Persistence of Alpha in South African General Equity Unit Trusts

Research dissertation presented for the approval of the University of Cape Town Senate in fulfilment of part of the requirements for the degree of Master of Commerce specialising in Finance (in the field of Financial and Risk Management)

By: Rowan Andrew Hoch (HCHROW001)

Supervisor: Darron West

August 2015

Declaration

I, Rowan Andrew Hoch, hereby declare that the work on which this dissertation is based is my original work (except where acknowledgements indicate otherwise) and that neither the whole work nor any part of it has been, is being, or is to be submitted for another degree in this or any other university. I authorise the University to reproduce for the purpose of research either the whole or any portion of the contents in any manner whatsoever.

Rowan Andrew Hoch

14 August 2015

Abstract

The ability of active managers to produce consistent benchmark-beating returns is a topic that has been widely debated with increasing interest over the past decade. The majority of previous studies in which persistence of performance is tested consider a fund's ability to maintain its relative ranking over various time periods amongst its peer group. This study adds to the literature by considering the persistence of alpha, where alpha is defined as the out- or under-performance of a market-related benchmark.

Persistence of alpha for South African general equity unit trusts is tested over six-month, one-, two- and three-year formation and holding periods using a similar methodology to that of Collinet & Firer (2003). Alpha is found to persist most prominently in tests of one-year periods, with other period lengths yielding less significant results. Additionally, using the methodology of Malkiel (1995), certain funds which have demonstrated statistically significant persistent alpha over various periods are identified.

Contents

1. Introduction

The South African unit trust fund market has shown remarkable growth over the last few decades. According to statistics by The Association for Savings and Investment South Africa ("Asisa"), R1.694 trillion has been entrusted in the hands of the managers of 1 171 funds as at 31 December 2014[1]. For the investor, the assortment of available mandates, the high degree of liquidity and the ability to create a diverse portfolio, even with a minimal amount to invest, have made these investment vehicles attractive. For the investment manager, the ability to pool investments creates an opportunity of scale like no other in the financial services industry.

The majority of South African unit trusts are actively managed, meaning that the managers of these funds make "active" decisions of which instruments to buy and sell rather than tracking a pre-defined index or basket of instruments. Determining whether active management is a worthy pursuit has been a debate researchers have been investigating for many years. Being an advocate of active management denotes that the investment manager should be able to beat some predetermined benchmark or expectation, resulting in outperformance (or positive "alpha") of that benchmark.

Studies by Jensen (1968), Sharpe (1991) and Malkiel (1995) amongst others have shown that active managers are unable, on average, to outperform the market return without additional risk, thereby adding no additional value to investors. This average underperformance is mostly explained by the fees charged by these funds (Ippolito 1989; Fama & French 2010) and studies have shown that the South African market is no different (Bertolis & Hayes 2014). This is consistent with the efficient market hypothesis, formalised by Eugene Fama (1970), which suggests that information which contributes to the value of a security or market is priced into the security or market making it difficult or impossible for active managers to outperform the market at large (Fama 1970). Many academics and practitioners have essentially given up on the pursuit of adding value through active management, which has resulted in a rapid rise in passive investment products that aim to replicate the performance of a particular benchmark.

The efficient market hypothesis however is generally accepted to be overly simplistic. Fama presents in his 1991 paper that subsequent returns can be predicted from certain starting variables and he also studies the effects of events on security prices (Fama 1991; French & Fama 1992). While this does not automatically disprove the efficient market hypothesis, it gives credence to the fact that particular managers can outperform a benchmark based on the securities they initially chose. The fact that the actively managed unit trust industry is so large is testament to the supposed benefits of such a strategy.

[1]ASISA, Local Fund Statistics, 31 December 2014. http://www.asisa.org.za/index.php/en/statistics/collective-investment-schemes/local-fund-statistics [accessed 5 April 2015]

While previous studies have indicated that the unit trust industry on average cannot outperform the market, this does not preclude certain individual funds from outperforming the market.

This study aims to address a practical problem. Investors have very little information at hand when choosing an actively managed fund, aside from the past returns of the fund and perhaps a few historical risk measures. The investor does not have any measures available to him which, at face value, can predict accurately whether a fund is going to do well in the future. Instead, all fund reporting is backward looking and investors commonly use this information to determine in which funds to invest.

So important is past performance, that fund managers regularly advertise and display their prior rankings in the media. An entire industry has developed around reporting and awarding good prior performance. But of what value is superior prior performance if one was not invested in the fund at the time? Is it worthwhile chasing this prior performance and investing in the fund after the fact?

A persistence study of this nature endeavours to find evidence that funds, whether in aggregate or individually, are able to produce a particular result consistently. The basic theory behind the method used in this and other studies is that there is a past period of which performance measures are known, which is defined as the *formation period*, after which the investment decision is made. The subsequent period in which the investor received the performance of the fund is known as the *holding period*. A fund would be regarded as a persistent performer if it is regarded as a *winner* in both of these periods.

Most persistence studies are based on some form of relative ranking, even if the study does not explicitly say so. The large majority of such studies test for evidence of persistence by comparing a performance measure, for example excess returns, Jensen's alpha or the Sharpe ratio, for a fund versus the median result of that performance measure of the fund's peer group. Should the result of a fund be above the median performance of the group, then the fund is classified as a *winner* for that period.

This study rather compares the returns of a fund to that of a defined market benchmark, in particular the FTSE/JSE All-Share Index, rather than against the median performance of the peer group. This study defines a *winner* as a fund which outperforms this benchmark, and hence produces positive alpha. With the exception of a section of Brown & Goetzmann's (1995) study, this has been studied infrequently, and has not to the author's knowledge been studied using South African data.

The premise inherent in this method is that there are some investment managers that are consistently able to beat a benchmark and their ability is masked by the noise of the other managers in a relative ranking of their peer group. For example, when looking at the relative rankings of a group of funds, a certain fund which can consistently beat the benchmark by 1% in every period would be amongst the top funds in a period when outperforming by 1% was almost impossible and, conversely, said fund

would be amongst bottom ranked funds when such an outcome is easily achievable by, for example, using a momentum strategy in a rising market.

The relative ranking basis, on which most persistence studies are based, gives one an inappropriate interpretation of a fund's performance, because it undermines the performance of a particular fund which can consistently and persistently add a particular increment above the market, irrespective of the performance of the peer group.

In contrast to the current research, this study uses a market-related benchmark rather than a ranking relative to a peer group. As an investor can achieve close to benchmark returns by buying index tracking funds or derivative contracts, the benchmark return is assumed. This study aims to find funds that will outperform this benchmark in consecutive rolling periods, if such funds exist. The investment strategy being implied here is opposite to the *hot-hand* effect of Hendricks et al. (1993) and Goetzmann & Ibbotson (1994) who found that by consistently chasing last year's winners, one could outperform the market. Our standard is higher – we want to know whether any fund consistently outperformed, on a rolling basis, without subsequently reversing its performance. Such a fund would be identified as a persistent performer.

Chapter two of this paper analyses the current literature on the topic, chapter three describes the data and research methods employed, chapter four contains the results of our tests and finally, chapter five concludes.

2. Literature review

This section summarises the main literature that has been written on persistence of performance of investment funds. International studies are summarised first, followed by South African studies. The main conclusions of the international studies are summarised in table 1 and those of South African studies are summarised in table 2.

2.1 International studies

2.1.1 Early studies on fund performance

Early studies on mutual fund (unit trust) performance include Jensen's 1968 study which set much of the ground work for studies of mutual fund performance. Jensen did not study the relationship of successive performance periods as later studies do (and as we do in this paper), but rather endeavoured to determine whether an investment manager has the ability to forecast security prices using a single absolute risk/reward measure (Jensen 1968).

Jensen (1968) develops a pricing model in the same vein as the Capital Asset Pricing Model by regressing multiple observations of a single fund's excess return on the excess return of an index-based benchmark. Jensen determined that the intercept of the line would be a measure of excess, risk-adjusted performance. The slope of the regression line indicated the beta, which is a measure of the riskiness of the fund. A statistically significant positive intercept meant that a fund could in most instances earn returns in excess of the returns obtained from just buying more risky stocks. This measure is widely used today and is known as Jensen's alpha. This is an absolute, risk-adjusted measure of performance. This measure is different to alpha investigated in this study, which compares fund returns to those of the benchmark, without making adjustments for risk.

Jensen (1968) used his new measure in a study of 115 US mutual funds and found that the average alpha earned by the individual funds was negative 1.1%, implying that the funds surveyed were earning 1.1% less than they should have for the amount of risk (beta of the market) that they were taking on. Ippolito (1989) updated and extended this work using the same methodology but used a cross-sectional sample in addition to testing individual funds. Ippolito found a higher average alpha for the funds than Jensen did, and in contrast to Jensen, found that his sample of actively managed funds outperformed index funds on a risk-adjusted basis. However, when taking load (initial) fees into account, most of this outperformance disappeared.

Table 1: Significant international persistence studies

Author	Date	Data	Performance measures	Statistical method	Observation
Jensen	1968	115 US mutual funds 1945 - 1964	Jensen's alpha	N/A (pricing model)	Average Jensen's alpha for group of funds below zero
Ippolito	1989	143 US mutual funds 1965 - 1984	Jensen's alpha	N/A (pricing model)	Average Jensen's alpha for group of funds slightly above zero
Grinblatt & Titman	1989	157 US mutual funds 1975 - 1984	Jensen's alpha	Regression	Significant persistence for 5 year periods
Brown, Goetzmann, Ibbotson & Ross	1992	Between 126 and 153 US growth funds (depending on period)	Jensen's alpha	Contingency tables and regression	Shows survivorship bias accounts for persistence
Grinblatt & Titman	1992	279 US mutual funds 1975 - 1984	Jensen's alpha using eight-portfolio benchmark	Regression	Strong evidence of persistence over a 5 year period
Hendricks, Patel & Zeckhauser	1993	165 US mutual funds 1974 - 1988	Excess returns above risk-free rate	Ranked octiles	Short term evidence of persistence. Strongest over 1 year period
Goetzman & Ibbotson	1994	728 US mutual funds 1976 - 1988	Raw returns and Jensen's alpha	Contingency tables and regression	Evidence of persistence over one month to three years
Brown & Goetzman	1995	829 US equity funds 1976 - 1988	Raw returns, Benchmark-adjusted returns versus S&P 500 for tests of absolute persistence	Contingency tables	Evidence of one year persistence, but primarily focussed amongst losers
Kahn & Rudd	1995	300 US equity and fixed income funds 1983 - 1993	Raw returns and information ratio	Contingency tables and regression	Only finds evidence of persistence for fixed interest for 2 year periods, although information ratio provides limited evidence of persistence for equity funds
Malkiel	1995	724 US equity funds 1971 - 1991	Raw returns	Contingency tables and regression	Evidence of persistence for one-year periods stronger in 70s than 80s and 90s

Author	Date	Data	Performance measures	Statistical method	Observation
Elton, Gruber & Blake	1996	188 US equity funds 1977-1993	Raw returns and 4-factor alpha	Ranked decile portfolios	Persistence observed for 1-year to 12-year periods.
Gruber	1996	270 US equity funds 1985-1994	4-factor alpha	Ranked decile portfolios	Persistence observed for 1 year and 3 year periods.
Ferson & Schadt	1996	67 mutual funds 1968 - 1990	Conditional alpha	Ranked halves	Monthly persistence observed, particularly in outlier funds
Carhart	1997	1892 equity funds 1962 - 1993	Jensen's alpha, Fama and French 3-factor model, new 4-factor model with a momentum factor	Ranked decile portfolios	Evidence of 1 year persistence, but mostly disappears after adding momentum factor. Longer term negative persistence only in bottom decile funds.
Daniel, Grinblatt, Titman & Wermers	1997	Over 2500 equity funds 1975 - 1994	Raw return, Jensen's alpha, Carhart 4-factor model, Grinblatt and Titman measure, Characteristic style measure	Ranked quintile portfolios	Some evidence of 1 year persistence when using Grinblatt and Titman measure and characteristic-style measure
Khorana & Nelling	1997	123 US sector equity funds 1987 - 1992	Performance relative to peer median, benchmark-adjusted performance relative to S&P 500	Runs test	Little evidence of monthly persistence using runs test. Funds that do exhibit persistence are mainly from negative persistence.
Wermers	1997	Over 2700 mutual funds 1975-1994	Raw returns	Ranked decile portfolios	Some evidence of 1 year persistence
Christoperson, Ferson & Glassman	1998	One representative account from each of 185 US pension fund equity managers 1979 - 1990	Jensen's alpha, Conditional alpha vs value weighted AMEX and NYSE benchmark	Regression, ranked quintiles	Evidence of persistence. Strongest over 3 years.
Ibbotson & Patel	2002	"Most" US domestic equity funds 1975-2000	Benchmark-adjusted performance relative to stylized benchmark, performance relative to peer median	Contingency table and ranked halves	1 year persistence described, although not statistically proven

Author	Date	Data	Performance measures	Statistical method	Observation
Bollen & Busse	2004	230 US equity mutual funds 1985 - 1995	Abnormal returns, Sharpe ratio, Raw returns	Regression, ranked decile portfolios	Quarterly persistence observed in top decile
Busse & Irvine	2006	230 US equity mutual funds 1985 - 1995	Bayesian alphas for Jensen, Fama and French 3-factor and Carhart 4-factor models	Ranked decile portfolios	Quarterly persistence observed in top decile
Kosowski, Timmerman and Wermers	2006	1788 US equity funds 1975 - 2002	Bootstrapped Jensen's alpha, and other multifactor alphas	Ranked decile portfolios	Significant persistence for funds in top decile, based on bootstrapped 3-year alphas due to skill
Huij & Verbeek	2007	Over 6400 US equity mutual funds 1984 - 2003	Bayesian Jensen's alpha, raw returns	Ranked decile portfolios	Persistence observed for 1 year and 3 year periods.
Fama & French	2010	US equity funds 1983 - 2006	Bootstrapped Fama and French 3-factor model and Carhart 4-factor model	N/A (bootstrapped pricing model)	Very small sample of funds showed positive alphas due to skill
Barras, Scaillet & Wermers	2010	2076 US equity mutual funds 1979 -2006	Carhart's 4-factor model, controlling for false discovery of alpha due to luck	Ranked portfolios based on *False Discovery Rate*	Some short term persistence amongst skilled funds
Busse, Goyal and Wahal	2010	4617 US institutional composite equity products 1991 - 2008	Jensen's alpha, alpha from 3-factor and 4-factor models	Ranked decile portfolios and regression	Modest persistence observed over quarterly and 1-year periods using Jensen's and 3-factor models; No persistence using a 4-factor model or with any model over longer periods.
Busse & Tong	2012	US equity funds 1980 - 2009	Jensen's alpha, alpha from 3-factor and 4-factor models - with alpha attributed to stock-selection and industry selection	Ranked decile portfolios	Persistence of industry-selection alpha over quarterly periods
Petajisto	2013	2740 US mutual funds 1980 - 2009	Benchmark-adjusted return	Ranked quintile portfolios	One year persistence observed for "concentrated" portfolios, in contrast to no persistence for "closet index" portfolios

2.1.2 Early persistence studies

Grinblatt & Titman (1992) perform a true persistence study by extending Jensen's approach by not only calculating the risk-adjusted regressed Jensen's alpha value, but by doing this for two separate periods and then analysing whether the two are related.

Jensen's alpha for each of the funds is calculated over two separate 5-year periods. When calculating Jensen's alpha, Grinblatt & Titman (1992) use a proprietary 8-portfolio benchmark as opposed to using a market index benchmark. Using a dataset of 279 funds from 1975-1985, Grinblatt & Titman (1992) test for persistence by estimating the slope coefficient in a cross sectional regression of the alpha calculated from the last five-year period data on the first five year period data. The study finds that persistence exists – a statistically significant (at almost 1% confidence level) coefficient of 0.28 – meaning that for every 1% alpha in the first 5 years, the average fund can produce a greater 0.28% alpha in the second period. Secondly, Grinblatt & Titman (1992) do the same tests again by randomly positioning the monthly returns in two groups of 60 (random) months, and achieve similar results. The main conclusion that can be drawn from this is that the persistence is not due to persistence of performance at the individual stock level. This, however, was refuted in later studies which show that the momentum of individual stocks contribute to the persistence of performance (see Carhart (1997) below).

In a different approach to the question of whether funds can persistently outperform, Hendricks et al. (1993) investigate the investment strategy of buying previous winning funds and selling previous losing funds. The notion is that the fund manager who has recent good performance currently has a "hot hand" and can repeat this good performance in the following period. Using performance data from 165 US mutual funds from 1974-1988, funds are divided into eight portfolios which are ranked based on the most recent quarter performance. These portfolios are then re-evaluated in successive holding periods of varying lengths to determine whether the top portfolio can outperform the bottom portfolio in those holding periods. Hendricks et al. (1993) find strong evidence for persistence over a one-year time horizon, showing that the difference in the risk-adjusted returns between the top and bottom ranked portfolios is between six and eight percent per year. In addition, they find that the recent poor performers continue to do poorly in the following periods. In conclusion, they determine that a strategy of buying previous winning funds every year is an outperforming strategy.

Brown & Goetzmann (1995) use a contingency table approach to test for both relative and absolute persistence – where absolute measures are defined as returns in excess of a market benchmark, hence using the same method as this study. Using a sample of 728 US equity funds from 1976-1988, each fund is identified as either a winner or a loser in each calendar year. Being identified as a winner or loser depends on whether the fund's returns were above or below the median return of all funds for that particular year for the test of relative persistence, or whether its returns were above or below the S&P

500 benchmark for the test of absolute persistence. A contingency table is drawn up with each fund being classified according to its two successive year results.

By using this methodology with relative rankings, Brown & Goetzmann (1995) test a cross-sectional sample of 829 US mutual funds from 1976-1988 and find that in eight of the thirteen one-year periods tested, significant positive persistence exists and in two of the thirteen one-year periods, significant negative persistence exists.

When using an absolute benchmark, Brown & Goetzmann (1995) find that most of the persistence is due to the repeat losers as opposed to the repeat winners, which implies that preceding year underperformance versus an index benchmark is an excellent predictor of future underperformance.

Brown & Goetzmann (1995) further conclude that persistence is largely a group phenomenon and is also dependent on the particular time period observed. They conclude that persistence exists primarily because managers buy similar stocks, as opposed to buying unpopular stocks. The conclusion in the study is that chasing prior winners is a positive strategy, but also results in an increase in risk.

Brown and Goetzmann's (1995) results are consistent with those of Goetzmann & Ibbotson (1994) as well as Brown et al. (1992). Goetzmann & Ibbotson (1994) find proof of persistence not only over a one-year period, but also over two- and three-year periods. However, Brown et al. (1992) show that the effect of survivorship bias is strong enough to account for the significance in these results.

In contrast to the results of Brown & Goetzmann (1995), Goetzmann & Ibbotson (1994) and Brown et al. (1992), Kahn & Rudd (1995) do not find any evidence of persistence amongst equity funds in the period from 1983-1993 using the same relative ranking contingency table test described above, and corroborated this result with regression analysis, as used in the Grinblatt & Titmann (1992) study described above. This particular test, however, was only done for one particular three-year period, which, considering Brown & Goetzmann's (1995) inference regarding persistence being dependent on the particular time period observed, could somewhat explain this result.

For the regression analysis, Kahn & Rudd (1995) evaluate funds against a style (value, growth etc.) benchmark and attribute their findings of lack of persistence to this approach compared to the persistence found in previous studies. As an example, there could be two successive periods in which a *value* strategy outperforms a *growth* strategy, which could result in spurious persistence being present, as all *value* funds would be winners in both periods, and all the *growth* funds losers in both periods. A similar approach was followed by Patel & Ibbotson (2002) by using a stylized benchmark to test for persistence in US equity funds. In contrast to the findings of Kahn & Rudd (1995), Patel & Ibbotson (2002) found that persistence exists even after adjusting for the style of the fund. The difference could

perhaps be explained by the longer period studied – 25 years (1975-2000) in the study by Patel & Ibbotson (2002), versus 10 years in the study by Kahn & Rudd (1995).

Malkiel (1995) gives further credence to the notion that persistence is sensitive to the particular time period studied. Using a much wider time period than other studies done and using a sample of funds free of survivorship bias, Malkiel (1995) studies all equity funds over a twenty-one year period from 1971-1991. Malkiel (1995) finds that persistence, as measured in one-month, one- and two-year periods, is significant in the 1970s. However, no such evidence is found in the 1980s. Similar to the *hot hands* approach used by Hendricks et al (1993), Malkiel (1995) concludes that chasing the recent winners every year in the 1970s results in outperforming the S&P 500, but results in underperformance in the 1980s. Interestingly, these two contrasting decades are largely consistent with the dates of the data in the studies described above.

Elton et al. (1996) develop a similar risk-adjusted measure to the one developed by Jensen (1968) and use this measure to test for persistence. In a similar approach to the 3-factor pricing model developed by Fama & French (1993), Elton et al. (1996) find the risk-adjusted alpha as the intercept of a regression-based 4-factor model including the factors of excess returns of the market, the difference in returns between small and large capitalisation stocks, the difference in returns between growth and value stock, and the excess return on the bond index.

Elton et al. (1996) test for persistence on a sample of 188 US funds from 1977-1993 by ranking funds into ten deciles based on the above measure and then following how each decile performs in the following period. The study finds that the one-year, as well as the three-year prior period risk-adjusted alpha ranking is a significantly more accurate predictor of following period returns than raw returns are. Elton et al. (1996) also study a far longer holding (subsequent) period than any of the other literature up to the date of their study. The study finds that the top-ranked funds continue to beat the bottom-ranked funds for almost all of the following twelve years. This appears to be the longest test for persistence in the literature to this point.

However, certain questions are not investigated in this study. The quantum of the difference between top and bottom ranked is not investigated over the extended period. In addition, other previous researchers have noted that “losing” persistence is stronger than “winning” persistence. The question needs to be asked whether the top-ranked funds that continue to beat the bottom-ranked funds do so because they are superior funds, or whether the losing persistence results in the top ranked continuing to beat the bottom ranked funds. This is a question that requires an absolute measure of persistence.

Khorana & Nelling (1997) use non-parametric runs tests on monthly return data from 123 individual sector-specific funds for the period from 1987-1992 to test for evidence of persistence. Funds are evaluated on both a relative peer-group basis and relative to an index benchmark, more specifically the

S&P 500. Evidence of monthly persistence is found in 15 of the 123 funds, although most of this is negative persistence.

2.1.3 Studies which attempt to explain persistence

Prior to 1997, very little research was done on why certain funds exhibit performance persistence. Despite some contradictory results, the large majority of the research up until this point seemed to indicate that persistence not only exists, but is significant. The general consensus was that the mutual fund industry on average could not outperform a passive investment strategy, but certain top performing funds could add value above this on a consistent basis, and even more accepted was the notion that bottom ranked funds would continue to underperform their peers. The results, however, were largely supportive of short-term persistence, although certain caveats apply. These include the fact that investing styles are perhaps relevant and that persistence possibly occurred in particular times by similarly invested funds. Either way, there seemed to be evidence that gave active management credence.

Carhart's (1997) study disputes the fact that persistence is due to superior stock picking ability but rather due to common factors. Carhart (1997) tests his hypothesis in a similar manner to Elton et al. (1996) by inventing a proprietary 4-factor model based on Fama and French's 3-factor model. In addition to the factors in the original 3-factor model (excess market returns, large versus small capitalisation stocks, book-to-market ratio), Carhart (1997) includes a momentum factor.

The momentum factor used by Carhart (1997) was developed by Jegadeesh & Titman (1993) in the paper *Returns to Buying Winners and Selling Losers: Implications for Stock Market Efficiency* where it is found that a strategy of buying stocks that have performed well in the past and selling stocks that have performed poorly in the past is a strategy that generates significant positive relative returns over a three- to twelve-month period. Carhart's view is that this is a strategy that any uninformed investor could implement, and as such, the component of the investment returns as a result of this strategy should essentially not be counted towards the skill of the fund managers when evaluating the superior performance of funds.

To test for persistence, Carhart (1997) uses the same technique that Hendricks et al. (1993) use, which simulates continuously chasing prior year winning fund managers that have a *hot hand*. Carhart (1997) tests a sample of 1 892 equity funds from 1962-1993 and the results are consistent with those of Hendricks et al. (1993), which shows that persistence strongly exists in one-year periods. In fact, a significant overall additional gain of 8% per year is generated from buying the top decile and selling the bottom decile funds every year. Once Carhart (1997) applies his 4-factor model, most of the persistence is explained by the common factors used in the model. The difference between the positive alpha of the Fama & French 3-factor model and the close to zero alpha of Carhart's 4-factor model is

significant. This implies that the momentum factor - funds buying the previous year's winning stocks - is a key reason why funds persistently outperform.

In addition, Carhart (1997) shows that funds in the top decile change every year with an almost 80% turnover rate. This gives credence to the *hot hands* strategy and is an adverse indicator for our notion of a single manager persistently performing. Furthermore, Carhart (1997) shows that fund fees and portfolio turnover are negatively correlated to performance, while fund age and size are positively correlated.

Work done by Wermers (1997) corroborates the findings of Carhart (1997). Wermers (1997) agrees with the fact that the momentum factor explains most of the persistence found in prior studies but also shows (by studying the individual holdings of funds) that performance persists, not only because funds happen to hold the prior year's winning stocks, but because they actively buy the prior year's winning stocks.

The work done by Carhart (1997) and Wermers (1997) largely changed the direction of subsequent research. More focus was placed on the question of why certain funds outperform, and the question of the luck versus the skill of investment managers in explaining the performance of their funds became all the more important.

2.1.4 Studies using conditional varying factors

In all the papers reviewed above, there is an assumption that any common factor used within any pricing model remains static throughout the period. This assumption was first challenged by Ferson & Schadt (1996) and further investigated by Christopherson et al. (1998) and Daniel et al. (1997). These papers use a conditional, time-varying approach to the various factors within their pricing models. The argument for this approach is that fund managers are likely to use current information, for example the current risk-free rate, dividend yield on the market as a whole, term structure of interest rates and quality spread in the bond market, when structuring their portfolios.

The theory is based on the premise that should managers make informed decisions, taking into account the publically available information for the factors listed above, then the exceptional performance of these funds can be measured in excess of the performance achieved from the publically available time-varying factors by a new conditional alpha. A positive alpha would indicate that funds can produce returns in excess of those resulting from the publically known time-varying factors.

Christopherson et al. (1998) apply this conditional performance evaluation to a sample of 273 pension funds from 1979–1990. The study concludes that this conditional approach is better able to detect performance persistence than an unconditional approach (using non-conditional Jensen's alpha).

Similar to previous studies, the evidence of persistence is concentrated amongst the worst performers. No strong evidence of persistence is found in the top third-ranked funds.

2.1.5 Studies separating luck and skill

Much of the recent literature on the topic of persistence focusses on determining whether alpha obtained in pricing models (such as Jensen's alpha, or any other multi-factor alpha) is due to the manager being lucky or skilful. Various approaches have been followed, such as the one by Kosowski et al. (2006) which uses a bootstrap approach to identify fund managers who are consistently top relative performers because of their skill, rather than because of luck.

Kosowski et al. (2006) argue that the bootstrap approach gives a better indication of a statistically significant positive alpha because the returns of a fund follow a non-normal distribution. This technique prevents a fund from having statistically significant positive alpha by chance. Kosowski et al. (2006) find that by adjusting for the non-normal distribution, they are able to identify certain superior managers who are able to generate positive alphas due to their skill.

In addition to finding funds with significant alphas due to skill, Kosowski et al. (2006) test the persistence of these alphas. Evidence is found that the top decile ranked performing funds based on previous 3-year alpha from Carhart's 4-factor model display persistence and can continue to maintain their ranking over time.

Fama & French (2010) use the same approach as Kosowski et al (2006) when calculating a bootstrapped alpha from the Fama & French 3-factor model and the Carhart 4-factor model. They find some evidence that there is persistence amongst the most highly ranked funds, however, only those within the 98^{th} percentile. Their result is therefore less convincing than that of Kosowski et al. (2006). Fama & French (2010) attribute this difference to the simulation approach used as well as the fact that they only required 8 months of return history to be included in their sample, whereas Kosowski et al (2006) required 60 months.

Both studies conclude that there are certain fund managers with the skill to persistently outperform on a risk-adjusted basis, although they are few and far between.

A different approach by Barras et al. (2010) to the luck versus skill question uses a False Discovery Rate approach to divide a fund population up into skilled funds, zero-alpha funds and unskilled funds. The study finds that there is some evidence of short term persistence amongst the very skilled managers. The study also finds that the proportion of skilled funds has decreased over the time period studied from 1979-2006.

2.1.6 Recent persistence studies

Bollen & Busse (2004) and Busse & Irvine (2006) use Bayesian statistics when calculating alphas on a sample of 230 equity funds from 1985–1995. The studies find that Jensen's alpha calculated using Bayesian techniques is a significant indicator of persistence. Most of the studies focus on shorter, mainly quarterly time periods and use daily data to calculate fund alphas. The Bayesian technique is used as opposed to an ordinary least squares regression when calculating alpha, as it reduces the problem of sampling error when there are a small number of observations. Furthermore, Busse & Irvine (2006) show that the alpha of the funds is greater than that which can be explained by Carhart's 4-factor model.

Busse & Irvine's (2006) results are corroborated by Huij & Verbeek (2007) who use a much larger sample of funds (6 400) over a longer period of time (1984–2003). Huij & Verbeeek (2007) follow the same methodology and also find statistically significant persistence for up to 36 months.

Very few studies have been performed on the persistence of performance using institutional-only investment products with the exception of Busse, Goyal & Wahal's 2010 paper. Busse et al. (2010) use a sample of 4 617 equity only institutional investment products for the period 1991–2008. Single-factor (Jensen's), 3- and 4-factor alphas are calculated for all the products and it is found that, consistent with the mutual fund studies, the aggregate alpha of these products is indistinguishable from zero, implying that the industry at large cannot outperform the market without taking on additional risk. Busse et al. (2010) test for persistence using a ranked decile approach and find modest evidence of persistence over shorter time periods (quarterly and yearly) using Jensen's alpha and the alpha from the Fama and French 3-factor model, but no evidence over longer periods. Consistent with the work done by Carhart (1997), no persistence is found in any period when controlling for the momentum factor.

Busse & Tong (2012) attempt to explain the alpha that funds generate by attributing it to individual stock selection and the industry selection of the fund. The thesis being that industry selection contributes to a fund's returns, and fund managers can earn positive alpha by having a portfolio of stocks in the right industry at the right time. The study tests for persistence separately for the industry-selection component of the alpha and the stock-selection component of the alpha, based on quarterly time periods. Testing almost all US equity funds from 1980-2009, the study finds that the industry-selection component of alpha persists while the stock-selection component of alpha does not.

Petajisto (2013) analyses 2 740 funds over the period 1980–2009 by categorising these funds based on their active share (percentage of fund that differs from benchmark) and tracking error into different categories ranging from *closet index* funds to *stock pickers*. The study tests for persistence for each of the categories and finds that the more active the fund is (the further the portfolio from the benchmark), the greater the evidence of persistence. Persistence of performance is the most prevalent for the *concentrated* category of funds over one-year periods.

2.2 South African studies

In line with international studies, the results of persistence studies performed in South Africa have been mixed. Studies performed on data prior to 2000 show more evidence of persistence than post-2000 studies, and the results are largely dependent on the performance measure tested, the length of period tested and the starting and end dates of each test study.

2.2.1 Early persistence studies

Early South African studies examining persistence include those by Meyer (1998) and von Wielligh & Smit (2000). Both of these studies focus on unit trusts from the late 1980s to the early 1990s and both find evidence of persistence. Both studies find evidence of winning funds repeating. However, interestingly, Meyer (1998) finds evidence of losers repeating, whereas von Wielligh & Smit (2000) find that losing funds tend to perform better in successive periods. The difference could likely be explained by the time periods studied; Meyer (1998) studies one-, two- and four-year holding periods, whereas von Wielligh & Smit (2000) study one-year periods.

Bradfield & Swartz (2001) study South African equity units from 1995-2001 and find significant evidence of persistence, most of which is primarily concentrated in the top quartile funds. Furthermore, the study tests the *hot hands* strategy of buying the previous year's top quartile funds and find that an investor would have earned a cumulative 96% return over the six-year period by following this strategy versus the peer group benchmark return of 58%.

Firer et al. (2001) examine persistence for both equity and fixed income South African unit trusts for the period from 1989-1999 using formation and holding periods of between three months and two years. The returns of the funds are evaluated relative to their peer group median return and strong evidence of persistence is found for equity funds irrespective of the combination of the holding and formation period tested. It is also found that two-year periods are the best predictor of following two-year period returns. This is in contrast to the study by Collinet & Firer (2003) discussed below, which finds that shorter periods are better predictors of subsequent performance. Some evidence of persistence is found for fixed income funds but the evidence is not as significant as it is for equity funds.

Table 2: South African persistence studies

Author	Date	Data	Performance measures	Statistical method	Persistence period and observation
Meyer	1998	13 SA equity and bond unit trusts 1985-1995	Raw returns, Jensen's alpha	Contingency tables	Evidence of persistence over 1-, 2- and 4-year periods, mostly due repeat losers
Von Wielligh & Smit	2000	SA general equity unit trusts 1988 - 1997	Raw returns	Ranked terciles	Evidence of winning persistence over 1-year periods
Bradfield & Swartz	2001	SA general equity unit trusts 1995 - 2001	Raw returns	Ranked quartiles	Significant winning persistence over 1-year periods
Collinet & Firer	2003	SA general equity unit trusts 1980 - 1999	Raw returns, Sharpe ratio	Contingency tables, Regression, Runs test on individual funds	Positive evidence of persistence found, mostly in 6-month period; evidence of persistence highly sensitive to ending date of test
Edwards, Firer, Hendie & Schepping	2001	SA equity and fixed income unit trusts 1989 - 1999	Raw returns	Contingency tables	Strong evidence for equity funds, particularly over 2-year periods; evidence for fixed income funds weaker than equity funds
Oldham & Kroeger	2005	SA equity unit trusts 1998 - 2002	Jensen's alpha, 4-factor APT model	Regression	Some persistence for some particular 1-year periods
Scher & Muller	2005	106 SA general equity unit trusts 1990-2002	Alpha from Fama & French 3-factor model	Regression	Negative persistence observed amongst small-cap and value funds for at least 2-year periods
Grey	2005	48 SA general equity unit trusts 1998-2003	Raw returns, Jensen's alpha, single and 2-factor APT models	Contingency tables, regression, ranked percentiles	Some evidence over 6-month periods
Wessels & Krige	2005	SA general equity unit trusts 1988 - 2003	Raw returns, benchmark adjusted returns	Ranked percentiles and deciles	Short-term persistence evident; only a few specific funds persistent performers or underperformers over longer periods (3 to 5 years)
Brown	2008	SA equity unit trusts 1993 - 2004	Excess returns, Jensen's alpha, Sharpe ratio, Treynor ratio, Sortino ratio and Omega statistic	Contingency tables and percentile ranking	Evidence of persistence, strongest in 1-quarter periods
Nana	2011	SA equity unit trusts 2001 - 2010	Raw returns, Sharpe ratio, Jensen's alpha, Fama & French 3-factor alpha, Carhart 4-factor alpha, conditional alpha	Contingency tables, regression, ranked percentiles	Evidence of short-term persistence between 2001-2005; limited evidence between 2006-2010
Thomas	2012	SA general equity unit trusts 2000 - 2011	Raw returns, Sharpe ratio	Contingency tables	No evidence of persistence

2.2.2 Recent persistence studies

The first significant persistence study based on South African data published in an international journal was done by Collinet & Firer (2003). The study uses both non-parametric (contingency tables) and parametric (regression) methods to test for persistence on a dataset of 47 actively managed South African general equity unit trusts for the 20-year period from 1980-1999. The number of funds in the dataset grew from 7 in 1980 to 47 by 1999 and a large proportion of the ultimate number of funds in the study were only established in the latter half of the 20-year period. The results therefore should be interpreted with caution due to the small sample size.

Using the contingency table methodology as used in the study by Brown & Goetzmann (1995), Collinet & Firer (2003) rank funds according to their relative returns against the median return of their peer group. The tests are done over various combinations of 6-month, 1-, 2- and 3-year formation and holding periods. The strongest evidence of persistence is found over 6-month formation and holding periods.

Collinet & Firer (2003) alter the starting point of the analysis a number of times. Irrespective of the starting period, funds exhibit performance persistence over the 6-month periods. However, over 1- and 2-year periods, the strength of the evidence of persistence depends on the start date of the test. No evidence of persistence is found over 3-year periods. Collinet & Firer (2003) corroborate their results using a regression-based methodology, which regresses the percentile rank of the funds in successive periods. Once again, the strongest evidence is found over 6-month periods, with a continual decrease in the slope coefficient as the length of the periods increases.

Collinet & Firer (2003) also follow the methodology of Khorana & Nelling (1997) to perform a multi-period runs test to test individual funds for evidence of persistence. Funds exhibit persistence based on this methodology if they consecutively repeated their status of returning above or below the mean in consecutive periods. Only two of twenty-five funds show a non-random sequence of returns based on 6-month consecutive periods, with the results from other period lengths being inconclusive.

Collinet & Firer's (2003) study was later updated by Thomas (2012) using South African general equity unit trusts from 2000-2011. Thomas (2012) finds no evidence of persistence based on the same methodology using this later dataset.

Wessels & Krige (2005) study performance persistence on South African equity funds from 1988–2003 using a ranked decile approach. The study finds that a few funds remain persistent outperformers and a few funds remain persistent underperformers over time, but the rankings of the large majority of funds appear to be random, particularly over 3-year and 5-year periods.

Amongst the South African studies using Jensen's alpha, or alpha from any other multi-factor pricing model as a performance measure are those of Scher & Muller (2005), Oldham & Kroeger (2005), Grey (2005) and Nana (2011).

Oldham & Kroeger (2005) use a limited dataset of only five years from 1998–2002 and perform the study with single calendar year formation and holding periods. Some evidence of negative persistence is found in 1999/2000 year pair based on Jensen's alpha, and some evidence of positive persistence is found in the 2001/2002 year pair using a multi-factor model, with industrial, mining and financial sector returns as factors. Grey (2005) uses rolling periods to analyse the data and his results are consistent in that he finds limited evidence of persistence, particularly over half-year periods. Nana (2011) observes a change in the limited evidence of persistence found from positive persistence in the former half of his ten-year study from 2001–2010, to negative persistence in the latter half of the study.

Scher & Muller (2005) use a stylised approach to test 106 South African equity funds from the period 1990–2002 to test for evidence of performance persistence. The study uses Sharpe's (1992) method for categorising the funds into one of the following four categories: value, growth, small-cap and large-cap, from which hypothetical stylised portfolios are created. Scher & Muller (2005) use the Fama & French 3-factor model to test for persistence by calculating the alpha of each portfolio one year after the initial categorisation to test for indication of persistence. It was found that the hypothetical small-cap and value portfolios exhibited negative persistence for at least two years. This implies that South African fund managers were unable to take advantage of inefficiencies in these categories of stocks to contribute to their overall return.

The results of these studies are consistent with international studies using alpha as a performance measure, as limited evidence of positive persistence was found. It appears that by using an alpha, much of the persistence found in other studies is explained away by the other factors in the model. It is also noticeable how the trend of persistence declines over time. This could, perhaps, be indicative of the South African market becoming more efficient over time, leading to limited opportunity to outperform.

In his PhD dissertation, Brown (2008) reconstructs theoretical equity carve-out portfolios from the equity holdings of South African unit trusts in General Equity, Value, and Growth categories for the period from 1993–2004. By reconstructing carve-out portfolios, Brown (2008) tests for persistence before fees are taken into account, which also diminishes the effect of cash-drag on portfolios. Brown (2008) tests for persistence using contingency tables and a ranking-based methodology utilising various performance measures and time periods. These measures include the Jensen's alpha, Sharpe ratio, Treynor ratio, Sortino ratio and Omega statistic for which performance persistence is tested over periods of one to four quarters.

Persistence is found to occur frequently across all measures used, with Jensen's alpha and the Omega statistic being stronger predictors of future returns than raw returns, Sharpe, Treynor and Sortino ratios. The strongest evidence of persistence is found in one quarter periods with declining evidence of persistence found for each successive longer period.

2.3 Conclusion

Studies in performance persistence have had mixed results. Overall we can conclude, with caution, that persistence of performance does exist. Early studies have shown persistence, with the large majority of significant studies reaching this conclusion decisively.

Carhart (1997) shows that most of the persistence found is due to the momentum of individual stock in the portfolio, while Brown et al. (1992) explain persistence through survivorship bias. Repeat losing persistence seems to be more prevalent than repeat winning persistence throughout all the studies reviewed and most studies show that shorter time periods are more likely to indicate persistence than longer time periods. Performance persistence is also shown to be a group phenomenon, and is also sensitive to the time period tested.

The majority of studies test for persistence on a relative basis. With a few exceptions, performance is rarely compared to an external measure, such as a market benchmark. This study aims to address this gap, specifically in the South African context.

3. Research methodology

3.1 Introduction

The key outcomes that this study aims to achieve are, firstly, whether there is evidence of persistence of performance using the returns of funds over or under the benchmark return, and secondly, whether individual funds can be identified that can persistently out- or underperform the benchmark.

This study defines "alpha" as the return of the fund less the return of the benchmark. This definition of alpha does not take risk adjustments into account, and is therefore not the same as the alpha calculated as the intercept of a regression-based model.

This study has practical implications. With the continued criticism of active management strategies, and the subsequent rise in passive investment products, this study aims to inform investors whether active strategies can produce persistent benchmark-beating returns. As the current literature indicates that on average funds cannot produce positive alpha, this study aims to identify the few individual funds that can persistently produce positive alpha. Despite knowing that equity returns are subject to volatility, an investor would prefer to be invested in a fund that has a high probability of beating the benchmark after investing in the fund, rather than to receive benchmark returns. This introduces the notion of persistence of alpha.

Investing in equity instruments is inherently a relative investment – relative to the market. By investing in equity instruments, we have to accept the level of risk of the market in order to achieve the return of the market. Actively managed funds strive to add alpha, while taking on less risk. In most of the studies discussed in Chapter 2, funds are ranked vis-á-vis one another in order to determine whether they are outperformers or underperformers. By ranking funds relative to each other, funds that can consistently beat a market benchmark could alter in ranking due to the median performance of the peer group to the benchmark changing. Because of this, this study's methodology focusses on alpha, as opposed to a fund's return relative to the peer-group aggregate return.

Fund returns are analysed on a rolling basis. Reported performance figures for funds, on a fund fact sheet for example, are subject to end-point bias. This implies that the prior returns, usually of varying lengths, are reported up to one specific date. This is a small sample from which to make an informed decision. By doing this analysis we are reducing the probability that one set of performance figures, up to one specific date, are random and were achieved due to luck.

In addition to the shortcoming of the current literature discussed above, most studies use a sample of funds to ascertain if there is statistically significant evidence of persistence for that sample at one point in time (a cross-sectional sample). Few studies use rolling data. Furthermore, most studies do not expand their results by identifying which of the funds exhibit persistence from their own performance

histories. Some exceptions to this include a small study of Portuguese mutual funds (Cortez et al. 1999) and a study of sector-specific funds (Khorana & Nelling 1997).

As discussed in Chapter 2, the results of current persistence studies are mixed. These results are ascribed to the fact that the aggregate performance of a group of funds is below that of the benchmark due to fees, and there appears to be limited skill in the investment industry. It is not, however, precluded that certain funds may have skilled managers, and that those specific funds should exhibit performance persistence. The question therefore is whether there is any evidence in the South African General Equity retail unit trust market of persistence of alpha and over what period persistence manifests. Unfortunately, most South African funds have relatively short histories, and therefore testing this hypothesis over longer time periods, where the effect of volatility is negated, is not possible.

This study largely follows established methodologies for testing for persistence. Care is taken, however, to ensure that we are not making assumptions which would lead to a spurious result when testing for persistence of alpha, as opposed to when testing relative persistence.

3.2 Hypothesis

3.2.1 Hypothesis 1

The first null hypothesis focusses on the aggregate sample of funds. It questions whether, collectively, the funds exhibit repeat performance in a two-period framework:

- There is no relationship between the direction of alpha in the formation period and the direction of alpha in the subsequent holding period for funds.

3.2.2 Hypothesis 2

The second null hypothesis focusses on individual funds. It questions whether there is consistency of performance of each of these funds:

- The direction of alpha in the formation period of an individual fund is unrelated to the direction of alpha of the holding period of that fund.

3.3 Data

A database of total monthly returns for each of the unit trusts in the *South Africa – Equity – General* category of the Association for Savings and Investing South Africa ("Asisa") was obtained for the 13-year period from 1 January 2002 to 31 December 2014 from the Morningstar Direct database. The data obtained are discrete returns, net of fees for the particular class, for each calendar month for each of the

unit trusts and calculated with distributions reinvested. If a fund has multiple classes, only the most common class available to retail investors directly from the fund manager is used. The other classes of the same funds, which are usually only available to institutional investors or via life insurance (or other) wrappers or fund platforms, are ignored. As the fees on the direct retail class are in most cases higher than other classes, our assessment of a fund's ability to outperform the benchmark after fees is conservative. Considerable care was taken in corroborating the data on a sample basis with other sources, including the fact sheets of the relevant funds and Profile's online FundsData database. No inconsistencies were found.

In order to select the sample for testing, all index-tracking funds, multi-managed funds and fund of funds were removed from the database. As this study focusses on the success of particular investment managers, it is inappropriate to include these funds in the sample. The resultant sample consists of 110 funds, of which 33 were in existence for the entire 13-year period. 12 of these funds had performance histories of shorter than one year, meaning that they do not contribute data to any of the tests done in this study, as the shortest period studied is a total of 12 months (6-month formation period followed by a 6-month holding period).

For the tests performed on individual funds (in order to test hypothesis 2), only funds that had a performance history of at least 12 years are tested. If the fund has a performance history of at least 12 years, then the full performance history, up to the total of 13 years available, is included in the test. The motivation for having at least 12 years of data is to prevent the statistical tests suffering from small sample bias. The reason why 12 years of data was required in order for the fund to be included as opposed to 13 years, being the total available data, was to ensure that all of the 10 largest actively managed equity funds in the Asisa category are included in the sample.

3.4 Survivorship bias

Brown et al. (1992), Carpenter & Lynch (1999) and Wermers (1997) all show that the effect of funds disappearing during the sample period of a persistence study tends to skew the results of statistical tests. Brown et al. (1992) show that most of the winning persistence found in prior studies could be attributed to losing funds closing down as the number of winners in a relative study would be overstated, while Carpenter & Lynch (1999) show that survivorship bias somewhat affects the results of tests but did not find it to change the overall outcome of their persistence study conclusively.

For this study, funds which may have closed, merged or otherwise disappeared during the period were not included in the sample. As such, survivorship bias potentially exists for the sample. Generally, the primary motivation for a fund to close or merge would be due to continuous periods of underperformance. Due to the fact that funds are evaluated as a winner or loser for a particular period

by exceeding or underperforming a market benchmark, as opposed to the median return of all funds used in most persistence studies, a fund disappearing due to underperformance would not overstate the number of winners in the sample. This would lessen the effect of survivorship bias on the results.

For tests on individual funds, survivorship bias is irrelevant as the fund would have unlikely had a long enough performance history to be included in the sample, as the requirement was 12 years of data. In any event, tests are only performed on the 13 year performance histories of the funds in existence at 31 December 2014.

3.5 Methodology

In order to test hypothesis 1, the methodology of Collinet & Firer (2003) is followed. The important difference between this study and the study by Collinet & Firer (2003) is how winners and losers are defined. For each period, a fund is defined as a winner if alpha is greater than or equal to zero for that period and as a loser if alpha is less than zero for that period. This is different to Collinet & Firer (2003), who define a winner as a fund which outperformed the median performance of the group of funds tested, and a loser as a fund which underperformed the median performance of the group of funds tested.

The benchmark used in this study is the FTSE/JSE All-Share Index ("Alsi"), with income reinvested. All funds are evaluated against this benchmark, irrespective of the actual benchmark used by the fund itself. Some funds in the sample have benchmarks other than the Alsi. These include the FTSE/JSE Top 40 Index and the FTSE/JSE Shareholder-Weighted Index. The Alsi is used in this study as it is the mostly widely used benchmark for South African unit trusts, and is frequently reported and well understood.

The precedent for defining a winner as a fund with positive alpha for the period, and a loser as a fund with negative alpha for the period comes from the section of the study that deals with absolute persistence by Brown & Goetzmann (1995), which perform tests on contingency tables of winners and losers, where winners or losers are defined as outperforming or underperforming a specific benchmark. The difference in the methodology between Brown & Goetzmann's (1995) study and this study is that they use a cross-sectional sample to test all funds for evidence of persistence at specific points in time, whereas this study uses rolling time periods, as discussed below. Rolling time periods are used in Collinet & Firer's (2003) methodology. Another study that uses this approach is by Cortez et al. (1999) where individual funds are tested for evidence of persistence using contingency tables.

In order to test hypothesis 2, we adopt a test used by Malkiel (1995) in his study of performance persistence. The premise is simple. Malkiel (1995) uses the ratio of repeat performance versus performance reversing to show performance persistence. Malkiel (1995) shows the statistical

significance of this ratio using a modified z-test on a cross-sectional sample. We perform this test on individual funds to find which funds show statistical evidence of performance persistence.

This study does not purport to make any risk-adjustments to the performance histories of funds. While these are not precluded from being useful, they are already widely used in the academic literature and the reader is referred to one of other studies discussed in Chapter 2 which do make such adjustments.

In order to ensure that no inferences are made on the distribution of the samples, this study avoids parametric tests. Non-parametric tests, which are used elsewhere in the existing literature on persistence of performance, are adopted for this study.

3.5.1 Funds collectively: contingency tables

In a similar fashion to much of the existing literature on persistence, contingency tables are formed for the aggregate sample of unit trusts in order to test hypothesis 1.

In this study, formation and holding periods of the same length are used. Formation and holding periods are formed on a rolling basis, with the second formation period starting on the same date as the start of the first holding period. As in the study by Collinet & Firer (2003), this study alters the end date of the tests several times. This is done for two reasons. Firstly, because of how the formation and holding periods are formed (described above), limited periods would be tested if the study only ended on one ending date. Secondly, if there are differences in the results between the different tests it gives further credence to the notion that persistence is dependent on the time period followed.

The results are summarised as follows:

	Holding period W	Holding period L	Totals
Formation period W	WW	WL	WW + WL
Formation period L	LW	LL	LW + LL
Totals	WW + LW	WL + LL	WW + WL + LW + LL = N

In order to test the hypothesis we use the cross-product ratio and the chi-squared test on the contingency table described above. These are discussed below.

Cross-product ratio

The cross-product ratio ("CPR") is calculated for each contingency table formed and is used to measure the degree and direction of dependence. The CPR is calculated as follows:

$$CPR = \frac{(WW * LL)}{(WL * LW)}$$

A CPR of 1 implies that formation and holding periods are independent of one another. A CPR of greater than one indicates that repeat performance (winning or losing) is more common than repeat performance reversal. A CPR of less than one implies that the performance reversal is more common than persistence. Importantly, the CPR does not distinguish whether winning or losing persistence is contributing to the result. For example, a high CPR could indicate that successive periods are either both winning periods, or both losing periods, or another combination of these.

To test for statistical significance of the CPR, a z-statistic is calculated as follows:

$$z = \frac{\ln(CPR)}{\sigma_{\ln(CPR)}}$$

where:

$$\sigma_{\ln(CPR)} = \sqrt{\frac{1}{WW} + \frac{1}{WL} + \frac{1}{LW} + \frac{1}{LL}}$$

The z-statistic is normally distributed with a mean of zero and a standard deviation of one if the samples are large. The null hypothesis is rejected at the critical value of 1.96 for 5% significance and 2.58 for 1% significance.

Chi-Squared test

The chi-squared goodness-of-fit test is used to test the probability of independence. For a 2x2 contingency table as presented above, this test is as follows:

$$X^2 = \frac{(WW - D1)^2}{D1} + \frac{(WL - D2)^2}{D2} + \frac{(LW - D3)^2}{D3} + \frac{(LL - D4)^2}{D4}$$

where:

$$D1 = \frac{(WW + WL) * (WW + LW)}{N}$$

$$D2 = \frac{(WW + WL) * (WL + LL)}{N}$$

$$D3 = \frac{(LW + LL) * (WW + LW)}{N}$$

$$D4 = \frac{(LW + LL) * (WL + LW)}{N}$$

This statistic is also known as the Pearson statistic and it follows a chi-squared distribution with one degree of freedom. The null hypothesis, being that the direction of alpha in successive periods is unrelated, is rejected at the critical value of 3.841 for 5% significance and 6.635 for 1% significance.

Other forms of the chi-squared test can be used to test for homogeneity. Some persistence studies use these tests, for example Carpenter & Lynch (1999). They are, however, inappropriate for a study of persistence of alpha because the assumption that has to be valid for these tests to be used is that the expected frequencies are the same for each of the outcomes, which does not hold for tests of persistence of alpha. A more detailed explanation of which chi-squared test is appropriate in which instance is contained in Brown (2008), pp 53-57.

3.5.2 Individual funds: Malkiel (1995) z-statistic

In order to test hypothesis 2, Malkiel's (1995) methodology is followed.

For these tests on individual funds, this study uses rolling periods. For the rolling periods used in the study of individual funds, each formation period starts one month after the last, irrespective of the lengths of the periods tested. This is different to the contingency table tests described above, where each formation period starts at the beginning of the pervious holding period. The motivation for this is to include as many data points as possible for tests on individual funds. This is consistent with the practical situation of an investor who can invest at any point, and hopes to achieve a successful outcome (positive alpha) in the future based on the prior positive alpha of the fund.

The following ratio considers the probability of a winning fund continuing to be a winning fund in a successive period, or conversely a losing fund continuing to be a losing fund in a successive period:

$$\%\ Repeat\ W = \frac{WW}{(WW + WL)} \qquad \%\ Repeat\ L = \frac{LL}{(LL + LW)}$$

Malkiel' (1995) application of the z-statistic is used to test the statistical significance of the results. The test assumes that the probability of a fund being a winner/loser in successive periods is 0.5 and successive winners/losers follow a binomial distribution. If the actual value is greater than 0.5, this indicates persistence, whereas if the actual value is less than 0.5, this indicates reversal. To test if the percentage of winners repeating is statistically different to 0.5, the following formula is used:

$$z = \frac{(WW - (WW + WL)0.5)}{\sqrt{(WW + WL)0.5 \,.\, 0.5}}$$

and as follows to test repeat losers:

$$z = \frac{(LL - (LL + LW)0.5)}{\sqrt{(LL + LW)0.5 \,.\, 0.5}}$$

z is normally distributed with a zero mean and a standard deviation of one. The null hypothesis is rejected at the critical value of 1.96 for 5% significance and 2.58 for 1% significance.

4. Results

4.1 Funds collectively: Contingency table results

Appendix 1 contains all the results for the tests performed on the contingency tables. Table 3 below summarises these results.

Following Collinet & Firer (2003), the tests were performed several times with different end dates in order to test whether the significance of the evidence of performance persistence is contingent on the time period studied. The same ending months were used as those used by Collinet & Firer (2003). As the test statistics vary for each of the tests for the same periods, we can conclude that persistence is dependent on the time period studied.

Table 3: Summary of test statistics for repeat winners and losers

Period length	Ending month	% WW	% LL	$\chi 2$ statistic	CPR	CPR z-statistic
6	Sep 2014	22.2%	27.4%	0.13	0.96	-0.37
6	Oct 2014	20.9%	32.0%	2.93	1.20	1.71
6	Nov 2014	21.8%	31.6%	4.95**	1.27	2.22*
6	Dec 2014	20.9%	29.8%	0.06	1.03	0.25
12	Mar 2014	23.1%	33.5%	9.26**	1.66	3.03**
12	June 2014	20.3%	32.2%	1.08	1.19	1.04
12	Sep 2014	24.9%	33.9%	18.10**	2.00	4.23**
12	Dec 2014	25.1%	34.2%	22.01**	2.09	4.66**
24	Jun 2013	14.0%	38.5%	0.00	1.00	-0.02
24	Dec 2013	29.5%	23.2%	1.08	1.31	1.04
24	Jun 2014	10.8%	35.6%	3.80	0.58	-1.94
24	Dec 2014	11.8%	40.5%	0.35	0.85	-0.60
36	Jun 2013	14.1%	26.7%	4.06**	0.48	-2.00
36	Dec 2013	12.7%	31.8%	1.25	0.68	-1.12
36	Jun 2014	17.0%	19.8%	3.20	0.55	-1.78
36	Dec 2014	14.7%	39.8%	0.17	1.14	0.42

* Significant at the 5% level

** Significant at the 1% level

From table 3 we can see that performance persistence is most prevalent over one-year formation and holding periods, with three out of four tests showing statistically significant persistence. One-year formation and holding periods exhibit higher levels of persistence than 6-month periods. This is unusual in comparison to the existing literature. Both Collinet & Firer's (2003) and Brown's (2008) studies on

South African unit trusts showed that shorter periods exhibited higher levels of persistence than longer periods.

The results from the 2-year and 3-year periods are largely erratic. The results of the test statistics are mixed. Losing persistence increases over time as we can see from Malkiel's z-test for repeat losers in Appendix 1, which gets bigger and more significant as the time period increases.

In conclusion, the direction of one-year prior alpha is a significant predictor of one-year future alpha for the funds studied.

4.2 Individual fund results

For complete results of the tests performed on individual funds, refer to Appendix B. This shows both the repeat winner and repeat loser results for each of the funds, as well as the statistical significance thereof. A summary of the funds which exhibit repeat winner persistence at the 5% level of confidence for the Malkiel z-test is provided in table 4.

Table 4: Funds exhibiting statistically significant positive performance persistence from Malkiel's z-test.

6-month formation and holding periods
Coronation Top 20
PSG Equity

1-year formation and holding periods
Coronation Equity
Coronation Top 20
Foord Equity
PSG Equity
SIM General Equity

2-year formation and holding periods
Coronation Top 20
Foord Equity
Prudential Equity
PSG Equity

3-year formation and holding periods
Coronation Equity
Coronation Top 20
Foord Equity
Prudential Equity
SIM General Equity

The results show that the only fund that exhibits winning persistence for all lengths of formation and holding periods is the Coronation Top 20 Fund. This does not indicate that this fund has the highest magnitude of persistence, but rather that it has statistically significant winning persistence for all periods observed. Other funds which exhibited significant persistence include the Coronation Equity, PSG Equity, Foord Equity, SIM General Equity and Prudential Equity funds.

It is interesting to note the direction of the statistical significance of persistence over different time periods. The Coronation Top 20 fund has a higher significance of persistence as the periods get longer, while the PSG Equity has a lower significance of persistence as the periods get longer. This implies that the prior 3-year positive alpha found is the best predictor for future 3-year positive alpha for the Coronation Top 20 Fund, while prior 6-month positive alpha is the best predictor for future 6-month positive alpha for the PSG Equity fund.

Strong evidence of losing persistence (losing funds continuing to be losing funds) is apparent in the analysis of some individual funds. Losing persistence is far more prevalent than winning persistence throughout the sample of funds, with 10 of the funds in the sample being persistent losers over 3-year periods.

As is observed with winning persistence, some funds exhibit losing persistence irrespective of the length of the period. The Oasis Crescent Equity, Old Mutual Albaraka Equity, Personal Trust High Yield Growth and Stanlib Capital Growth Funds all exhibit statistically significant negative persistence, irrespective of the length of the holding and formation periods.

It is observed that as the periods lengthen, the number of funds exhibiting negative persistence increases. If these funds underperform in one period, it is highly unlikely that they will outperform in the next.

In summary, even though the tests of the aggregate sample of funds mostly exhibit losing persistence, there is evidence that some individual funds are persistently winning or persistently losing funds.

5. Conclusion

This study aims to address persistence of alpha produced by unit trusts and investigates persistence of the direction of alpha on an individual unit trust basis. By addressing persistence of alpha, the study attempts to reduce the noise effect of funds which vary in ranking over time, despite being consistent performers against a specific benchmark.

The hypothesis that a fund's past performance is not a predictor of its future performance could not be rejected outright. There is some evidence that past direction of alpha is an indicator of future direction of alpha. This evidence is strongest for one-year formation and holding periods. Consistent with the study by Collinet & Firer (2003), the persistence test statistics are highly dependent on the time period of the test. This study finds that persistence is primarily concentrated amongst losing funds, and the evidence of losing persistence increases over time. This conjectures that a fund that does poorly in one period, will most likely do poorly again in the next period.

Certain individual funds are identified as being persistent performers over 6-month, 1-, 2- and 3-year periods. A small number of funds are persistent performers irrespective of the formation and holding period studied. The only fund that is identified as a persistent performer in all of these period lengths is the Coronation Top 20 Fund. An increasing number of funds are identified as persistent losing performers as the formation and holding period duration increased. By assessing funds individually, it is deduced which funds are contributing to the persistence in the aggregate sample.

This study leaves many avenues for future research. In essence, the inclination of this study is towards an absolute measure of performance persistence. This is a vastly under-studied area. This study makes mention of the preferred investment outcome of a fund which can consistently outperform the benchmark. A future study can measure the consistency of an absolute alpha. The inherent limitation of this study is the binary winner or loser category by which a fund is evaluated. To take this further, a study could consider which funds are able to produce a consistent quantum of alpha period after period.

The study uses limited data in the statistical tests. A future study which considers consistency of an absolute quantum alpha, as mentioned above, could use data for a longer time period. Despite the fact that many established investment managers have been in existence for several decades, their unit trust funds are relatively new. In order to find data for a longer period study, one would need to look at established combined institutional products from the investment managers.

This study contributes to the literature in a South African context by addressing persistence of alpha- a topic which has not previously been researched. The study has practical implications for an investor considering the investment choice of firstly, whether to invest in funds with an active or passive strategy, and secondly, which actively managed funds to choose from.

References

Barras, L., Scaillet, O. & Wermers, R., 2010. False Discoveries in Mutual Fund Performance : Measuring Luck in Estimated Alphas. *The Journal of Finance*, 65(1), pp.179–216.

Bertolis, B.D.E. & Hayes, M., 2014. An investigation into South African general equity unit trust performance during different economic periods. In *Actuarial Society of South Africa's Convention*.

Bollen, N. & Busse, J., 2004. Short-Term Persistence in Mutual Fund Performance. *The Review of Financial Studies*, 18(2), pp.569–597.

Bradfield, D. & Swartz, J., 2001. Recent evidence on the persistence of fund performance–A note. *SA Journal of Accounting research*, 15(2), pp.99–109.

Brown, S. et al., 1992. Survivorship Bias in Performance Studies. *The Review of Financial Studies*, 5(4), pp.553–580.

Brown, S. & Goetzmann, W., 1995. Performance persistence. *The Journal of Finance*, 50(2), pp.679–698.

Brown, W.G.P., 2008. *Fund and Manager Characteristics: Determinants of Investment Performance*. University of Stellenbosch.

Busse, J., Goyal, A. & Wahal, S., 2010. Performance and Persistence in Institutional Investment Management. *The Journal of Finance*, 65(2), pp.765–790.

Busse, J. & Irvine, P., 2006. Bayesian Alphas and Mutual Fund Persisence. *The Journal of Finance*, 61(5), pp.2251–2288.

Busse, J. & Tong, Q., 2012. Mutual Fund Industry Selection and Persistence. *Review of Asset Pricing Studies*, 2(2), pp.245–274.

Carhart, M.M., 1997. On Persistence in Mutual Fund Performance. *The Journal of Finance*, 52(1), pp.57–82.

Carpenter, J.N. & Lynch, A.W., 1999. Survivorship bias and attrition effects in measures of performance persistence. *Journal of Financial Economics*, 54, pp.337–374.

Christopherson, J.A., Ferson, W.E. & Glassman, D.A., 1998. Conditioning Manager Alphas on Economic Information: Another Look at the Persistence of Performance. *The Review of Financial Studies*, 11(1), pp.111–142.

Collinet, L. & Firer, C., 2003. Characterising persistence of performance amongst South African general equity unit trusts. *Omega*, 31(6), pp.523–538.

Cortez, M.D.C.R., Paxson, D. a. & Armada, M.J.D.R., 1999. Persistence in Portuguese mutual fund performance. *The European Journal of Finance*, 5(4), pp.342–365.

Daniel, K. et al., 1997. Measuring Mutual Fund Performance with Characteristic-Based Benchmarks. *The Journal of Finance*, 52(3), pp.1035–1058.

Elton, E., Gruber, M. & Blake, C., 1996. The Persistence of Risk-Adjusted Mutual Fund Performance. *The Journal of Business*, 69(2), pp.133–157.

Fama, E.F., 1970. Efficient Capital Markets: A Review of Theory and Empirical Work. *The Journal of Finance*, 25(2), pp.383–417.

Fama, E.F., 1991. Efficient Capital Markets: II. *Journal of Finance*, 46(5), pp.1575–1617.

Fama, E.F. & French, K.R., 2010. Luck versus Skill in the Cross-Section of Mutual Fund Returns. *The Journal of Finance*, 65(5), pp.1915–1947.

Ferson, W.E. & Schadt, R., 1996. Measuring Fund Strategy and Performance in Changing Economic Conditions. *The Journal of Finance*, 51(2), pp.425–461.

Firer, C. et al., 2001. The persistence of performance of South African unit trusts. *South African Journal of Business Management*, 32(2), pp.1–8.

French, K.R. & Fama, E.F., 1992. The Cross-Section of Expected Stock Returns. *The Journal of Finance*, 47(2), pp.427–465.

Goetzmann, W. & Ibbotson, R.G., 1994. Do Winners Repeat? *The Journal of Portfolio Management*, 20(2), pp.9–18.

Grey, J.P., 2005. *Performance and Performance Persistence in South African General Equity Unit Trusts, a test of South African Market Efficiency*. University of Cape Town.

Grinblatt, M. & Titman, S., 1992. The Persistence of Mutual Fund Performance. *The Journal of Finance*, 47(5), pp.1977–1984.

Hendricks, D., Patel, J. & Zeckhauser, R., 1993. Hot Hands in Mutual Funds: Short-Run Persistence of Relative Performance. *The Journal of Finance*, 48(1), pp.93–130.

Huij, J. & Verbeek, M., 2007. Cross-sectional learning and short-run persistence in mutual fund performance. *Journal of Banking & Finance*, 31(3), pp.973–997.

Ippolito, R., 1989. Efficiency with Costly Information: A Study of Mutual Fund Performance, 1965-1984. *The Quarterly Journal of Economics*, 104(1), pp.1–23.

Jegadeesh, N. & Titman, S., 1993. Returns to buying winners and selling losers: Implications for stock market efficiency. *The Journal of Finance*, 48(1), pp.65–91.

Jensen, M., 1968. The Performance of Mutual Funds in the Period 1945-1964. *The Journal of Finance*, 23(2), pp.389–416.

Kahn, R.N. & Rudd, A., 1995. Does Historical Performance Predict Future Performance? *Financial Analysts Journal*, 51(6), pp.43–52.

Khorana, A. & Nelling, E., 1997. The Performance, Risk and Diversification of Sector Funds. *Financial Analysts Journal*, 53(3), pp.62–74.

Kosowski, R. et al., 2006. Can Mutual Fund "Stars" Really Pick Stocks? New Evidence from a Bootstrap Analysis. *The Journal of Finance*, 61(6), pp.2551–2595.

Malkiel, B.G., 1995. Returns from Investing in Equity Mutual Funds 1971 to 1991. *The Journal of Finance*, 50(2), pp.549–572.

Meyer, M.C., 1998. The persistence of unit trust performance from July 1985 to June 1995. *South African Journal of Business Management*, 29(3), pp.100–108.

Nana, M., 2011. *Unit Trust Performance in South Africa: An Emperical Investigation of the Outperformance and Performance Persistence over the Period 2001 to 2010*. The Univesity of the Witswatersrand, Johannesburg.

Oldham, G. & Kroeger, J.A., 2005. Performance, persistence and benchmarks of selected South African unit trusts for the period 1998-2002. *South African Journal of Business Management*, 36(4), pp.81–90.

Patel, A.K. & Ibbotson, R.G., 2002. Do Winners Repeat with Style? (unpublished working paper)

Petajisto, A., 2013. Active share and mutual fund performance. *Financial Analysts Journal*, 69(4), pp.73–93.

Scher, N. & Muller, C., 2005. Equity style and performance persistence in South African unit trusts. *Investment Analysts Journal*, 61(61), pp.5–16.

Sharpe, W.F., 1991. The Arithmetic of Active Management. *Financial Analysts Journal*, 47(1), pp.7–8.

Wermers, R., 1997. Momentum Investment Strategies of Mutual Funds, Performance Persistence, and Survivorship Bias. (unpublished working paper)

Wessels, D.R. & Krige, J.D., 2005. The persistence of active fund management performance. *South African Journal of Business Management*, 36(2), pp.71–84.

Von Wielligh, J.F.. & Smit, E. V, 2000. The persistence of performance of South African unit trusts. *South African Journal of Business Management*, 31(3), pp.120–129.

Appendix 1: Contingency table results

1.1 6-month formation and holding periods

Ending month	Sep 2014	Oct 2014	Nov 2014	Dec 2014
Observations	1410	1417	1431	1477
No. of Funds	96	97	98	98
WW	313	296	312	309
LL	387	453	452	440
WL	362	337	338	363
LW	348	331	329	365
% WW	22.2%	20.9%	21.8%	20.9%
% LL	27.4%	32.0%	31.6%	29.8%
CPR	0.96	1.20	1.27	1.03
CPR z-statistic	-0.37	1.71	2.22*	0.25
p-value	0.714	0.087	0.026	0.806
$\chi 2$	0.13	2.93	4.95**	0.06
p-value	0.714	0.087	0.026	0.806
% Repeat W	46.4%	46.8%	48.0%	46.0%
Malkiel z-test W	-1.89	-1.63	-1.02	-2.08
p-value	0.059	0.103	0.308	0.037
% Repeat L	52.7%	57.8%	57.9%	54.7%
Malkiel z-test L	1.44	4.36**	4.40**	2.64**
p-value	0.150	0.000	0.000	0.008

* Significant at the 5% level

** Significant at the 1% level

1.2 1-year formation and holding periods

Ending month	Mar 2014	June 2014	Sep 2014	Dec 2014
Observations	597	611	626	672
No. of Funds	83	86	86	88
WW	138	124	156	169
LL	200	197	212	230
WL	141	166	138	141
LW	118	124	120	132
% WW	23.1%	20.3%	24.9%	25.1%
% LL	33.5%	32.2%	33.6%	34.2%
CPR	1.66	1.19	2.00	2.09
CPR z-statistic	3.03**	1.04	4.23**	4.66**
p-value	0.002	0.299	0.000	0.000
$\chi 2$	9.26**	1.08	18.10**	22.01* *
p-value	0.002	0.299	0.000	0.000
% Repeat W	49.5%	42.8%	53.1%	54.5%
Malkiel z-test W	-0.18	-2.47	1.05	1.59
p-value	0.857	0.014	0.294	0.112
% Repeat L	62.9%	61.4%	63.9%	63.5%
Malkiel z-test L	4.60**	4.07**	5.05**	5.15**
p-value	0.000	0.000	0.000	0.000

* Significant at the 5% level

** Significant at the 1% level

1.3 2-year formation and holding periods

Ending month	Jun 2013	Dec 2013	Jun 2014	Dec 2014
Observations	200	241	250	262
No. of Funds	65	68	68	71
WW	28	71	27	31
LL	77	56	89	106
WL	57	72	85	69
LW	38	42	49	56
% WW	14.0%	29.5%	10.8%	11.8%
% LL	38.5%	23.2%	35.6%	40.5%
CPR	1.00	1.31	0.58	0.85
CPR z-statistic	-0.02	1.04	-1.94	-0.60
p-value	0.988	0.300	0.052	0.552
$\chi 2$	0.00	1.08	3.80	0.35
p-value	0.988	0.299	0.051	0.551
% Repeat W	32.9%	49.7%	24.1%	31.0%
Malkiel z-test W	-3.15	-0.08	-5.48	-3.80
p-value	0.002	0.933	0.000	0.000
% Repeat L	67.0%	57.1%	64.5%	65.4%
Malkiel z-test L	3.64**	1.41	3.41**	3.93**
p-value	0.000	0.157	0.001	0.000

* Significant at the 5% level

** Significant at the 1% level

1.4 3-year formation and holding periods

Ending month	Jun 2013	Dec 2013	Jun 2014	Dec 2014
Observations	135	173	182	191
No. of Funds	57	60	62	65
WW	19	22	31	28
LL	36	55	36	76
WL	27	71	93	48
LW	53	25	22	39
% WW	14.1%	12.7%	17.0%	14.7%
% LL	26.7%	31.8%	19.8%	39.8%
CPR	0.48	0.68	0.55	1.14
CPR z-statistic	-2.00	-1.12	-1.78	0.42
p-value	0.046	0.264	0.075	0.678
$\chi 2$	4.06**	1.25	3.20	0.17
p-value	0.044	0.263	0.074	0.678
% Repeat W	41.3%	23.7%	25.0%	36.8%
Malkiel z-test W	-1.18	-5.08	-5.57	-2.29
p-value	0.238	0.000	0.000	0.022
% Repeat L	40.4%	68.8%	62.1%	66.1%
Malkiel z-test L	-1.80	3.35**	1.84*	3.45**
p-value	0.072	0.001	0.066	0.001

* Significant at the 5% level

** Significant at the 1% level

Appendix 2: Individual fund results

2.1 6-month formation and holding periods

Fund	WW	LL	WL	LW	% Repeat W	Malkiel z-test W	*p*-value	% Repeat L	Malkiel z-test L	*p*-value
Allan Gray Equity	32	28	44	41	42.1%	-1.38	0.169	40.6%	-1.57	0.118
Community Growth Equity	30	66	24	25	55.6%	0.82	0.414	72.5%	4.30**	0.000
Coronation Equity	48	24	39	34	55.2%	0.96	0.335	41.4%	-1.31	0.189
Coronation Top 20	59	18	36	32	62.1%	2.36*	0.018	36.0%	-1.98	0.048
Element Earth Equity	32	73	23	17	58.2%	1.21	0.225	81.1%	5.90**	0.000
FNB Momentum Growth	34	43	34	34	50.0%	-	1.000	55.8%	1.03	0.305
Foord Equity	42	11	42	42	50.0%	-	1.000	20.8%	-4.26	0.000
Investec Equity	37	33	39	36	48.7%	-0.23	0.819	47.8%	-0.36	0.718
Investec Value	40	35	38	32	51.3%	0.23	0.821	52.2%	0.37	0.714
Marriott Dividend Growth	29	33	41	42	41.4%	-1.43	0.151	44.0%	-1.04	0.299
MET General Equity	20	39	42	44	32.3%	-2.79	0.005	47.0%	-0.55	0.583
Momentum Equity	38	45	31	31	55.1%	0.84	0.399	59.2%	1.61	0.108
Momentum Value	44	39	34	28	56.4%	1.13	0.258	58.2%	1.34	0.179
Nedgroup Investments Core Equity	27	46	39	33	40.9%	-1.48	0.140	58.2%	1.46	0.144
Nedgroup Investments Growth	37	37	36	35	50.7%	0.12	0.907	51.4%	0.24	0.814
Nedgroup Investments Rainmaker	47	36	31	31	60.3%	1.81	0.070	53.7%	0.61	0.541
Nedgroup Investments Value	40	33	38	34	51.3%	0.23	0.821	49.3%	-0.12	0.903
Oasis Crescent Equity	23	62	33	27	41.1%	-1.34	0.181	69.7%	3.71**	0.000
Oasis General Equity	22	51	38	34	36.7%	-2.07	0.039	60.0%	1.84	0.065
Old Mutual Active Quant Equity	39	33	36	37	52.0%	0.35	0.729	47.1%	-0.48	0.633
Old Mutual Albaraka Equity	28	55	33	29	45.9%	-0.64	0.522	65.5%	2.84**	0.005
Old Mutual Growth	36	46	33	30	52.2%	0.36	0.718	60.5%	1.84	0.066
Old Mutual High Yield Opportunity	41	39	34	31	54.7%	0.81	0.419	55.7%	0.96	0.339
Old Mutual Investors	40	37	34	34	54.1%	0.70	0.485	52.1%	0.36	0.722
Old Mutual Top Companies	44	47	28	26	61.1%	1.89	0.059	64.4%	2.46*	0.014
Personal Trust High Yield Growth	14	64	26	20	35.0%	-1.90	0.058	76.2%	4.80**	0.000
Prudential Dividend Maximiser	31	34	41	39	43.1%	-1.18	0.239	46.6%	-0.59	0.558
Prudential Equity	46	23	39	37	54.1%	0.76	0.448	38.3%	-1.81	0.071
PSG Equity	68	21	29	27	70.1%	3.96**	0.000	43.8%	-0.87	0.386
SIM General Equity	48	14	44	39	52.2%	0.42	0.677	26.4%	-3.43	0.001
SIM Value	43	24	42	36	50.6%	0.11	0.914	40.0%	-1.55	0.121
STANLIB Capital Growth	37	47	33	28	52.9%	0.48	0.633	62.7%	2.19*	0.028
STANLIB Equity	27	54	33	31	45.0%	-0.77	0.439	63.5%	2.49*	0.013
STANLIB SA Equity	34	41	35	35	49.3%	-0.12	0.904	53.9%	0.69	0.491
STANLIB Value	43	34	37	31	53.8%	0.67	0.502	52.3%	0.37	0.710

* Significant at the 5% level
** Significant at the 1% level

2.2 1-year formation and holding periods

Fund	WW	LL	WL	LW	% Repeat W	Malkiel z-test W	*p*-value	% Repeat L	Malkiel z-test L	*p*-value
Allan Gray Equity	29	20	44	40	39.7%	-1.76	0.079	33.3%	-2.58	0.010
Community Growth Equity	25	57	28	23	47.2%	-0.41	0.680	71.3%	3.80**	0.000
Coronation Equity	65	15	30	23	68.4%	3.59**	0.000	39.5%	-1.30	0.194
Coronation Top 20	73	7	26	27	73.7%	4.72**	0.000	20.6%	-3.43	0.001
Element Earth Equity	23	74	24	12	48.9%	-0.15	0.884	86.0%	6.69**	0.000
FNB Momentum Growth	28	52	30	23	48.3%	-0.26	0.793	69.3%	3.35**	0.001
Foord Equity	68	11	21	25	76.4%	4.98**	0.000	30.6%	-2.33	0.020
Investec Equity	27	51	31	24	46.6%	0.53	0.599	68.0%	3.12**	0.002
Investec Value	41	29	33	30	55.4%	0.93	0.352	49.2%	-0.13	0.896
Marriott Dividend Growth	36	32	36	29	50.0%	-	1.000	52.5%	0.38	0.701
MET General Equity	10	50	40	33	20.0%	-4.24	0.000	60.2%	1.87	0.062
Momentum Equity	25	53	30	25	45.5%	-0.67	0.500	67.9%	3.17**	0.002
Momentum Value	33	46	33	21	50.0%	-	1.000	68.7%	3.05**	0.002
Nedgroup Investments Core Equity	21	58	32	22	39.6%	-1.51	0.131	72.5%	4.02**	0.000
Nedgroup Investments Growth	35	42	32	24	52.2%	0.37	0.714	63.6%	2.22*	0.027
Nedgroup Investments Rainmaker	26	41	35	31	42.6%	-1.15	0.249	56.9%	1.18	0.239
Nedgroup Investments Value	37	33	37	26	50.0%	-	1.000	55.9%	0.91	0.362
Oasis Crescent Equity	15	65	32	21	31.9%	-2.48	0.013	75.6%	4.74**	0.000
Oasis General Equity	19	49	38	27	33.3%	-2.52	0.012	64.5%	2.52*	0.012
Old Mutual Active Quant Equity	39	29	34	31	53.4%	0.59	0.558	48.3%	-0.26	0.796
Old Mutual Albaraka Equity	18	71	27	17	40.0%	-1.34	0.180	80.7%	5.76**	0.000
Old Mutual Growth	36	40	29	28	55.4%	0.87	0.385	58.8%	1.46	0.146
Old Mutual High Yield Opportunity	36	53	26	18	58.1%	1.27	0.204	74.6%	4.15**	0.000
Old Mutual Investors	30	35	34	34	46.9%	-0.50	0.617	50.7%	0.12	0.904
Old Mutual Top Companies	35	46	26	26	57.4%	1.15	0.249	63.9%	2.36*	0.018
Personal Trust High Yield Growth	5	54	31	22	13.9%	-4.33	0.000	71.1%	3.67**	0.000
Prudential Dividend Maximiser	32	16	46	39	41.0%	-1.59	0.113	29.1%	-3.10	0.002
Prudential Equity	54	10	38	31	58.7%	1.67	0.095	24.4%	-3.28	0.001
PSG Equity	59	20	27	27	68.6%	3.45**	0.001	42.6%	-1.02	0.307
SIM General Equity	60	11	31	31	65.9%	3.04**	0.002	26.2%	-3.09	0.002
SIM Value	39	29	36	29	52.0%	0.35	0.729	50.0%	-	1.000
STANLIB Capital Growth	28	49	34	22	45.2%	-0.76	0.446	69.0%	3.20**	0.001
STANLIB Equity	26	54	31	22	45.6%	-0.66	0.508	71.1%	3.67**	0.000
STANLIB SA Equity	31	52	31	19	50.0%	-	1.000	73.2%	3.92**	0.000
STANLIB Value	26	43	38	26	40.6%	-1.50	0.134	62.3%	2.05*	0.041

* Significant at the 5% level
** Significant at the 1% level

2.3 2-year formation and holding periods

Fund	WW	LL	WL	LW	% Repeat W	Malkiel z-test W	*p*-value	% Repeat L	Malkiel z-test L	*p*-value
Allan Gray Equity	42	9	36	22	53.8%	0.68	0.497	29.0%	-2.33	0.020
Community Growth Equity	5	32	47	25	9.6%	-5.82	0.000	56.1%	0.93	0.354
Coronation Equity	46	3	30	30	60.5%	1.84	0.066	9.1%	-4.70	0.000
Coronation Top 20	74	1	17	17	81.3%	5.98**	0.000	5.6%	-3.77	0.000
Element Earth Equity	4	37	46	22	8.0%	-5.94	0.000	62.7%	1.95	0.051
FNB Momentum Growth	7	46	40	16	14.9%	-4.81	0.000	74.2%	3.81**	0.000
Foord Equity	47	7	22	25	68.1%	3.01**	0.003	21.9%	-3.18	0.001
Investec Equity	9	57	31	12	22.5%	-3.48	0.001	82.6%	5.42**	0.000
Investec Value	15	22	48	24	23.8%	-4.16	0.000	47.8%	-0.29	0.768
Marriott Dividend Growth	32	6	42	29	43.2%	-1.16	0.245	17.1%	-3.89	0.000
MET General Equity	2	61	25	21	7.4%	-4.43	0.000	74.4%	4.42**	0.000
Momentum Equity	9	58	33	9	21.4%	-3.70	0.000	86.6%	5.99**	0.000
Momentum Value	12	25	48	24	20.0%	-4.65	0.000	51.0%	0.14	0.886
Nedgroup Investments Core Equity	9	28	48	24	15.8%	-5.17	0.000	53.8%	0.55	0.579
Nedgroup Investments Growth	10	33	44	22	18.5%	-4.63	0.000	60.0%	1.48	0.138
Nedgroup Investments Rainmaker	21	20	46	22	31.3%	-3.05	0.002	47.6%	-0.31	0.758
Nedgroup Investments Value	33	12	43	21	43.4%	-1.15	0.251	36.4%	-1.57	0.117
Oasis Crescent Equity	0	59	32	18	0.0%	-5.66	0.000	76.6%	4.67**	0.000
Oasis General Equity	6	36	45	22	11.8%	-5.46	0.000	62.1%	1.84	0.066
Old Mutual Active Quant Equity	26	28	28	27	48.1%	-0.27	0.785	50.9%	0.13	0.893
Old Mutual Albaraka Equity	0	62	31	16	0.0%	-5.57	0.000	79.5%	5.21**	0.000
Old Mutual Growth	10	27	47	25	17.5%	-4.90	0.000	51.9%	0.28	0.782
Old Mutual High Yield Opportunity	7	33	46	23	13.2%	-5.36	0.000	58.9%	1.34	0.181
Old Mutual Investors	8	28	40	33	16.7%	-4.62	0.000	45.9%	-0.64	0.522
Old Mutual Top Companies	9	30	46	24	16.4%	-4.99	0.000	55.6%	0.82	0.414
Personal Trust High Yield Growth	5	49	20	14	20.0%	-3.00	0.003	77.8%	4.41**	0.000
Prudential Dividend Maximiser	27	5	40	37	40.3%	-1.59	0.112	11.9%	-4.94	0.000
Prudential Equity	59	0	25	25	70.2%	3.71**	0.000	0.0%	-5.00	0.000
PSG Equity	46	10	27	26	63.0%	2.22*	0.026	27.8%	-2.67	0.008
SIM General Equity	42	5	31	31	57.5%	1.29	0.198	13.9%	-4.33	0.000
SIM Value	18	19	47	25	27.7%	-3.60	0.000	43.2%	-0.90	0.366
STANLIB Capital Growth	20	46	31	12	39.2%	-1.54	0.123	79.3%	4.46**	0.000
STANLIB Equity	15	53	17	24	46.9%	-0.35	0.724	68.8%	3.30**	0.001
STANLIB SA Equity	13	37	35	24	27.1%	-3.18	0.001	60.7%	1.66	0.096
STANLIB Value	16	36	40	17	28.6%	-3.21	0.001	67.9%	2.61**	0.009

* Significant at the 5% level
** Significant at the 1% level

2.4 3-year formation and holding periods

Fund	WW	LL	WL	LW	% Repeat W	Malkiel z-test W	*p*-value	% Repeat L	Malkiel z-test L	*p*-value
Allan Gray Equity	25	4	41	15	37.9%	-1.97	0.049	21.1%	-2.52	0.012
Community Growth Equity	1	49	26	9	3.7%	-4.81	0.000	84.5%	5.25**	0.000
Coronation Equity	43	0	16	26	72.9%	3.52**	0.000	0.0%	-5.10	0.000
Coronation Top 20	65	0	9	11	87.8%	6.51**	0.000	0.0%	-3.32	0.001
Element Earth Equity	11	13	44	17	20.0%	-4.45	0.000	43.3%	-0.73	0.465
FNB Momentum Growth	0	36	36	13	0.0%	-6.00	0.000	73.5%	3.29**	0.001
Foord Equity	30	1	16	30	65.2%	2.06*	0.039	3.2%	-5.21	0.000
Investec Equity	0	46	31	8	0.0%	-5.57	0.000	85.2%	5.17*	0.000
Investec Value	19	4	46	16	29.2%	-3.35	0.001	20.0%	-2.68	0.007
Marriott Dividend Growth	20	6	25	34	44.4%	-0.75	0.456	15.0%	-4.43	0.000
MET General Equity	0	59	17	9	0.0%	-4.12	0.000	86.8%	6.06**	0.000
Momentum Equity	0	50	30	5	0.0%	-5.48	0.000	90.9%	6.07**	0.000
Momentum Value	13	0	47	25	21.7%	-4.39	0.000	0.0%	-5.00	0.000
Nedgroup Investments Core Equity	0	22	40	23	0.0%	-6.32	0.000	48.9%	-0.15	0.881
Nedgroup Investments Growth	1	26	44	14	2.2%	-6.41	0.000	65.0%	1.90	0.058
Nedgroup Investments Rainmaker	13	10	46	16	22.0%	-4.30	0.000	38.5%	-1.18	0.239
Nedgroup Investments Value	31	0	33	21	48.4%	-0.25	0.803	0.0%	-4.58	0.000
Oasis Crescent Equity	2	54	20	9	9.1%	-3.84	0.000	85.7%	5.67**	0.000
Oasis General Equity	6	25	35	19	14.6%	-4.53	0.000	56.8%	0.90	0.366
Old Mutual Active Quant Equity	11	23	17	34	39.3%	-1.13	0.257	40.4%	-1.46	0.145
Old Mutual Albaraka Equity	0	63	13	9	0.0%	-3.61	0.000	87.5%	6.36**	0.000
Old Mutual Growth	8	12	44	21	15.4%	-4.99	0.000	36.4%	-1.57	0.117
Old Mutual High Yield Opportunity	0	22	43	20	0.0%	-6.56	0.000	52.4%	0.31	0.758
Old Mutual Investors	7	29	26	23	21.2%	-3.31	0.001	55.8%	0.83	0.405
Old Mutual Top Companies	0	20	40	25	0.0%	-6.32	0.000	44.4%	-0.75	0.456
Personal Trust High Yield Growth	0	40	10	14	0.0%	-3.16	0.002	74.1%	3.54**	0.000
Prudential Dividend Maximiser	43	0	28	14	60.6%	1.78	0.075	0.0%	-3.74	0.000
Prudential Equity	51	0	21	13	70.8%	3.54**	0.000	0.0%	-3.61	0.000
PSG Equity	12	9	33	31	26.7%	-3.13	0.002	22.5%	-3.48	0.001
SIM General Equity	43	0	16	26	72.9%	3.52**	0.000	0.0%	-5.10	0.000
SIM Value	20	0	47	18	29.9%	-3.30	0.001	0.0%	-4.24	0.000
STANLIB Capital Growth	0	50	35	0	0.0%	-5.92	0.000	100.0%	7.07**	0.000
STANLIB Equity	0	42	9	34	0.0%	-3.00	0.003	55.3%	0.92	0.359
STANLIB SA Equity	0	31	21	33	0.0%	-4.58	0.000	48.4%	-0.25	0.803
STANLIB Value	6	32	35	12	14.6%	-4.53	0.000	72.7%	3.02**	0.003

* Significant at the 5% level
** Significant at the 1% level