85	0.0136	0.0526	0.2593	0.7956

Table 6

Equity Funds (5 Year)				
Date	Spearman Rank Correlation	Standard Error	t-statistic	P-Value
Oct-14	0.2809	0.0504	5.5685	0.0000
Sep-14	0.2850	0.0504	5.6578	0.0000
Aug-14	0.2711	0.0506	5.3595	0.0000
Jul-14	0.3334	0.0496	6.7285	0.0000
Jun-14	0.2901	0.0503	5.7672	0.0000
May-14	0.2663	0.0507	5.2564	0.0000
Apr-14	0.3061	0.0500	6.1176	0.0000
Mar-14	0.3017	0.0501	6.0197	0.0000
Feb-14	0.3312	0.0496	6.6794	0.0000
Jan-14	0.2668	0.0507	5.2676	0.0000
Dec-13	0.3145	0.0499	6.3027	0.0000
Nov-13	0.3845	0.0485	7.9259	0.0000
Oct-13	0.3009	0.0501	6.0042	0.0000
:	:	:	:	:
Apr-85	0.0186	0.0525	0.3542	0.7234
Mar-85	0.0771	0.0524	1.4716	0.1420
Feb-85	0.0027	0.0526	0.0515	0.9589

Table 7

Fixed-Income Funds (6 Month)				
Date	**Spearman Rank Correlation**	**Standard Error**	**t-statistic**	**P-Value**
Oct-14	0.4657	0.0562	8.2873	0.0000
Sep-14	0.4803	0.0557	8.6242	0.0000
Aug-14	0.3774	0.0588	6.4181	0.0000
Jul-14	0.5258	0.0540	9.7356	0.0000
Jun-14	0.5326	0.0537	9.9093	0.0000
May-14	0.4750	0.0559	8.4998	0.0000
Apr-14	0.3751	0.0589	6.3720	0.0000
Mar-14	0.4062	0.0580	6.9996	0.0000
Feb-14	0.4236	0.0575	7.3638	0.0000
Jan-14	0.4188	0.0577	7.2638	0.0000
Dec-13	0.4071	0.0580	7.0195	0.0000
Nov-13	0.4041	0.0581	6.9574	0.0000
Oct-13	0.4574	0.0565	8.0995	0.0000
:	:	:	:	:
Apr-85	0.0229	0.0635	0.3605	0.7188
Mar-85	-0.1466	0.0628	-2.3333	0.0204
Feb-85	0.0717	0.0633	1.1323	0.2586

Table 8

Fixed-Income Funds (2 Year)				
Date	**Spearman Rank Correlation**	**Standard Error**	**t-statistic**	**P-Value**
Oct-14	0.4014	0.0582	6.9024	0.0000
Sep-14	0.5491	0.0531	10.3475	0.0000
Aug-14	0.4354	0.0572	7.6161	0.0000
Jul-14	0.5473	0.0531	10.2984	0.0000
Jun-14	0.5088	0.0547	9.3066	0.0000
May-14	0.4500	0.0567	7.9365	0.0000
Apr-14	0.4725	0.0560	8.4437	0.0000
Mar-14	0.3836	0.0586	6.5416	0.0000
Feb-14	0.4442	0.0569	7.8075	0.0000
Jan-14	0.3746	0.0589	6.3621	0.0000
Dec-13	0.3505	0.0595	5.8942	0.0000
Nov-13	0.3950	0.0583	6.7714	0.0000
Oct-13	0.3995	0.0582	6.8635	0.0000
:	:	:	:	:
Apr-85	0.0506	0.0634	0.7975	0.4260
Mar-85	0.0639	0.0634	1.0077	0.3146
Feb-85	0.1180	0.0631	1.8712	0.0625

Table 9

Fixed-Income Funds (5 Year)				
Date	**Spearman Rank Correlation**	**Standard Error**	**t-statistic**	**P-Value**
Oct-14	0.3989	0.0582	6.8506	0.0000
Sep-14	0.4272	0.0574	7.4403	0.0000
Aug-14	0.2689	0.0612	4.3971	0.0000
Jul-14	0.3242	0.0601	5.3968	0.0000
Jun-14	0.4000	0.0582	6.8728	0.0000
May-14	0.3511	0.0595	5.9044	0.0000
Apr-14	0.3490	0.0595	5.8639	0.0000
Mar-14	0.3374	0.0598	5.6435	0.0000
Feb-14	0.3173	0.0602	5.2686	0.0000
Jan-14	0.3027	0.0605	5.0013	0.0000
Dec-13	0.3537	0.0594	5.9543	0.0000
Nov-13	0.3388	0.0597	5.6709	0.0000
Oct-13	0.2422	0.0616	3.9316	0.0001
:	:	:	:	:
Apr-85	0.0149	0.0635	0.2354	0.8141
Mar-85	-0.0840	0.0633	-1.3271	0.1857
Feb-85	-0.0628	0.0634	-0.9908	0.3228

Table 10

Property Funds (6 Month)				
Date	**Spearman Rank Correlation**	**Standard Error**	**t-statistic**	**P-Value**
Oct-14	0.5935	0.1323	4.4854	0.0001
Sep-14	0.5556	0.1367	4.0642	0.0003
Aug-14	0.4851	0.1438	3.3747	0.0018
Jul-14	0.2067	0.1608	1.2852	0.2072
Jun-14	0.3872	0.1516	2.5541	0.0152
May-14	0.3981	0.1508	2.6397	0.0123
Apr-14	0.2737	0.1581	1.7307	0.0923
Mar-14	0.1555	0.1624	0.9578	0.3447
Feb-14	0.1684	0.1621	1.0389	0.3060
Jan-14	0.4498	0.1468	3.0635	0.0042
Dec-13	0.6470	0.1254	5.1617	0.0000
Nov-13	0.7505	0.1086	6.9087	0.0000
Oct-13	0.5614	0.1360	4.1270	0.0002
:	:	:	:	:
Apr-85	-0.2143	0.1606	-1.3344	0.1907
Mar-85	0.0796	0.1639	0.4855	0.6304
Feb-85	0.2935	0.1572	1.8677	0.0702

Table 11

Property Funds (2 Year)				
Date	**Spearman Rank Correlation**	**Standard Error**	**t-statistic**	**P-Value**
Oct-14	0.2583	0.1633	1.5817	0.1227
Sep-14	0.0667	0.1687	0.3953	0.6950
Aug-14	0.4526	0.1507	3.0025	0.0049
Jul-14	0.6136	0.1335	4.5974	0.0001
Jun-14	0.4660	0.1496	3.1162	0.0036
May-14	0.3684	0.1571	2.3447	0.0248
Apr-14	0.5675	0.1392	4.0771	0.0002
Mar-14	0.5022	0.1462	3.4357	0.0015
Feb-14	0.4166	0.1537	2.7113	0.0103
Jan-14	0.2014	0.1656	1.2165	0.2319
Dec-13	0.4130	0.1539	2.6831	0.0111
Nov-13	0.5362	0.1427	3.7577	0.0006
Oct-13	0.3069	0.1609	1.9080	0.0646
:	:	:	:	:
Apr-85	0.0461	0.1689	0.2730	0.7865
Mar-85	0.2121	0.1652	1.2841	0.2075
Feb-85	0.1887	0.1660	1.1371	0.2632

Table 12

Property Funds (5 Year)				
Date	**Spearman Rank Correlation**	**Standard Error**	**t-statistic**	**P-Value**
Oct-14	0.3435	0.1587	2.1641	0.0374
Sep-14	0.6624	0.1266	5.2306	0.0000
Aug-14	0.3489	0.1584	2.2022	0.0343
Jul-14	0.1662	0.1667	0.9969	0.3257
Jun-14	0.2620	0.1631	1.6059	0.1173
May-14	0.3481	0.1585	2.1965	0.0348
Apr-14	0.2249	0.1647	1.3656	0.1808
Mar-14	0.4277	0.1528	2.7993	0.0083
Feb-14	0.3101	0.1607	1.9300	0.0617
Jan-14	0.2856	0.1620	1.7633	0.0866
Dec-13	0.3398	0.1590	2.1373	0.0396
Nov-13	0.3251	0.1599	2.0335	0.0496
Oct-13	0.1638	0.1667	0.9824	0.3327
:	:	:	:	:
Apr-85	-0.0193	0.1690	-0.1140	0.9099
Mar-85	0.1690	0.1666	1.0143	0.3174
Feb-85	0.3092	0.1607	1.9236	0.0626

Table 13

Other Funds (6 Month)				
Date	**Spearman Rank Correlation**	**Standard Error**	**t-statistic**	**P-Value**
Oct-14	0.4156	0.1857	2.2386	0.0347
Sep-14	0.5605	0.1690	3.3160	0.0029
Aug-14	0.6596	0.1534	4.2997	0.0002
Jul-14	0.4545	0.1818	2.4999	0.0197
Jun-14	0.4329	0.1840	2.3527	0.0272
May-14	0.1763	0.2009	0.8772	0.3891
Apr-14	0.3296	0.1927	1.7100	0.1002
Mar-14	0.4602	0.1812	2.5396	0.0180
Feb-14	0.4909	0.1778	2.7604	0.0109
Jan-14	0.4547	0.1818	2.5010	0.0196
Dec-13	0.4209	0.1852	2.2732	0.0322
Nov-13	0.2806	0.1959	1.4323	0.1650
Oct-13	0.3730	0.1894	1.9696	0.0605
:	:	:	:	:
Apr-85	-0.0414	0.2039	-0.2032	0.8407
Mar-85	0.0910	0.2033	0.4477	0.6584
Feb-85	-0.0425	0.2039	-0.2084	0.8367

Table 14

Other Funds (2 Year)				
Date	**Spearman Rank Correlation**	**Standard Error**	**t-statistic**	**P-Value**
Oct-14	0.0584	0.2038	0.2865	0.7770
Sep-14	0.0414	0.2039	0.2030	0.8409
Aug-14	0.3570	0.1907	1.8721	0.0734
Jul-14	0.4789	0.1792	2.6726	0.0133
Jun-14	0.4466	0.1826	2.4451	0.0222
May-14	0.4242	0.1849	2.2946	0.0308
Apr-14	0.0947	0.2032	0.4661	0.6453
Mar-14	0.4660	0.1806	2.5799	0.0164
Feb-14	0.4733	0.1798	2.6323	0.0146
Jan-14	-0.0332	0.2040	-0.1628	0.8721
Dec-13	0.4679	0.1804	2.5933	0.0159
Nov-13	0.4494	0.1824	2.4645	0.0213
Oct-13	-0.1698	0.2012	-0.8441	0.4070
:	:	:	:	:
Apr-85	0.4665	0.1806	2.5836	0.0163
Mar-85	-0.4495	0.1823	-2.4655	0.0212

Table 15

Other Funds (5 Year)				
Date	**Spearman Rank Correlation**	**Standard Error**	**t-statistic**	**P-Value**
Oct-14	0.5062	0.1760	2.8756	0.0083
Sep-14	0.5105	0.1755	2.9086	0.0077
Aug-14	0.2591	0.1972	1.3143	0.2012
Jul-14	0.5218	0.1741	2.9964	0.0063
Jun-14	0.4452	0.1828	2.4354	0.0227
May-14	0.1399	0.2021	0.6923	0.4954
Apr-14	0.4351	0.1838	2.3674	0.0263
Mar-14	0.3429	0.1917	1.7885	0.0863
Feb-14	0.4658	0.1806	2.5784	0.0165
Jan-14	0.3291	0.1928	1.7073	0.1007
Dec-13	0.4888	0.1781	2.7451	0.0113
Nov-13	0.2812	0.1959	1.4354	0.1641
Oct-13	0.1906	0.2004	0.9513	0.3509
:	:	:	:	:
Apr-85	0.3615	0.1903	1.8993	0.0696
Mar-85	0.1333	0.2023	0.6591	0.5161
Feb-85	-0.0669	0.2037	-0.3284	0.7454