Fund and Manager Characteristics: Determinants of Investment Performance

by

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Declaration

By submitting this dissertation electronically, I declare that the entirety of the work contained therein is my own, original work, that I am the owner of the copyright thereof (unless to the extent explicitly otherwise stated) and that I have not previously in its entirety or in part submitted it for obtaining any qualification.

Date: December 2008

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Abstract

The objective of this study is to provide a new approach to assessing fund management and to establish whether there is empirical support for this approach. The new approach will improve investors' decision making with respect to the management and investment of their assets.

We construct equity-only funds from quarterly equity holdings of unit trusts. The funds are ranked each quarter using various performance measures and segmented into winners and losers; firstly according to the median of the ranks and secondly according to quintile rankings. The funds' rankings are examined for evidence of persistence.

Secondly, a performance attribution method is introduced that identifies the static ("buy-and-hold") portion and the trading portion of a fund. The funds are examined in terms of characteristics that distinguish between funds according to how the manager has chosen to organise (or construct) the fund. These characteristics are the static portion, the trading portion, the size of the static portion and the extent of the overlap between funds' holdings and the large, mid and small capitalisation indices. Relationships between winners and losers (based on quartiles) and the fund characteristics are examined.

Finally, the trading activities of investment managers, for their funds, are examined. This examination begins with the use of traditional measures that focus on a holistic approach to evaluating trading ability. The examination is enhanced with the introduction of a new reductionism approach, where the success of individual trades is examined. The results of the earlier performance attribution are included in the evaluation of investment managers' abilities to add value to investors' assets via trading activities.

Consistent with prior research, but using different data, we find persistence in the rankings of equity fund performance, particularly among the top and bottom quintiles. The strength (or reliability) of the performance persistence reduces over an increasing number of quarters. The poorer performing funds ranked in the centre are more likely to enjoy improved rankings than the better performing ones are likely to suffer a deterioration. The presence of persistence is greater when measuring performance using Jensen's alpha and the Omega statistic than when using the raw returns or the traditional Sharpe, Treynor and Sortino measures.

When attributing performance to a static portion and a trading portion, we find that the static portion is the dominant driver of fund performance. With respect to the trading portion as the lesser performance driver, the better performing funds enjoy better returns from trading than the poorer performing funds.

Better performing funds are organised differently to poorer performing funds. The better performing funds have a smaller static size, lower overlap with the large-cap market index and greater overlap with the small-cap index.

The results of the performance attribution suggest that investment managers are relatively poor at adding value to investors' assets through trading activities. Our further analysis supports this result with firstly, traditional measures (returns-based) indicating an absence of timing ability and secondly, an analysis of individual trades in each fund suggesting an absence of ability at the individual security level. These results suggest that managers would add more value to investors' funds if they reduced their trading activities and focused more on their buy-and-hold strategies.

Samevatting

Die doel van hierdie studie is die daarstel van ’n nuwe benadering tot evaluering van fondsbestuur, asook om te bepaal of daar empiriese steun vir so ’n benadering bestaan. Hierdie nuwe benadering sal beleggers se besluitneming ten opsigte van die bestuur en belegging van hul bates verbeter.

Ons skep suiwer aandelefondse uit kwartaallikse aandeelhoudings van effektetrusts. Die fondse word elke kwartaal volgens verskeie prestasiemaatstawwe geklassifiseer en in wenners en verloorders verdeel, eerstens volgens die mediaan van die rangorde en tweedens volgens rangorde van vyfdes(kwantiele). Die fonds se rangorde word dan geëvalueer vir bewyse van standhoudende prestasie.

’n Prestasie toerekeningsmetode word gebruik om die vaste (“koop-en-hou”) sowel as die omsetgedeelte (verhandelende gedeelte) van ’n fonds te identifiseer. Die fondse word geëvalueer volgens eienskappe wat fondse onderskei ten opsigte van hoe die fondsbestuurder besluit het om dit te organiseer (of saam te stel). Hierdie eienskappe is die vaste deel, die verhandelende deel, die grootte van die vaste deel en die mate van oorvleueling tussen die fondsaandelebesit en die groot, medium en klein kapitaliseringsindekse. Verhoudings tussen die wenners en verloorders en die fondseienskappe word ondersoek.

Laastens word belegginsbestuurders se handelsbedrywighede in belang van hul fondse bestudeer. Hierdie ondersoek begin met die gebruik van tradisionele maatstawwe wat fokus op ’n holistiese benadering tot die evaluering van handelsvermoë. Die ondersoek word verskerp deur die invoering van ’n inkortingsbenadering uitgangspunt waarin die sukses van individuele verhandelings ondersoek word. Die resultate van vorige toerekenings word ingesluit in die evaluering van die beleggingsbestuurders se vermoë om deur hul verhandelingsaktiwiteite waarde tot die belegger se bates toe te voeg.

In ooreenstemming met vorige navorsing, maar met gebruik van ander data, het ons standhoudendheid gevind in die klassifisering van effektefondse se prestasie, veral betreffende die boonste en onderste vyfdes. Die sterkte (of betroubaarheid) van die prestasievolhoubaarheid verminder oor toenemende kwartale. Die swakker presterende fondse met ’n gemiddelde

rangorde is meer geneig om in plasing te styg en dié wat beter presteer is meer geneig om te verswak. Groter volhoubaarheid word aangetref wanneer prestasie gemeet word volgens Jensen se Alfa en die Omega-statistiek as wanneer rou opbrengste of die tradisionele Sharpe, Teynor en Sortino maatstawwe gebruik word.

Wanneer prestasie toegeken word aan ’n vaste en ’n verhandelende deel, bevind ons dat die vaste deel die oorheersende drywer van fondsprestasie is. Betreffende die verhandelende deel as die swakker prestasiedrywer, geniet beter presterende fondse groter opbrengste van verhandeling as swakker presterende fondse.

Fondse wat beter presteer word anders saamgestel as fondse wat swakker presteer. Die fondse wat beter presteer het ’n kleiner vaste deel, ’n kleiner oorvleueling met die groot kapitalisasie markindeks en ’n groter oorvleueling met die klein kapitalisasie indeks.

Die resultate van die prestasietoerekening dui daarop dat beleggingsbestuurders redelik swak vaar om deur verhandelingsbedrywighede waarde tot beleggers se bates toe te voeg. ’n Verdere ontleding ondersteun hierdie resultate eerstens deur tradisionele (opbrengsgebaseerde) maatstawwe, wat die dui op ’n gebrekkige vermoë tot goeie tydsberekening. Tweedens dui ’n ontleding van afsonderlike verhandelings in elke fonds op gebrekkige vermoë op die individuele aandeelvlak. Hierdie bevindinge dui daarop dat bestuurders meer waarde tot beleggers se bates sal toevoeg indien verhandeling verminder word en daar meer op koop-en-hou strategieë gefokus word.

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Chapter 1: Research Overview and Data Handling

1.1 Background

Investors use performance rankings of funds to evaluate a manager's skill and ability and identify winners and losers. Raw-returns for funds, and their relative rankings, are widely published and are a common source of information among investors for their investment decisions. The categorizations of funds provide investors with some guidance as to which fund objectives, and hence which funds, are best suited to meeting their investment needs. Selecting a single fund from a group of potential funds requires an investigation into the performance and sources of performance for those funds. Funds compete against each other within their categories and, sometimes, across categories. For example, in South Africa, General Equity unit trusts compete with each other with the aim of achieving the best performance, but unit trusts from the Value and Growth categories also compete with the General Equity unit trusts by trying to outperform those funds. The achievement of superior performance (relative to peers) attracts the flow of new money into those funds, which will translate into higher fees earned by the funds.

1.2 Relevance of relative performance

Is an investor's quest to find funds and fund managers that deliver superior peer-relative performance a reasonable quest? Investors require rates of return on their capital that are in excess of their opportunity costs of capital. Investors seeking excess returns from financial investments (as opposed to purely real-asset investments) entrust their money to investment managers who will maintain a portfolio of financial securities for the investor. The cost of capital for an investor placing money in a fund that is managed by an investment manager is usually linked to the performance achieved by the investment opportunities that are alternatives to the investor's choice, i.e. the performance achieved by funds with similar objectives. This performance measure may be the average but is usually the median performance for a peer group of funds. Investors will at least seek out managers with the skill to achieve returns above the peer-median return. Therefore, investors are interested in finding the funds and fund managers that will deliver consistent superior performance.

When it comes to the investments of pension funds, there is vociferous opposition to peer-relative benchmarking. Opponents argue that peer-relative benchmarking encourages managers to take unnecessary risks in an effort to out-perform peers. Rather, performance should be evaluated relative to an index that represents an investible universe of securities. A popular index used to evaluate South African pension fund performance is the Shareholder-weighted index (SWIX). The origins of the support for index-relative performance evaluation lay in the traditional asset-liability modelling that supports actuarial valuations of pension funds. Actuarial valuations are approximations of the liabilities of a pension fund. Capital market assumptions that are based on risk and return expectations for various asset class indices are used to determine an approximate asset allocation for the pension fund in order for it to meet its approximated liabilities. Since the asset-liability modelling is based on performance expectations for indices, it is believed that fund performance should be evaluated relative to these indices. In this case, the performance of the benchmark index becomes the opportunity cost of capital.

The performance evaluation method specified *a priori* will likely influence the investment decision-making process and strategy followed by the investment manager. A fund that is evaluated on a peer-relative benchmark basis will probably have different securities holdings (quantities and/or weightings) to a fund that is evaluated relative to a benchmark that is based on an index. It is therefore likely that the investment decision-making process and strategy followed is different and dependent on the method of evaluation.

The reality is that there is a strong case to be made for index-relative investing when liability estimates are more certain. For example, when all the pension fund members have five years to retirement, the estimated future liabilities are more certain than when all those members had twenty five years to retirement. However, there is growing concern that the use of market-capitalisation weighted indices leads to sub-optimal investments (Arnott, Hsu and Moore, 2004, and Treynor, 2005). This is relevant to asset-liability modelling, investment processes dependent on index-relative investing and performance evaluation based on indices. The case for index-relative performance evaluation is dismal, unless it can be convincingly show that the use of market-capitalisation weighted indices leads to optimal investment allocations for pension funds. In other words, the case against the use of market-capitalisation benchmarks must be shown to be irrelevant to traditional mean-variance optimisation.

The case for peer-relative performance evaluation is more convincing as a means to meeting the requirements for a large number of pension funds. Since the estimated future liabilities of pension funds are only approximations to unknown future liabilities, the investment market has organized itself to accommodate groupings of pension funds according to their risk and return profile requirements. The investment market organization is broadly based on groupings that distinguish between (and associate themselves with) an aggressive, balanced or conservative risk profile. In other words, these groupings are the market's answer to accommodating the approximate requirements for pension fund investments. The performance evaluation of each member within each of these groups should be relative to the other members of their group – peer relative performance.

Some well-known researchers suggest that performance should be evaluated relative to a combination of reference points or benchmarks. Arnott (2003) suggests that the reference point should be a combination of the liability-based, peer group and real-return benchmarks for a fund. However, this study does not attempt such a compromise. We consider superior performance to be evaluated on a peer-relative basis and, therefore, we use rankings of funds' performances at each quarter. We have taken the view that specific benchmarks, risk tolerances, etc. for a fund have been considered as part of the process of identifying a peer group. The fund's peer-relative performance will then indicate superiority or inferiority of the investor's return on capital. Moreover, we investigate sources of performance and the role that they have in influencing funds' performances.

We have indirectly referred to performance as it relates to return and risk for a fund. However, the investor's utility may have more components than only risk and return. A Watson Wyatt survey (1999) of UK participants shows dissimilar preferences among fiduciaries. Figure 1.1 indicates the different preferences that can be interpreted as the components of an investor's utility function.

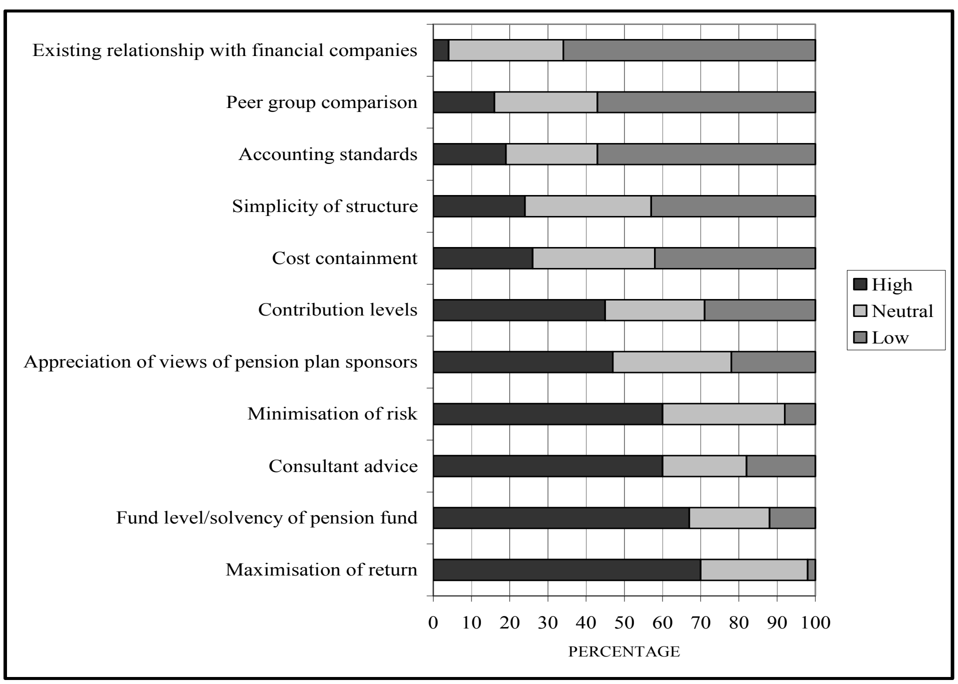

Figure 1.1: Dissimilar preferences among fiduciaries

Source: Watson Wyatt Global Asset Study Survey 1999; data for UK participants only

Our study does not take other components, apart from risk and return, of an investor's utility function in to account when distinguishing between the superiority and/or inferiority of funds' performances.

1.3 Structure and performance sources

In this section we wish to identify a broad, but robust, structure within the investment research arena so as to clarify the contribution of this study to the enormous amount of information available on the subject. We will identify three different groups of influences on fund performance, motivate the suitability of a proposed structure by sampling what other researchers have considered and then elaborate on the proposed structure.

What are the broad sources of investment performance? Given a set of financial market and economic conditions, fund performance is dependent on the selection of attractive investments and the extent to which the benefits of the chosen combinations of individual selections (fund organization) can contribute to fund performance. Many studies have captured the collective contribution of these two drivers of performance through returns-based analysis. Few studies have focused on distinguishing between the separate impacts of manager ability and fund organization on fund performance. More specifically, there is a lack of distinction and a dearth of information with respect to the relationships that manager characteristics and fund characteristics, independently, have with fund performance. These relationships should also be considered as distinct from the relationship between fund performance and financial market and economic conditions. In other words, ergonomical (environmental) characteristics are associated with fund performance and these associations are distinct from the associations that manager characteristics and fund characteristics have with fund performance.

Other researchers have referred to the three groups of influences on fund performance. We will consider some of these references in order to build credibility for our proposed structure and to provide some description, with examples of the characteristics of the three different influences of fund performance. It is important to note that this discussion is centred on active fund management as opposed to passive fund management which is, simplistically, concerned with fund replication of the "market portfolio".

Carhart (1997) says: "Persistence in mutual fund performance does not reflect superior stock-picking skill. Rather, common factors in stock returns and persistent differences in mutual fund performance expenses and transaction costs explain almost all of the differences of the predictability in mutual fund returns." Stock-picking skill refers to the ability to select attractive investments and is specific to a manager. A manager's characteristics such as experience, qualification, age, preferred investment strategy and personal risk preferences will contribute to that manager's ability to select attractive investments. Selecting attractive investments, or, more precisely, selecting attractive individual securities, is associated with fund performance. Note that the weighted combination of individual securities, which may be optimal or sub-optimal, will have a different association with fund performance. The weighted combination of securities is considered as an aspect of fund organization since the fund mandate, or objective, will prescribe risk and return preferences that the combination of securities are expected to satisfy. Fund characteristics determine fund organization, which, in turn, determine fund performance. The fund mandate is, therefore, a fund characteristic that will influence fund performance. Fund expenses and transaction costs are also fund characteristics and will influence fund performance. Common factors in stock returns are an element of the environment and have an impact on performance that is independent from the manager and fund organization.

Baks (2003) says: "It seems reasonable to entertain the notion that part of the performance of a mutual fund resides in the manager, who is responsible for the investment decisions, and part resides in the fund organization, which can influence performance through administrative procedures, execution efficiency, corporate governance, quality of the analysts, relationships with companies, etc." While Baks (2003) provides more transparency for our identification of the set of fund characteristics, he offers very little that will help improve the crystallisation of the set of manager characteristics. In contrast, Chevalier and Ellison (1999) investigate the relationship between fund performance and manager characteristics that include "…a manager's age, the name (and average student SAT score) of the institution from which a manager received his/her undergraduate degree, whether he/she has an MBA degree, and how long a manager has held his/her current position." A study of the role of manager characteristics in the South African context was conducted by Friis and Smit (2004) and yielded similar results to the Chevalier and Ellison (1999) study.

We now provide more clarity about what we refer to as ergonomical characteristics. One way to start identifying ergonomical characteristics is to consider the influences on the performance of a fund that has an equal weighting of all the securities in the investment universe. If the individual securities are highly volatile then the fund return is likely to be more volatile than when the securities have little or no volatility. Therefore, stock specific risk is an ergonomical characteristic. This is quickly recognised as being related to the systematic risk used in the CAPM and Fama and

French's (1993) three factor model. Fama and French (1993) also use size (market capitalisation) and book-to-market price (value) as stock specific characteristics that are related to fund performance. Jegadeesh and Titman (1993) identify price "momentum" as a stock characteristic. The characteristics of the financial markets such as the number of securities available for investment, the liquidity of individual securities (influenced by factors other than market capitalisation) and the asset class of the securities are part of the set of ergonomical characteristics and will influence fund performance. Other ergonomical characteristics will relate to political risks and economic conditions. Akinjolire and Smit (2003) studied the relationship between an ergonomical characteristic such as a "changing economic climate" and the performance of South African funds.

It should be clear that the three forces (manager, ergonomical and fund characteristics) affecting fund performance are not independent of each other despite the above discussion of them as separate, identifiable influences. For example, managers will make decisions regarding the organisation of a fund and therefore a relationship exists between the manager characteristics and fund characteristics. An investment universe of large capitalisation securities will influence the application of a manager's skill if that manager specialises in selecting attractive small capitalisation securities and will influence the organisation of a fund. Therefore, ergonomical characteristics will have relationships with manager characteristics and fund characteristics.

Research has sought, at different levels, to clarify the nature of the relationships that different characteristics have with performance. Behavioural finance research has addressed aspects relating to manager characteristics such as cognitive dissonance. Factor models, such as that of Fama and French (1993), and characteristic models, such as that of Daniel and Titman (1997), have addressed aspects of asset pricing that relate to ergonomical characteristics. Massa (2004), has considered the impact of fund characteristics on performance.

It is difficult to fully capture all the dynamics between the different influences on fund performance. However, Figure 1.2 attempts to provide a summary of the above discussion of the separate influences of manager, ergonomical and fund characteristics on fund performance.

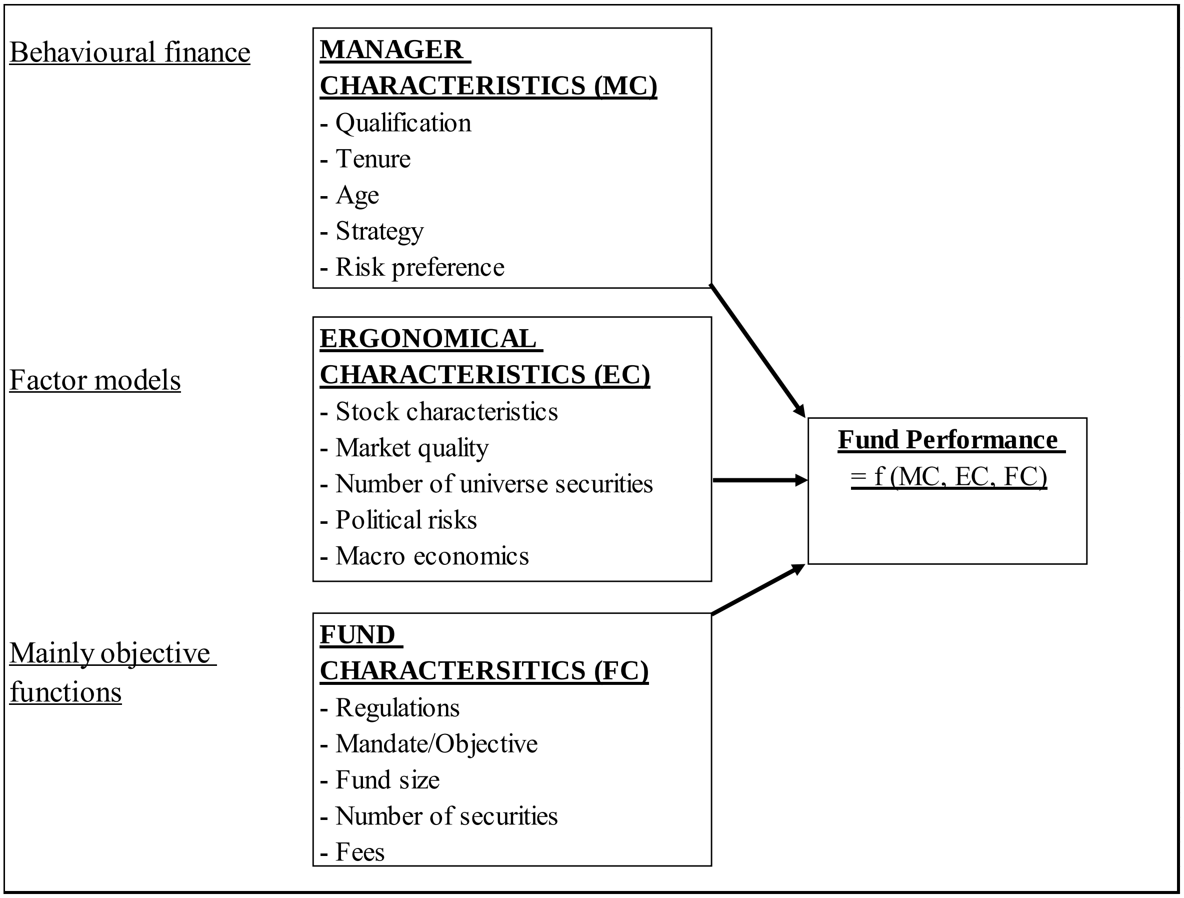

Figure 1.2: Characteristics framework and fund performance

Further support for our proposed structure is drawn from the ease with which the structure can be mapped onto Clarke, de Silva and Thorley's (2002) extended version of Grinold's (1989) "Fundamental Law of Active Management".

The Fundamental Law of Active Management relates the information ratio to the security forecasting ability of the manager and the opportunity set that the manager may utilise. The law may be written as:

$$IR = ICx\sqrt{N}$$

where *IR* is the information ratio and is calculated as the fund's active return divided by the standard deviation of those active returns. The information coefficient (*IC*) is a measurement of manager skill and is calculated as the correlation between the manager's forecast alphas of securities and the actual alphas realised at the end of the forecast period. Alphas are defined as returns in excess of a benchmark. The breadth (*N*) is the number of independent forecasts that may be made and is a function of the number of securities for which forecasts may be made multiplied by the number of times (frequency) the forecast can be made in a period. The extended version of the fundamental law says that the extent to which the forecasts can be implemented as the investment strategy of the fund will also affect the information ratio. The extended law may be written as

$$IR = ICx\sqrt{N}xTC$$

The transfer coefficient (*TC*) is a measure of the extent to which a manager's forecast is transferred to the fund and is the correlation between the manager's forecasts and the actual weights of securities in the fund. Restrictions such as regulatory and long-only constraints may limit the translation of the manager's "bets" into a fund. When there are no restrictions on the fund's investments, *TC* = 1.

We can now align our proposed structure with the extended version of the fundamental law of active management. We associate manager characteristics with the information coefficient (*MC*↔*IC*), ergonomical characteristics with the breadth (*EC*↔*N*) and fund characteristics with the transfer coefficient (*FC*↔*TC*). Figure 1.3 provides a summary of the associations between characteristics and the fundamental law. The arrows indicate the direction of interactions that the influences have with each other.

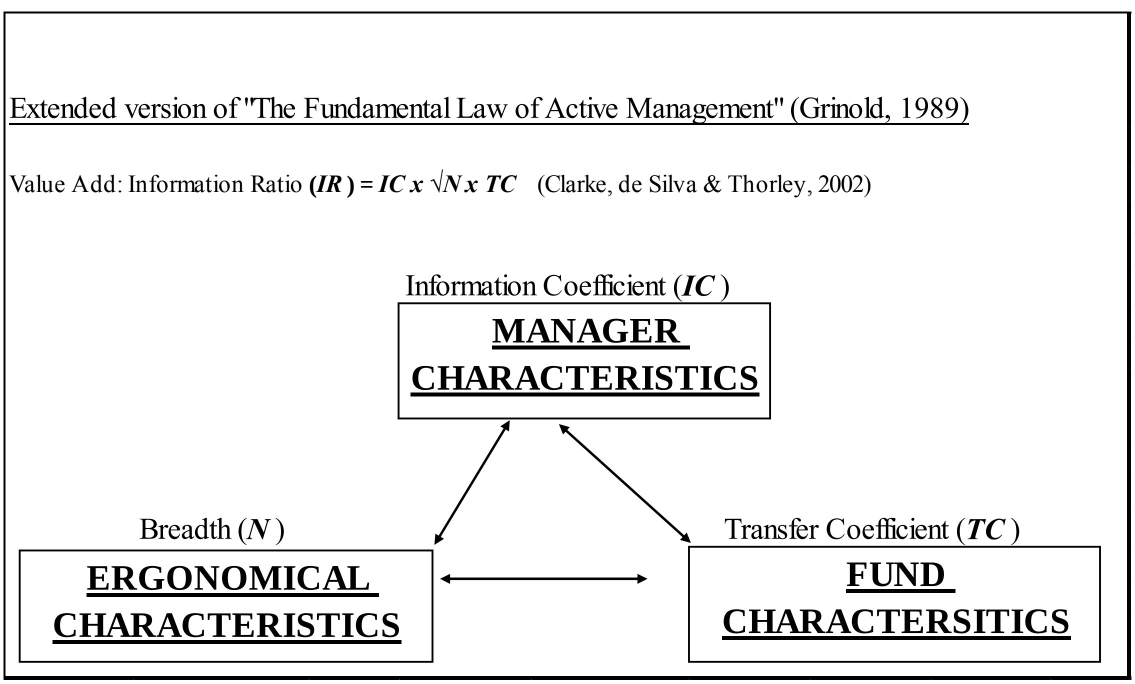

Figure 1.3: Characteristics and the Fundamental Law

1.4 The focus of this study within the proposed structure

The fund characteristics reflect the organization of a fund and are a critical element to influencing performance and performance persistence of a fund. This study will start with investigating performance persistence of equity investments of funds. Next, we will consider the main focus of the study which is on the relationship between fund performance and fund characteristics such as the proportion of securities within a fund that are frequently traded, the proportion seldomly traded and the extent to which fund holdings overlap with various benchmarks. We relate these fund characteristics to fund performance. We will then consider the success of funds' equity trading strategies. It is difficult to provide a clear classification of trading activities as either a fund characteristic or a manager characteristic, so we have chosen to assume that trading could be both.

This study has three main parts. We provide a brief context to the three parts and identify each part.

Experts in the field of fund performance measurement will suggest that risk-adjusted returns, rather than raw returns, should be used to identify superior performing funds. However, there are many different measures of performance and investors need to understand the differences between the different measures and to what extent the measures indicating current losers and winners may predict future winners and losers. This study evaluates the reliability of some performance measures, as an alternative to raw returns, for identifying and predicting winning funds.

Investment advisors and consultants that involve themselves in research into investment managers and their funds will look beyond performance rankings when evaluating current and potential winners and losers. They will study details such as the security holdings of funds and identify what characteristics will ensure the future superior performance of a fund. This study identifies fund characteristics associated with winning funds and evaluates the reliability of these characteristics as predictors of future winning funds.

One way that investment managers can achieve returns on their funds is by increasing or decreasing the fund's market exposure, in order to capture gains or avoid losses as a result of market fluctuations. Past research suggests that the skills of investment managers in timing the market and trading securities are very poor. This study examines whether market timing and/or trading strategies enhance or destroy fund value. Moreover, we evaluate the timing success of individual security trades for equity-only funds.

Within each chapter we provide further context by examining the literature relating to these three areas of this study.

1.5 Methodology

A substantial amount of research has been published with the intention of demonstrating the existence or non-existence of determinism/predictability in capital markets. However, the research is inconclusive. An approach to confronting the analysis of the capital market within an uncertain world and without the luxury of perfect foresight is to order the categories of the capital markets that are to be analyzed. The categories that we focus on are: performance persistence and the relationships between superior performing funds and fund characteristics and the success of timing and /or trading strategies for funds.

Our scientific research methodology can be characterized as empirical positivism. The theory provides a null hypothesis and this is tested using empirical data. The results are compared to the theoretical prescriptions.

The Efficient Market Hypothesis states that it is impossible to consistently earn abnormal returns for portfolios – the null hypothesis. In particular, the null hypothesis says that past performance has no relationship with future performance and therefore there can be no determinism in fund performance. We use experimental and statistical methods to test the null hypothesis. Although the rejection of the null hypothesis is not the primary purpose of this study, it is a necessary precursor to the justification for the remainder of the study. Based on empirical evidence, our results show probabilistic relationships among variables and our interpretation of these probabilistic relationships leads to the conclusion that there is a degree of determinism in capital markets. The methodology can therefore be seen as an econometric methodology with an objective consistent with that of the Econometric Society: "unification of the theoretical-quantitative and the empirical-quantitative approach to economic problems". While parts of the study are descriptive, the conclusions of the study are prescriptive, focusing on what happens in practice and highlighting an inferential direction from data to theory.

Our approach to analysing the data is based on what prominent researchers have suggested for similar types of analysis. A survey of high-profile international and South African journals reveals that there is little variation in the scientific methodology of empirical positivism and the methods used to analyse capital markets. These methods include cross-sectional and longitudinal studies and performance evaluation using mathematical formulae. The results of the analysis reveal the probabilistic (or the extent of) relationships between the variables under focus. Economic theory provides the basis for interpreting the probabilistic relationships that are largely a consequence of operational inefficiencies within capital markets.

This study focuses on reconstructed funds that only hold equity securities. The objective of this is to enrich the study by ensuring that results are more relevant to a particular asset class and type of fund. Most other South African studies are based on data that reflect the entire fund's holdings, including other asset classes such as those containing only interest bearing instruments. This study is based on information from two levels: the performance of the fund (performance-based analysis) and the security holdings for each fund (holdings-based analysis). The information is taken at each quarter over the period for the data set. Figure 1.4 shows a comparison between average actual published total returns for the funds and the average returns for the reconstructed funds based on price changes only.

The performance-based analysis provides evidence of differences in the way funds are constructed and the resultant performance behaviour for each fund. The holdings based analysis is used to confirm or complement results from the performance-based analysis and reveal details of the actual fund construction.

1.6 Data: Use of raw returns

Research literature reveals different views with respect to the use of raw returns and risk-adjusted returns when analyzing fund performance.

Hallahan and Faff (2001) justify the use of raw returns in their study of performance among Australian funds by following Capon, Fitzsimons and Prince (1996) and Lawrence (1998), noting that raw returns are the most frequently reported figures in the media and referred to by investors.

In their second 2002 report to the Investment Management Association on performance persistence, Charles River Associates (CRA) found greater evidence of persistence when using raw returns than had been found in earlier studies using risk-adjusted returns. They support their use of raw returns by pointing out that:

- "A consumer would be making a decision based solely on raw returns, as this is how performance information is displayed".
- "…given that reliable risk models employ two to four risk factors and the calculation is beyond the average investor, we felt any results would be rejected on grounds of impracticality of calculation and use".

In an assessment of studies prepared by Charles River Associates, Blake and Timmermann (2003) argue that managerial skill cannot be evaluated by considering only raw returns and suggest the use of risk-adjusted performance measures. However, they do acknowledge that: "The only potentially persuasive argument for using raw returns is that it is a 'model-free' approach that does not involve taking a stand on which particular model to use for risk-adjustment purposes or on how to estimate the parameters of the risk-adjustment model".

Perhaps risk is not relevant. By adjusting for risk using the CAPM and Fama-French three-factor models, Jegadeesh and Titman (1993, 2001) point out that the best performers are not riskier than the worst performers and hence risk adjustments may increase the spread in performances between winners and losers. For example, suppose performance is measured using the simple ratio of return divided by risk, where risk is measured by the standard deviation of returns. The widely accepted view that higher returns are compensation for higher levels of risk consumption would imply that differences (spreads) between the performance ratios for winners and losers would be less than if the same risk measure was used in calculating the performance ratios for both groups. The obvious implication, of there being no difference in risk consumption between winners and losers, is that the use of risk–adjusted performance measures is not a necessary or sufficient condition to evaluating fund performance.

In contrast to this view, there is support for using historical risk-adjusted returns for predicting unadjusted returns. In his Presidential Address to the American Finance Association, Gruber (1996, p. 796) suggests that past risk-adjusted performance is a better predictor of future raw return performance than past raw returns.

Suppose that there was a desire to use a risk-adjusted performance measure. Exactly what risk should be used when calculating a risk-adjusted return is itself a complex issue. Fisher and Statman (1999) agree with Kritzman (1997) that a debate about the meaning of risk is futile. Shifting the focus to risk factors that may be considered, Fisher and Statman (1999) say: "The box of factors that we call "risk" is both too large and too small. The box is large enough to include many, sometimes conflicting, measures of risk – variance and semi variance, probabilities of losses and their amounts. But the box is too small to include factors that affect choices but fall outside the boundaries of risk-frames and cognitive errors, self-control and regret".

Why is risk an important part of performance measurement? Investors face uncertainty with respect to the future outcomes of their investments. In order to make optimal investments, investors must not only consider the possible different future investment outcomes, but must consider the probability of each outcome occurring within their preferred time horizon. By associating probabilities with future outcomes, uncertainty is transformed into risk. Indeed, Lindley (1988) concludes that: "… there is essentially only one way to reach a decision sensibly. First, the uncertainties present in the situation must be quantified in terms of values called probabilities. Second, the various consequences of the courses of action must be similarly described in terms of utilities. Third, that decision must be taken which is expected – on the basis of the calculated probabilities – to give the greatest utility". Where risk is measurable, its inclusion in a risk-adjusted performance measure allows investors to evaluate investment returns in the context of their (returns) associated levels of risk and make sensible decisions with regard to optimising their (investor's) specific investment utility functions.

The meaning of risk, and consequential choice of an appropriate measure, will depend on an investor's particular utility function. For example, investors who maintain very short investment time horizons and have a high probability of having to meet liabilities within their investment horizons, are more likely to choose a risk measure that focuses on the uncertainty of losses occurring than an investor with an ultra long investment time horizon and who is not concerned with volatility within that horizon. This study follows the suggestion by Blake and Timmermann (2003) that reporting on persistence results from both raw and risk-adjusted returns will allow readers to decide which set of results are more relevant to their investment decisions.

1.7 Data and its treatment

The primary data used is quarterly South African unit trust fund holdings and performances over the period 03/1993 to 12/2004 for General Equity, Value and Growth unit trusts categories. The unit trust holdings data used in this study was obtained from J.P. Morgan Equities Ltd., Johannesburg, South Africa. The J.P. Morgan database consists of instrument holdings for virtually all the unit trusts between September 1992 and December 2004 (inclusive). For consistency, the same data has been used in each of the chapters.

We use funds from three unit trust categories. It may be argued that since the fund objectives or declared styles of the funds differ between the funds in the different categories, studying the funds within the different fund categories separately would lead to more convincing interpretation of the results and conclusions drawn. However, evidence of the misclassification of funds would suggest the contrary and even indicate that more funds from other categories should be included in order to enlarge the data set and improve the analysis. In studies of US mutual funds, diBartolomeo and Witkowski (1997) show that about 40% of funds are misclassified and 9% seriously misclassified while Kim, Shukla and Thomas (2000) show that more than 50% of funds are misclassified and almost 33% severely misclassified. More recent studies show that misclassifications continue to occur - Castellanos and Alonzo (2005) show that almost 33% of Spanish mutual funds are misclassified. In South Africa, Robertson, Firer and Bradfield (2000) find that more than 17% of the 51 funds in their study are misclassified, with all of the misclassified funds coming from the general equity fund category.

The market indices (and their constituents) used were provided by PeregrineQuant (Pty) Ltd, a quantitative asset management company that reconstructed the historical data for the new FTSE/JSE indices that were then distributed to the South African investing community by the JSE. The indices changed in March 2000 from market capitalization- weighted indices to free-float capitalization-weighted indices. We use the indices that were "in-force" at each period rather than using the reconstructed historical indices for the new indices. This approach avoids biases when comparing fund holdings and index constituents at each quarter-end, particularly when an investment manager uses an index as part of developing their investment strategy (often referred to as "benchmark-aware" managers).

The funds from the chosen categories are "equity funds" and the filtered primary data set for these funds, used to establish a secondary data set, should still be comparable with the primary data and therefore facilitate a reasonability check on the data that is used for this study. We calculate the quarterly performances for the "new" funds (that are constructed by taking only the equity share holdings for each fund) and compare them with the fund performances as published by Profile Media, a provider of unit trust data to the South African investment industry.

Filtering the primary data involves stripping out only the individual equity security holdings of funds for each quarter and building up "new" portfolios with this data. This means that the new portfolios exclude fixed interest instruments, unlisted instruments, dividends/interest, derivative positions and foreign security holdings. This follows Jensen (1998) who notes that one of the dimensions of portfolio performance is “(t)he ability of the portfolio manager or security analyst to increase returns on the portfolio through successful prediction of future security prices." We draw support for our focus on dividends from Miller and Modigliani (1961) who show that investor s should be indifferent to receiving returns in the form of dividends or price appreciation. In addition, intuition suggests that including dividends in return calculations introduces a positive bias on returns that will have a negative impact on our investigation into performance persistence. Our use of price changes is a subset of total returns and places a lower bound on the portion of returns that are a source of performance persistence, the evaluation of fund characteristics and the evaluation of trading ability. Our method also draws support from Oosthuizen and Smit (2002) who note that the exclusion of dividends and transaction costs in their return calculation is consistent with that done by Grinblatt and Titman (1993).

The data set includes the FTSE/JSE All Share Index (ALSI) and the 3 month Treasury Bill rate which are readily available and widely accepted as representing the market portfolio and the risk free rate. The distributions for the returns of these variables are shown in Appendix 1 in Figure 1.6 and Figure 1.7 respectively.

The FTSE/JSE All Share Index (ALSI) is the representation for the South African equity market portfolio. Published indices represent prices for the market portfolio and prices plus dividends from which, respectively, price returns and total returns can be calculated. Since we use only prices to calculate the returns for the newly constructed equity funds, we use the price index for the ALSI in calculations where necessary. Also, as mentioned earlier, we use the ALSI returns for the index that existed at each quarter and not those for the index as it was reconstructed in 2002.

The 3 month Treasury Bill (3mthTB) discount rate is a nominal, annually compounded quarterly, (NACQ) discount rate. This means that the published discount rate should be converted to a yield from which the quarterly returns can be calculated. The calculation for converting the 3mthTB discount rate (d) to a yield (i) is:

$$i = \frac{d}{1 - \frac{d}{4}}$$

Since i is an annual yield, we divide by 4 to get the quarterly return. For example, a 3mthTB discount rate of 7.80% translates into a yield of 7.95% from which the quarterly return of 1.99% is determined. Table 1.1 is an extract from data used in this study and shows the annual discounts and yields from which the quarterly returns for 2004 are derived.

Table 1.1: Annual discount converted to quarterly return

	discount NACQ	yield NACQ	quarterly return
31/03/2004	7.80%	7.95%	1.99%
30/06/2004	7.87%	8.03%	2.01%
30/09/2004	7.10%	7.23%	1.81%
31/12/2004	7.32%	7.46%	1.86%

1.8 Dietz method

The value of each portfolio at each quarter is determined. The quarterly performance can then be calculated using the Dietz method that assumes cash flows occur at the midpoint of two quarter-ends (see Appendix 1). This contrasts with the assumption by Oosthuizen and Smit (2002) of cash flows occurring at the end of each quarter, used in their investigation into investors' selection ability. The Dietz method approximates money-weighted returns, which include transactions, and is an alternative to time-weighted returns, which effectively neutralizes transactions, reflecting daily price return as a buy-and-hold return.

The performance is a price performance of the pure equity fund/portfolio where dividends are excluded. The new performance figures are compared (see Figure 1.4 in Appendix 1) to the published figures for each of the funds to highlight any data corruption in both the primary and secondary data.

1.9 Data description

Tables 1.3 and 1.4 in Appendix 1 provide the longitudinal and cross-sectional descriptions for the secondary data. We briefly discuss these two tables.

Fund name

Table 1.3 shows that 55 funds were considered with an average of 27 quarters of returns for the funds.

Mean

From Table 1.3, the average mean quarterly return is 4.7% with a maximum fund mean of 16.8% and a minimum fund mean of –0.6%. However, the number of quarters over which the mean is calculated varies from 47 to 1. Table 1.4 shows that the mean based on cross-sectional quarterly returns is 2.6% with a range from 29.7% for the quarter ending in March 1998 to –32.7% for September 1998 quarter-end. This translates into an annualized return of 11%, which compares with that for the ALSI of 14.2% and the 3mthTB rate of 13%.

Standard deviation

The average quarterly standard deviation of returns of the funds is 12.1%, which is marginally higher than that of 11.5% for the ALSI. Turning to Table 1.4 for the cross-sectional data description, we should place little emphasis on the 1993, 1994 and 1995 standard deviation of fund quarterly returns since the accumulation method for the data used in their calculation, renders these values less reliable. The standard deviations from 1996 are based on 12 quarters of returns, and are therefore more reliable, and show a high deviation of returns (7.2%) across 24 funds in the first quarter of 1998 and a low variation (1.3%) for 51 funds in the first quarter of 2004.

Minimum

From Table 1.4, a minimum return of –82.7% in the third quarter of 1993 suggests that there may an error in the portfolio holdings for one of the funds (Futuregrowth Albaraka Equity).The impact of this outlier on the overall results is expected to be negligible. More specifically, the risk-adjusted performance measures used in our analysis start in June 1996 and are based on the prior twelve quarters' data points. Therefore, the performance measures for the one fund will be affected by the outlier for the first two quarter-end measurements out the total of thirty-six measurements over the 9-year period. The fund is one of eighteen funds at those first two quarters. Since the impact is expected to be negligible, we have not adjusted the data that so as to compensate for this potential initial data error.

Also from Table 1.4, we observe that other relatively large negative returns occurred around the Russian financial crisis and the LTCM failure in 1998 (-43%) and 9/11 bombing of the twin towers, New York, in 2001 (-24%).

Maximum

ABSA General achieved its maximum of 47.1% (see Table 1.3) in the first quarter of 1998 (see Table 1.4). Table 1.4 shows that this maximum return corresponds with a minimum return for that quarter of 19.6%, which is the highest of all the minimum returns over other quarters – an indication that this was a particularly good quarter for funds in terms of returns.

Skewness

The analysis of skewness and kurtosis has implications for the use of traditional performance measures since those measures are more reliable when returns are normally distributed. For a normal distribution, Fisher skewness should be zero. Table 1.3 shows that 50% of the funds have a negative skew while the overall average was –1.15. Skewness was not calculated for the six funds with less than 3 data points.

Kurtosis

The normal distribution is called mesokurtic with (Fisher) kurtosis close to 0. A distribution with a kurtosis greater than 0 is leptokurtic and has a relatively high concentration around the mean and "fat tails". Platykurtic distributions have a kurtosis less than 0, lower peaks and thinner tails. Table 1.3 indicates that more than 50% of the funds are leptokurtic.

Tests for normality

We use three tests for testing departure from the normal distribution. The Kolmogorov-Smirnoff test is not as popular as the Lilliefors and Shapiro-Wilk test, largely due to the limitations of sample size and prior specification of the expected distribution. We briefly discuss the three tests below.

Kolmogorov-Smirnov

We use the Kolmogorov-Smirnov (K-S) test to test for normality in the distributions of returns for each fund. From Table 1.3, the p-values for the test suggest that at the 5% significance level, we should accept the null hypothesis that the returns for each fund are normally distributed over the period of measurement. Table 1.4 suggests that at quarter ends September 1993 and December 2000, the null hypothesis for returns across funds should be rejected. Due to criticisms (such as low sensitivity to the distribution tails and greater sensitivity to the distribution centre) against the reliability of this test, a test called the Anderson-Darling test could be used. The Anderson-Darling test is effectively a modified K-S test but is also reliant on certain distributional assumptions (as is the K-S test). We do not apply the Anderson-Darling test for normality but have rather chosen to use another modified K-S test, the Lilliefors test (discussed below), that is better suited to small sample sizes.

The Jarque-Bera test remains a popular alternative method for testing normality (e.g. Kosowski, Naik and Teo, 2007), specifically determining whether the sample skewness and kurtosis are unusually different from those for a normal distribution. However, the Jarque-Bera test is an asymptotic test and is increasingly unreliable for data sets of less than 100 observations. We supplement the results from the K-S test with those of the Lilliefors and Shapiro-Wilk test for normality – the latter two tests are more reliable for small sample sizes.

Lilliefors

The Lilliefors test is similar to the K-S test except that the parameters of the normal distribution, mean and variance, are estimated from the sample and not prescribed, as is the case for the K-S test. Finkelstein and Schafer (1971) show, that for small samples, the Lilliefors test is more powerful than the K-S test. The test results in Table 1.3 suggest that we reject the null hypothesis at the 10% level of significance for only three of the funds while Table 1.4 suggests that the normality of returns at fifteen of the thirty one quarters should be rejected at the 5% level of significance.

Shapiro-Wilk

The advantage of using the Shapiro-Wilk test is that it can be applied without prior specification of the mean and variance of the hypothesized normal distribution. Moreover, the test was originally introduced for application to small sample sizes (less than 50). The restriction to small sample sizes was as a result of the calculation and use of a covariance matrix of the order statistics in the Shapiro-Wilk test. However, now there are various approximations that allow the test to be applied to samples sizes up to 5000. The test results in Table 1.3 suggest that we reject the null hypothesis at the 5% and 10% level of significance for only four of the funds. Table 1.4 suggests that normality of returns for funds at seventeen quarters should be rejected at the 5% level of significance.

In summary, it seems reasonable to assume that the price returns for funds over time are approximately normally distributed for most of the funds. The reliability of some performance measures (see Chapter 2) is dependent on the assumption of the normality of returns.

1.10 References

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1.11 Appendix 1

1.11.1 The application of the Dietz method to performance evaluation

Let

Q_{it} = Quantity of security i held in the portfolio at time t

P_{it} = Price of security i held in the portfolio at time t

Then the Modified Dietz formula for the return for each security is:

$$R_{it} = \frac{MV_{it} - MV_{i(t-1)} - CF}{MV_{i(t-1)} + \sum (CF_i \times w_i)}$$

where

$MV_{it} = Q_{it} \times P_{it}$ = Market Value for a security,

CF is the net cash flow during the period t and $t-1$ and

w_i is the proportion of the period for which each cash flow (CF_i) is held in the account.

The Dietz method assumes that a single cash flow occurs in the middle of the period and its value is the average of the prices at the beginning and at the end of the period, then:

$$CF = (\frac{P_{it} + P_{i(t-1)}}{2}) \times (Q_{it} - Q_{i(t-1)})$$

and the w_i in the second term in the denominator is 0.5 since the cash flow will have been in the account for half of the period.

We now have

$$R_{it} = \frac{MV_{it} - MV_{i(t-1)} - (\frac{P_{it} + P_{i(t-1)}}{2}) \times (Q_{it} - Q_{i(t-1)})}{MV_{i(t-1)} + 0.5 \times (\frac{P_{it} + P_{i(t-1)}}{2}) \times (Q_{it} - Q_{i(t-1)})}$$

Simplify the denominator in the above formula by letting the adjusted beginning market value for each security be:

$$MVA_{it} = MV_{i(t-1)} + 0.5 \times (\frac{P_{it} + P_{i(t-1)}}{2}) \times (Q_{it} - Q_{i(t-1)})$$

and the adjusted beginning market value for the fund with n securities at t :

$$MVAP_t = \sum MVA_{it}$$

The fund weighting for each security is then

$$\frac{MVA_{it}}{MVAP_t}$$

Substituting into the Dietz formula and assuming a single, mid-period cash flow gives the fund weighted holdings-based return for each i as

$$R^*_{it} = \frac{MVA_{it}}{MVAP_t} \times \frac{(MV_{it} - MV_{i(t-1)} - (\frac{P_{it} + P_{i(t-1)}}{2}) \times (Q_{it} - Q_{i(t-1)}))}{(MV_{i(t-1)} + 0.5 \times (\frac{P_{it} + P_{i(t-1)}}{2}) \times (Q_{it} - Q_{i(t-1)}))}$$

$$= \frac{1}{MVAP_t} \times (MV_{it} - MV_{i(t-1)} - (\frac{P_{it} + P_{i(t-1)}}{2}) \times (Q_{it} - Q_{i(t-1)}))$$

or

$$R^*_{it} = \frac{MVA_{it}}{MVAP_t} \times R_{it}$$

The sum of the fund weighted holdings-based returns at t for each i is the holdings-based return for the fund with n securities, i.e.

$$R_t = \sum R^*_{it} \ .$$

1.11.2 Example of fund performance calculation

The table below is used to demonstrate steps taken in the calculation process for determining the fund returns.

Suppose a fund holds three shares over the quarter ends starting in July 2005 and ending in December 2006. The top of the table shows the quarterly quantities for the three JSE listed ordinary shares held by the fund: BHP Billiton (BIL), Impala Platinum Holdings (IMP) and Remgro (REM). The second section of the table shows the share prices at each quarter-end. The market values for each of the share holdings are shown in the third section. For example, the market value for BIL at the end of September 2005 is the number of shares held in the fund multiplied by the price of each share:

211 400 shares x 10 380 cents = 2 194 332 000 cents

The total market value for the fund at the quarter-end is 13 881 622 900 cents.

The fourth section shows the adjusted beginning market value for BIL (value in cents)

$$1829859500 = 1862952000 + 0.5 \times \left(\frac{10380 + 8530}{2}\right) \times (211400 - 218400)$$

The sum of the adjusted beginning market values for each share at the end of September 2005 is 12 245 023 525 cents.

Table 1.2: Example of performance calculation

Number of shares held							
	06/2005	09/2005	12/2005	03/2006	06/2006	09/2006	12/2006
BIL	218,400	211,400	208,700	410,000	379,900	628,500	625,100
IMP	2,545,700	2,545,700	2,832,200	2,988,700	793,900	753,700	843,500
REM	682,000	805,500	860,050	951,450	635,550	438,550	338,850
Prices							
	06/2005	09/2005	12/2005	03/2006	06/2006	09/2006	12/2006
BIL	8530	10380	10390	11249	13875	13366	12895
IMP	1012	1112	1185	1415	1180	1225	1500
REM	10520	10995	12200	13500	13501	15400	17801
End of period Quantities Holding Value							
Col Totals	11,613,840,400	13,881,622,900	16,017,160,000	21,685,675,500	14,788,475,050	16,077,483,500	15,357,783,350
	06/2005	09/2005	12/2005	03/2006	06/2006	09/2006	12/2006
BIL	1,862,952,000	2,194,332,000	2,168,393,000	4,612,090,000	5,271,112,500	8,400,531,000	8,060,664,500
IMP	2,576,248,400	2,830,818,400	3,356,157,000	4,229,010,500	936,802,000	923,282,500	1,265,250,000
REM	7,174,640,000	8,856,472,500	10,492,610,000	12,844,575,000	8,580,560,550	6,753,670,000	6,031,868,850
Adjusted Beginning Market Value							
Col Totals		12,245,023,525	14,348,447,588	17,795,112,675	17,940,336,925	15,033,958,700	15,288,802,975
		09/2005	12/2005	03/2006	06/2006	09/2006	12/2006
BIL		1,829,859,500	2,180,312,250	3,257,375,675	4,423,031,900	6,964,140,650	8,378,209,150
IMP		2,576,248,400	2,995,341,025	3,457,882,000	2,805,134,000	912,631,750	984,458,750
REM		7,838,915,625	9,172,794,313	11,079,855,000	10,712,171,025	7,157,186,300	5,926,135,075
Holdings Based Returns for Total Portfolio							
Col Totals		8.2%	8.4%	11.9%	3.3%	5.3%	5.6%
		09/2005	12/2005	03/2006	06/2006	09/2006	12/2006
BIL		3.2%	0.0%	1.5%	5.8%	-1.7%	-1.9%
IMP		2.1%	1.4%	3.8%	-2.5%	0.2%	1.4%
REM		2.9%	7.0%	6.6%	0.0%	6.8%	6.1%

Assuming a single, mid-period cash flow gives the holdings-based return for BIL at the end of September 2005 as:

$$21.7\% = \frac{2194332000 - 1862952000 - (\frac{10380 + 8530}{2}) \times (211400 - 218400)}{1862952000 + 0.5 \times (\frac{10380 + 8530}{2}) \times (211400 - 218400)}$$

The fund weighting of BIL is

$$14.9\% = \frac{1829859500}{12245023525}$$

and the fund weighted return for BIL is

3.2% = 14.9% x 21.7%

The sum of the fund weighted returns for the three shares is 8.2%, the return for the fund over the quarter ending in September 2005.

1.11.3 Figures and tables

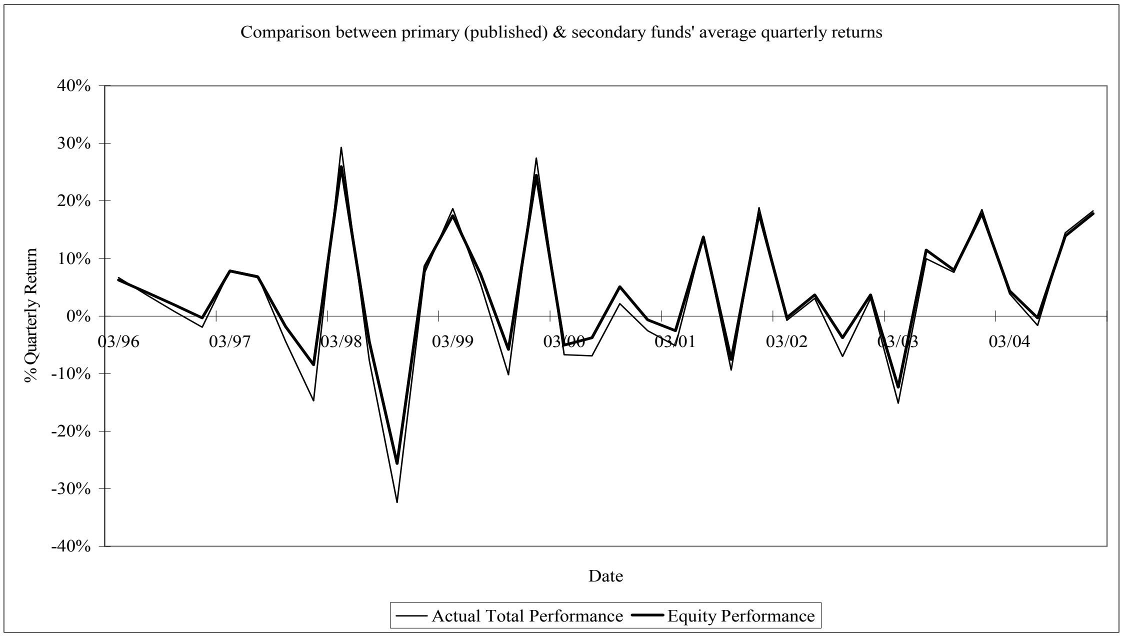

Figure 1.4: Average returns for equity funds

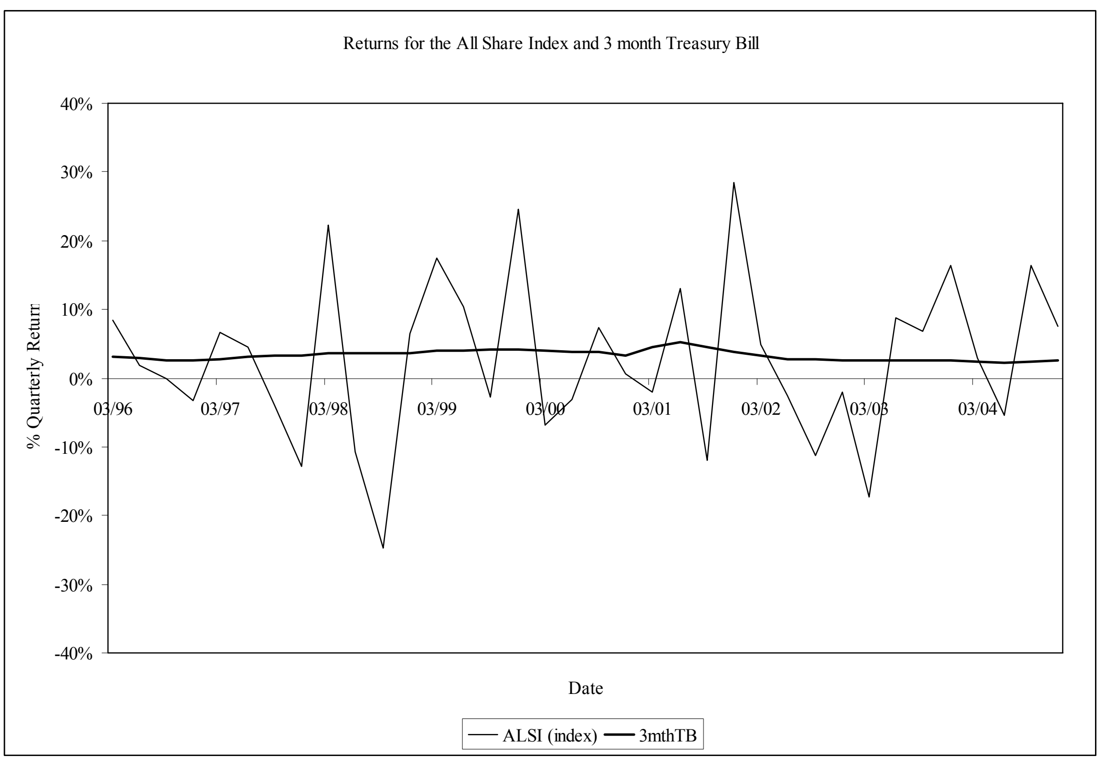

Figure 1.5: Market returns and risk-free rate

Table 1.3: Data description for reconstructed funds from general equity, value and growth unit trust categories

Fund name	No. of quarters	Mean	Standard Deviation	Minimum	Maximum	Skew	Kurtosis	K-S d	K-S p-values	Lilliefors	Shapiro-Wilk W	S-W p-values
Sanlam General Equity	47	3.0%	12.1%	-30.1%	30.9%	0.08	0.52	0.083	p> .20	p> .20	0.9834	0.7363
Sanlam Growth	47	1.7%	15.4%	-42.5%	39.3%	-0.23	1.44	0.103	p> .20	p> .20	0.9655	0.1775
Investec Equity	47	4.5%	13.7%	-36.4%	30.8%	-0.38	0.99	0.084	p> .20	p> .20	0.9725	0.3284
Metropolitan General Equity	47	3.0%	13.2%	-29.4%	37.6%	0.49	0.83	0.091	p> .20	p> .20	0.9733	0.3517
RMB Equity	47	3.8%	13.3%	-32.9%	33.7%	-0.16	0.28	0.069	p> .20	p> .20	0.9905	0.9651
ABSA General	47	2.9%	13.1%	-39.1%	47.1%	0.13	3.45	0.085	p> .20	p> .20	0.9446	0.0267
Nedbank Growth	47	1.5%	12.7%	-30.2%	27.2%	-0.04	-0.02	0.051	p> .20	p> .20	0.9905	0.9646
Community Growth	46	2.8%	13.4%	-31.3%	36.3%	0.18	0.45	0.121	p> .20	p< .10	0.9793	0.5768
Old Mutual Investors	47	2.7%	13.2%	-34.7%	34.0%	0.09	0.75	0.071	p> .20	p> .20	0.9818	0.6680
Old Mutual Top Companies	47	3.8%	12.6%	-33.8%	34.6%	-0.14	0.93	0.068	p> .20	p> .20	0.9849	0.7981
Futuregrowth Core Growth	47	1.3%	13.5%	-31.1%	32.8%	0.06	0.18	0.058	p> .20	p> .20	0.9914	0.9784
Futuregrowth Albaraka Equity	47	1.6%	16.5%	-82.7%	21.0%	-3.04	14.27	0.166	p< .15	p <.01	0.7493	0.0000
Stanlib Wealthbuilder	47	1.8%	11.4%	-25.5%	25.8%	-0.18	0.08	0.073	p> .20	p> .20	0.9865	0.8572
Sage Fund	47	2.8%	11.5%	-31.4%	27.1%	-0.38	0.77	0.084	p> .20	p> .20	0.9824	0.6933
Old Mutual Growth	44	2.5%	14.4%	-43.0%	41.8%	-0.16	2.63	0.116	p> .20	p< .15	0.9473	0.0437
Stanlib Prosperity	39	2.1%	11.8%	-30.9%	27.6%	-0.24	0.59	0.085	p> .20	p> .20	0.9854	0.8841
Stanlib Index	37	2.5%	11.9%	-23.6%	29.2%	0.05	-0.01	0.076	p> .20	p> .20	0.9892	0.9713
Investec Index	36	2.6%	12.0%	-23.6%	27.9%	0.08	-0.11	0.081	p> .20	p> .20	0.9892	0.9748
Stanlib Capital Growth	34	1.8%	14.3%	-36.1%	25.9%	-0.31	0.04	0.078	p> .20	p> .20	0.9756	0.6298
Coronation Equity	32	2.6%	13.4%	-30.8%	32.2%	0.10	0.35	0.097	p> .20	p> .20	0.9732	0.5915
Investec Growth	28	3.5%	17.1%	-38.7%	42.9%	0.01	0.80	0.072	p> .20	p> .20	0.9862	0.9640
Investec Value	28	5.3%	13.7%	-39.1%	23.6%	-1.27	2.57	0.144	p> .20	p< .10	0.9047	0.0147
RMB Strategic Opportunities	28	4.0%	16.9%	-43.4%	42.2%	-0.19	1.60	0.104	p> .20	p> .20	0.9651	0.4571
Gryphon All Share Tracker	29	2.0%	14.0%	-27.0%	29.8%	0.03	-0.50	0.061	p> .20	p> .20	0.9881	0.9805
Nedbank Value	26	4.1%	12.5%	-33.8%	25.8%	-0.97	2.23	0.116	p> .20	p> .20	0.9435	0.1628
Nedbank Equity	25	3.2%	12.8%	-22.0%	24.0%	-0.15	-0.96	0.131	p> .20	p> .20	0.9639	0.4976
PSG Growth	24	3.0%	13.3%	-16.6%	31.8%	0.47	-0.69	0.110	p> .20	p> .20	0.9566	0.3743
Old Mutual Value	24	5.7%	10.3%	-14.4%	24.9%	-0.02	-0.73	0.086	p> .20	p> .20	0.9835	0.9501
RMB Value	23	5.5%	10.3%	-12.2%	23.6%	0.15	-0.90	0.102	p> .20	p> .20	0.9686	0.6558
Nedbank Rainmaker	22	2.6%	12.2%	-19.8%	21.9%	0.03	-0.89	0.090	p> .20	p> .20	0.9658	0.6148
Allan Gray Equity	22	4.3%	9.0%	-15.5%	21.7%	-0.14	-0.15	0.097	p> .20	p> .20	0.9886	0.9942
Old Mutual High Yield Opportunity	22	5.1%	8.8%	-14.8%	25.7%	0.19	0.81	0.142	p> .20	p> .20	0.9719	0.7547
FNB Growth	22	3.5%	12.5%	-13.2%	27.1%	0.41	-1.06	0.119	p> .20	p> .20	0.9358	0.1616
Sanlam Value	22	5.6%	11.9%	-14.7%	29.8%	0.55	-0.34	0.131	p> .20	p> .20	0.9565	0.4219
Futuregrowth Active Quant Equity	21	4.1%	11.6%	-15.8%	27.7%	0.39	-0.64	0.129	p> .20	p> .20	0.9631	0.5802
Appleton Visionary Growth	19	-0.6%	12.5%	-23.9%	16.9%	-0.21	-1.18	0.139	p> .20	p> .20	0.9428	0.2957
Prudential Dividend Maximiser	19	4.8%	9.9%	-15.7%	23.3%	0.15	0.12	0.145	p> .20	p> .20	0.9657	0.6886
Prudential Optimiser	19	4.9%	10.9%	-15.2%	23.3%	0.16	-0.66	0.116	p> .20	p> .20	0.9687	0.7492
Woolworths Unit Trust	18	3.6%	10.6%	-16.0%	20.8%	0.05	-0.74	0.114	p> .20	p> .20	0.9682	0.7629
Coris Capital General Equity	17	2.8%	12.3%	-17.4%	28.5%	0.28	-0.20	0.110	p> .20	p> .20	0.9763	0.9155
Tri-Linear Equity	17	2.8%	11.3%	-14.2%	18.8%	0.01	-1.41	0.155	p> .20	p> .20	0.9219	0.1593
Stanlib Value	15	6.1%	10.1%	-12.3%	22.8%	-0.15	-0.69	0.095	p> .20	p> .20	0.9814	0.9782
Galaxy Equity	11	3.4%	10.8%	-17.2%	17.9%	-0.42	-0.26	0.114	p> .20	p> .20	0.9664	0.8479
Inv Solutions MM Equity	10	4.2%	11.5%	-16.3%	18.4%	-0.49	-0.54	0.128	p> .20	p> .20	0.9523	0.6958
Fraters Earth Equity	10	5.7%	10.6%	-16.5%	19.7%	-0.86	1.00	0.154	p> .20	p> .20	0.9487	0.6528
Interneuron Equity	8	6.5%	12.1%	-18.3%	20.6%	-1.23	1.97	0.191	p> .20	p> .20	0.9102	0.3552
Foord Equity	7	8.4%	7.6%	-3.1%	16.3%	-0.48	-1.22	0.177	p> .20	p> .20	0.9159	0.4384
Nedbank Quants Core Equity	18	2.1%	11.4%	-24.1%	20.1%	-0.41	0.50	0.122	p> .20	p> .20	0.9543	0.4956
RMB Structured Equity	1	17.4%		17.4%	17.4%							
RMB Core Equity	1	19.9%		19.9%	19.9%							
Oasis General Equity	2	10.0%	7.8%	4.5%	15.5%							
Oasis Crescent Equity	2	8.2%	9.0%	1.8%	14.6%							
Blue Horizon High Dividend	2	16.8%	8.4%	10.8%	22.7%							
ABSA Select Equity	1	13.5%		13.5%	13.5%							
Stanlib MM Equity Feeder	21	3.1%	11.7%	-15.8%	30.0%	0.74	0.29	0.1431	p> .20	p> .20	0.95332	0.39286
Averages	27	4.7%	12.1%	-21.8%	26.7%	-0.15	0.54	0.108	p> .20	p> .21	0.9613	0.5965

Where p-value is greater than the significance level alpha=0.05, accept the null hypothesis H0 - the data is normally distributed.
The p-value is the risk to rejecting the null hypothesis H0 while it is true.
The marked cells indicate where normality is rejected at the 5% level.

Table 1.4: Data description by quarter-end returns (cross-sectional) of reconstructed funds

Quarter end	No. of Funds	Mean	Standard Deviation	Minimum	Maximum	Skew	Kurtosis	K-S d	K-S p-values	Lilliefors	Shapiro-Wilk W	S-W p-values
06/93	13	8.1%	6.5%	-11.7%	15.1%	-2.58	8.10	0.323	p<.15	p<.01	0.7105	0.0007
09/93	14	-16.2%	21.5%	-82.7%	-3.8%	-2.76	7.77	0.356	p<.05	p<.01	0.5703	0.0000
12/93	14	21.6%	7.4%	0.9%	30.5%	-1.86	4.39	0.283	p<.20	p<.01	0.8115	0.0070
03/94	15	-2.2%	9.0%	-22.8%	9.6%	-1.63	2.22	0.290	p<.15	p<.01	0.7616	0.0012
06/94	15	7.0%	8.4%	-13.2%	17.0%	-1.29	1.41	0.188	p> .20	p<.15	0.8861	0.0585
09/94	15	-4.1%	8.5%	-18.8%	7.4%	-0.53	-1.00	0.161	p> .20	p> .20	0.9229	0.2132
12/94	15	0.3%	7.3%	-17.7%	6.8%	-1.55	1.82	0.244	p> .20	p<.05	0.8106	0.0051
03/95	15	-8.1%	1.7%	-10.2%	-4.0%	1.12	1.46	0.131	p> .20	p> .20	0.9241	0.2220
06/95	16	0.5%	3.7%	-6.2%	6.3%	-0.50	-0.90	0.226	p> .20	p<.05	0.9186	0.1602
09/95	16	5.2%	1.5%	3.0%	8.4%	0.37	-0.40	0.147	p> .20	p> .20	0.9500	0.4891
12/95	17	11.9%	4.7%	-1.5%	21.0%	-1.00	3.66	0.192	p> .20	p<.10	0.8961	0.0584
03/96	18	6.6%	2.1%	2.2%	12.3%	0.73	3.16	0.173	p> .20	p<.15	0.9075	0.0778
06/96	18	3.5%	1.5%	1.3%	6.5%	0.59	-0.35	0.184	p> .20	p<.15	0.9339	0.2270
09/96	19	0.7%	1.6%	-1.3%	4.4%	0.93	0.20	0.156	p> .20	p> .20	0.9193	0.1099
12/96	19	-2.2%	3.3%	-5.6%	4.9%	1.21	0.44	0.196	p> .20	p<.05	0.8366	0.0041
03/97	20	7.8%	3.6%	2.4%	20.2%	2.00	6.84	0.182	p> .20	p<.10	0.8227	0.0019
06/97	20	7.1%	3.7%	1.1%	16.0%	0.71	0.50	0.104	p> .20	p> .20	0.9616	0.5752
09/97	20	-4.4%	1.9%	-7.9%	0.3%	0.65	1.24	0.117	p> .20	p> .20	0.9637	0.6201
12/97	21	-15.5%	5.2%	-27.3%	-6.1%	-0.45	0.19	0.115	p> .20	p> .20	0.9722	0.7816
03/98	24	29.7%	7.2%	19.6%	47.1%	0.61	-0.22	0.119	p> .20	p> .20	0.9464	0.2261
06/98	24	-7.1%	6.9%	-18.0%	7.9%	0.40	-0.53	0.119	p> .20	p> .20	0.9668	0.5891
09/98	25	-32.7%	5.4%	-43.4%	-23.6%	-0.23	-0.34	0.121	p> .20	p> .20	0.9721	0.6987
12/98	26	7.8%	4.5%	-3.4%	17.2%	-0.43	0.58	0.092	p> .20	p> .20	0.9731	0.7041
03/99	28	18.7%	2.7%	14.0%	25.8%	0.69	0.99	0.094	p> .20	p> .20	0.9519	0.2206
06/99	29	5.3%	5.6%	-4.1%	14.2%	-0.11	-1.10	0.096	p> .20	p> .20	0.9534	0.2243
09/99	35	-11.0%	6.4%	-24.1%	0.6%	-0.11	-0.73	0.081	p> .20	p> .20	0.9794	0.7394
12/99	36	27.7%	6.8%	10.3%	42.9%	0.04	0.71	0.086	p> .20	p> .20	0.9810	0.7783
03/00	36	-6.7%	2.8%	-10.2%	3.1%	1.51	3.40	0.151	p> .20	p<.05	0.8908	0.0019
06/00	39	-7.1%	4.1%	-15.2%	-0.4%	-0.57	-0.75	0.149	p> .20	p<.05	0.9285	0.0160
09/00	41	2.0%	3.7%	-6.0%	10.1%	-0.14	0.09	0.129	p> .20	p<.10	0.9748	0.4859
12/00	43	-2.6%	4.7%	-22.0%	2.5%	-2.27	6.38	0.230	p<.05	p<.01	0.7727	0.0000
03/01	43	-5.1%	6.8%	-23.9%	13.0%	-0.09	1.53	0.102	p> .20	p> .20	0.9703	0.3238
06/01	44	13.9%	2.5%	1.6%	19.5%	-2.46	12.60	0.163	p<.20	p<.01	0.7856	0.0000
09/01	44	-9.4%	5.1%	-24.1%	3.2%	0.33	1.32	0.168	p<.20	p<.01	0.9385	0.0208
12/01	44	18.8%	6.2%	3.5%	30.7%	-0.45	-0.17	0.128	p> .20	p<.10	0.9646	0.1929
03/02	44	-0.7%	3.5%	-8.0%	5.9%	-0.21	-0.11	0.132	p> .20	p<.10	0.9512	0.0610
06/02	45	3.1%	3.7%	-3.2%	11.9%	0.23	-0.46	0.091	p> .20	p> .20	0.9761	0.4699
09/02	47	-7.0%	3.6%	-13.7%	2.5%	0.85	0.76	0.148	p> .20	p<.05	0.9422	0.0215
12/02	47	3.1%	2.9%	-2.3%	12.1%	0.63	0.73	0.099	p> .20	p> .20	0.9690	0.2425
03/03	48	-15.2%	1.8%	-18.3%	-10.1%	0.90	0.51	0.158	p<.20	p<.01	0.9332	0.0090
06/03	49	9.9%	3.1%	1.9%	17.0%	0.18	0.21	0.120	p> .20	p<.10	0.9740	0.3474
09/03	49	7.6%	2.0%	4.2%	13.4%	0.83	0.73	0.101	p> .20	p> .20	0.9515	0.0423
12/03	53	18.4%	2.4%	14.6%	24.7%	0.51	-0.40	0.141	p> .20	p< .05	0.9527	0.0476
03/04	51	3.9%	1.3%	0.7%	6.9%	0.28	0.31	0.094	p> .20	p> .20	0.9759	0.4075
06/04	49	-1.6%	2.0%	-5.9%	1.8%	-0.13	-0.69	0.062	p> .20	p> .20	0.9775	0.4654
09/04	50	14.5%	1.8%	7.6%	18.4%	-1.04	3.19	0.104	p> .20	p> .20	0.9277	0.0050
12/04	50	18.3%	4.7%	8.0%	29.8%	-0.10	0.11	0.073	p> .20	p> .20	0.9791	0.5420
Averages	31	2.6%	4.6%	-8.0%	11.1%	-0.13	1.48	0.152	p> .20	p< .05	0.9136	0.2446

Where p-value is greater than the significance level alpha=0.05, accept the null hypothesis H0 - the data is normally distributed.
The p-value is the risk to rejecting the null hypothesis H0 while it is true.
The marked cells indicate where normality is rejected at the 5% level.

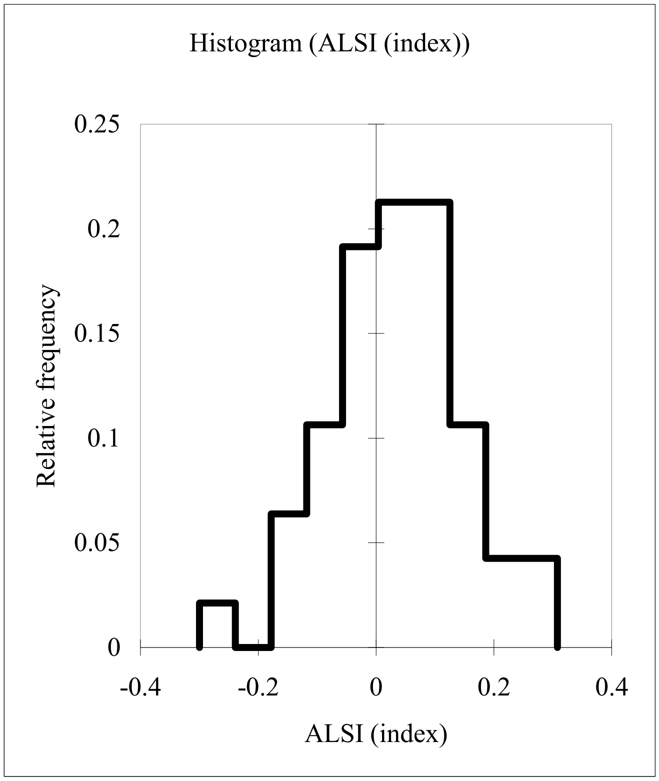

Figure 1.6: Distribution for the All Share Index

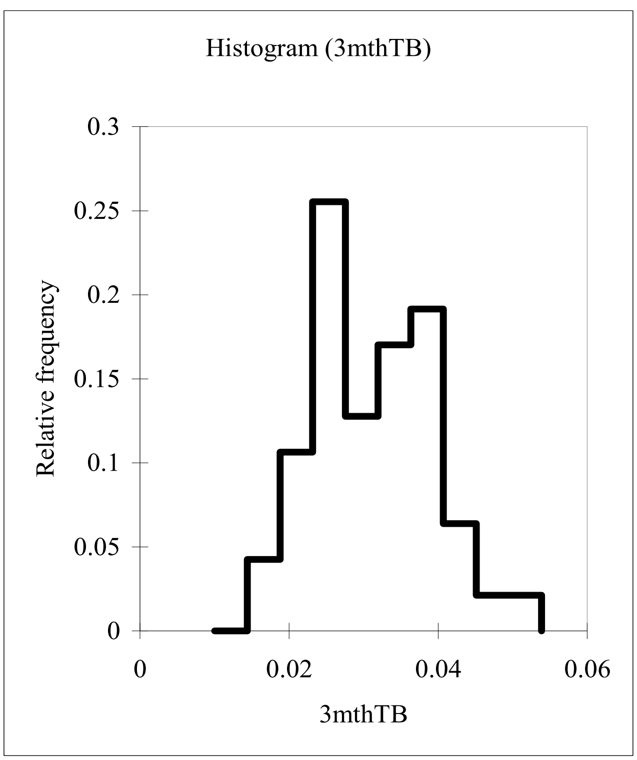

Figure 1.7: Distribution for the 3 month Treasury Bill Rate

Table 1.5: Descriptive statistics for the market and risk-free rate

	ALSI	3-mth TB
No. of quarters	47	47
Mean	3.4%	3.1%
Std dev	11.5%	0.8%
Minimum	-24.7%	1.8%
Maximum	29.8%	5.3%
Skewness	0.15	0.46
Kurtosis	0.28	0.02
Shapiro-Wilk W	0.988	0.973
p-value	0.917	0.346
Lilliefors p-value	0.684	0.292

As the computed p-values for both normality tests and each data set is greater than the significance level alpha=0.05, we should accept the null hypothesis that each sample follows a normal distribution.

Chapter 2: Performance Persistence

2.1 Introduction

Many will agree with the view that the future is uncertain. Keynes (1937) referred to uncertainty as the prospect of events, like war, occurring where for "…these matters there is no scientific basis on which to form any calculable probability whatever". By assigning probabilities to future outcomes, uncertainty is transformed into risk. Therefore, while future fund performance may be viewed as uncertain by some investors, by assigning probabilities to alternative performance outcomes and transforming uncertainty into risk, investors are able to formulate performance expectations for funds. Investors use past performance when determining probabilities that they assign to future performance outcomes. They assume that features of past performance will recur. For example, they may assume that winning funds in one period will be winning funds in the subsequent period. The recurrence of features of performance from one period to the next is referred to as performance persistence.

The Efficient Market Hypothesis (EMH) says that past performance is not a determinant of future performance. This hypothesis applies at the stock and fund levels. However, available evidence suggests the contrary and as Gruber (1996) shows, investors who chase past performance are rational wealth maximisers. Using past performance to predict future performance can, itself, affect future performance. Campbell and Viceira (2005) find that asset return predictability has important effects on the variance and correlation structure of returns on stocks, bonds and T-bills across investment horizons. Also, the belief that investors use historical fund performance to choose funds for future investments, is an incentive for fund managers to have their funds perform well at the end of performance evaluation periods. Steyn and Smit (2004) support this view with their evidence of window-dressing by South African funds at quarter-end.

The presence of performance persistence can benefit fund managers as well as investors. The identification of persistence allows managers to simultaneously position themselves relative to their competitors' funds and decide on necessary adjustments to the management of their own fund, and it allows investors to compare investment alternatives when making choices as to which manager they should entrust the investment of their capital.

We can now isolate two distinct purposes for identifying persistence: to determine whether past performance is a reliable indicator of future performance and whether fund managers possess the ability to consistently achieve superior performance.

Various performance measures, apart from raw returns, have been used to investigate fund performance persistence. As highlighted in "Data: Use of Raw Returns", Chapter 1, investigating persistence in raw returns does enjoy support but it is insufficient and persistence of risk-adjusted performance must be considered. White and Miles (1999) use raw returns in their investigation into performance persistence and downplay the relevance of risk-adjusted performance measures that use beta or standard deviation as measures of risk. In contrast, we use both of these risk measures in our risk-adjusted performance measures.

Two EDHEC surveys by Amenc, Delaunay, Giraud, Goltz and Mertellini (2003, 2004) suggest that the Sharpe ratio is one of the most preferred risk-adjusted performance indicators among investors and fund managers. Mcleod and van Vuuren (2004) provide support for its use in South Africa for superior fund selection (with a minor interpretation shift). We examine performance persistence using six different performance measures including raw excess returns, Jensen's alpha, the popular Sharpe ratio, the Sortino ratio, the Treynor ratio and a relatively new performance measure, the Omega statistic.

Our study focuses on reconstructed "equity-only" South African portfolios in order to determine whether equity holdings are a source of persistence. Our study is a refinement on previous studies that have considered the returns for entire funds, of which each usually include instruments other than ordinary shares (e.g. bonds, money market instruments, derivatives, etc.) when investigating performance persistence. Therefore, this study adds to the documentation on South African fund performance persistence and tries to narrow the sources of persistence to the equity security holdings of funds as an explanation of fund performance persistence found in the South African literature reviewed below.

2.2 Literature review

2.2.1 International backdrop

A number of investigations into fund performance and timing persistence have been conducted. Anderson and Schnusenberg (2005), Allen, Brailsford, Bird and Faff (2003) and Kazemi, Schneeweis and Pancholi (2003) together provide a review of the persistence studies that have been conducted over the last four decades. While the debate continues, there are a larger number of studies suggesting that persistence exists. However, these results have been attributed to, among others, survivorship biases or benchmark errors (e.g., Brown, Goetzmann, Ibbotson and Ross, 1992, Malkiel, 1995, Wermers, 1997, Carhart, 1997).

Carhart (1997) notes that: "Mutual fund performance is well documented in the finance literature, but not well explained". Identifying the sources of persistence is a step forward to explaining fund performance. Different sources of persistence have been identified in the existing literature. Carhart (1997) finds that persistence in expense ratios drives much of the persistence in fund performance. In contrast to earlier studies, Phelps and Detzel (1997) argue that positive persistence disappears when more complete risk adjustments are made or the more recent past is examined. We use various risk-adjusted measures and examine data over the 9-year, 5-year and more recent 3-year period, each ending in December 2004. In another opposing study to earlier studies, Bollen and Busse (2001) find evidence of persistence when using daily data suggesting that data frequency may influence the results from a persistence analysis. Data availability limits this study to the use of quarterly data.

Jegadeesh and Titman (1993) explore persistence in individual stocks. They find that strategies based on past performance for winning and losing stocks, calculated over 1, 2, 3 and 4 quarters, are profitable over the subsequent 1, 2, 3 and 4 quarters – stock momentum explains persistence in fund performance. In contrast, our study uses portfolios of stocks and investigates the association between ranking of funds at a quarter-end with the rankings of those funds over 1, 2, 3 and 4 subsequent quarters. This gives a total of four strategies which contrasts with the Jegadeesh and Titman (1993) study where sixteen strategies are examined.

Carhart (1997) points out that the winning funds are not a result of managers successfully following momentum strategies but because they "…just happen by chance to hold relatively larger positions in last year's winning stocks". He finds that common factors in stock returns (including the afore-mentioned momentum factor) and investment differences largely explain the performance persistence in the average and risk-adjusted returns of equity funds. In our analysis, we exclude the fund expenses and transaction cost associated with funds but include risk-adjusted returns.

Khorana and Nelling (1997) have approached the investigation into performance persistence differently to most previous studies that consider the performance for entire funds. Their study examines the performance of equity sector funds and finds no significant persistence among these funds. While sector funds will also hold instruments that are not equity securities (e.g. money market securities), their investigation is a refinement of the studies of entire funds where exposure is diversified across sectors. Similarly, our study seeks to refine the investigation into fund performance persistence by examining the diversified equity holdings of funds without distilling the impact of sector holdings for the funds.

2.2.2 South African research

While a large number of previous studies have been conducted using data for developed markets (predominantly US and UK markets), there have been studies conducted using emerging market data. We review South African published literature, relating to fund performance persistence, for the ten years to 2005. Collinet and Firer (2003) say that the tests are inconclusive and that performance persistence appears to depend on the period analysed, the length of the holding period and the test method applied. We include these components of persistence tests in brief notes for the following particular aspects of the South African literature reviewed and where all funds, used in each analysis, were South African Unit Trusts:

- Number of unit trusts funds used
- Category of unit trust funds used
- Period over which data extends
- Data type and frequency
- Performance measures used
- Methods used
- Horizon for persistence evaluation
- Conclusion of the study

The review notes on the South African literature are followed by a review summary that aims to provide a bird's eye view of the review notes to facilitate easier positioning of this study relative to those reviewed. A discussion on alternative persistence sources and issues relating to survivorship biases which, with the review notes and summary, provide context to Section 2.2.5, where we discuss aspects of this study.

2.2.2.1 Review notes

Meyer (1998) used funds that traded in SA from July 1985 to June 1995 – 13 funds for the entire 10 years plus 33 for the last five years. Repurchase prices plus dividends were used to calculate monthly total returns. Jensen's alpha (using 24 and 48 data points) was used to calculate a risk-adjusted performance for all funds. Historical periods of 2 and 4 years were used to test for persistence over 4, 2 and 1 year forward periods. Two tests based on two different definitions of winners and losers were conducted. The first test was based on evaluating (visual inspection) the consecutive negative/positive alphas, where winners were positive alphas and losers, negative alphas. Rank order correlations for the risk-adjusted returns were also used for adjacent periods. The second test follows Goetzmann and Ibbotson's (1994) definitions (not methodology), where winners are above median and losers below median performance. The nominal and risk-adjusted performances were used in this second test. Percentages of repeat winners and losers were calculated as probabilities of occurrence. The analysis concludes that some persistence exists for SA unit trust performances but it is not statistically significant. The repeat winner phenomenon, based on nominal and risk-adjusted returns, exists for 1, 2 and 4-year periods (albeit that the 1-year results were weak). A much stronger loser phenomenon existed over the same periods. Results for nominal and risk-adjusted measures were the same. The longer the evaluation period, the better the results for the winner phenomenon.

Firer, Beale, Edwards, Hendrie and Scheppening (2001) use 43 funds from the general equity category and 35 from the bond and fixed income category. Monthly price and dividend/interest data were used to calculate total returns for the period January 1989 to December 1999. Raw returns and Sharpe measures were used (the Sharpe measure was not used for the fixed income funds) to rank funds according to quartiles and medians and persistence was tested for formation and holding periods over three months, six months, one year and two years. 36 months were used to calculate standard deviations used in the Sharpe measures. Following Kahn and Rudd (1995), winner-loser contingency tables were used and a Chi-squared test was applied. The conclusion was that there is significant persistence for the equity unit trusts. Formation and holding periods of three months, six months, twelve months and two years were used. The strongest overall persistence was found when the six-month formation period was used to predict a three-month holding period. Top quartile and bottom quartile persistence existed for the three month formation period and subsequent four holding periods. However, the best winner-winner persistence was for the two-year formation-holding period.

Von Wieligh and Smit (2000) use the following unit trust data:

- 10 funds from general equity for January 1988 – December 1997
- Funds from general equity for January 1993 – December 1997
- All 21 funds for January 1988 – December 1997
- All 42 funds for January 1993 – December 1997

Monthly price (selling) data (after fees) was used to calculate portfolio returns. Performance measurement was based on the CAPM, a two-factor APT and a three-factor APT model. These regressions used 60 and 120 data points – monthly data for the five and ten year periods. The test for persistence is based on a modified version of the methodology of Hendricks, Patel and Zeckhauser (1993) and is evaluated for 1-year (short-term) and 5-year (long-term) performance. The study finds persistence in all funds over the short and long term. The results show more evidence for performance persistence in General Equity Funds over the long-term. The worst performers stay worst performers while best performers converge to average performers.

Collinet and Firer (2003) use domestic general equity funds for the period December 1979 to December 1999. The total number of funds during the period was 47 with 7 funds in January 1980, 14 in January 1990 and 43 in December 1998. Total monthly returns (selling price plus distributions) were obtained. Excess return and the Sharpe ratio were used as performance measures. The standard deviation of returns was calculated using 36 months' returns. Various formation and holding periods were combined: 6 months, 1 year, 2 years and three years. The persistence analysis was approached in three ways:

- The first part follows the methodology of Kahn and Rudd (1995), where 2X2 contingency tables are used. The Chi-squared statistic was used to test independence.
- The second part is based on regressions of the percentile rankings from one period to the next. They use the slope of the regression to measure the relationship between rankings at different times. This methodology follows that of Grinblatt and Titman (1992), Goetzmann and Ibbotson (1994) and Hallahan (1999).
- The third method is the runs test which is used to test the randomness of the sequence of relative performance of a fund over time.

They conclude that a weak but positive relationship exists between past and future fund performance rankings. Persistence for winning and losing funds was evident for holding periods of 6 months.

Gopi, Bradfield and Maritz (2004) use funds from the general equity category excluding fund-of-funds and index tracking funds for the period March 1995 to March 2004. The data consists of 41 funds of which eight were non-surviving funds. The monthly price (bid-to-bid) data after fees is used to calculate annualised returns. Funds are ranked according to quartiles at each quarter and Spearman's Coefficient of Rank correlation was used to evaluate the relationship of one quarter's fund rankings with subsequent quarters' rankings. The same exercise was done using calendar year rankings. In addition, the percentage of funds that moved from one quarter to another was determined and the Chi-squared test at the 5% significance level was applied. If the proportion of movements is significantly different from 25%, then the null hypothesis of random movement is rejected. They find evidence of persistence over calendar years and over consecutive quarters. First quartile performers show greatest persistence, followed by the bottom quartile performers.

Wessels and Krige (2005) use 32 Funds from the general equity category. Monthly price data (after fees) from 1988 to 2003 was used to calculate performance data on which funds were ranked in terms of percentiles, deciles and quartiles over rolling three, five and ten year investment periods. The analysis focuses on results for individual funds and not aggregate results for all funds. The frequencies of quartile rankings for each fund over the rolling three horizons are calculated and expressed as a percentage, indicating the probability of the fund ranking in the top 25%, middle 50% and the bottom 25%. The individual funds are ranked again, except this ranking is according to their average percentile rankings with a view to visually comparing the average rankings over the rolling three horizons. In order to evaluate whether funds outperform the JSE All Share Index, the percentage out-performance over the three rolling periods was calculated for each fund. The test for persistence is based on probabilities derived from shifts in decile rankings for the bottom, middle and top third of fund rankings using the rolling three year performance data and the funds' performances over subsequent successive monthly, quarterly, yearly and three-yearly periods. Persistence was found for successive monthly and quarterly periods, particularly with respect to repeat top performers, while movements for one year forward became more random and even more so for the three-year forward period.

Oldham and Kroeger (2005) use 20 funds from the following categories: Domestic AA Prudential, Domestic Equity General, Domestic Equity Growth, Domestic Equity Smaller Companies, Domestic Equity Value. Weekly price returns for the period January 1998 to December 2002. The performance measure is the Jensen's alpha that results from applying the CAPM and three-factor APT equations. These regressions use weekly data over one year – approximately 52 data points. Following Goetzmann and Ibbotson (1994), persistence is measured by regressing the current year's alpha values on the previous year's alpha values. The overall conclusion was that there is some convincing evidence to support the view of fund persistence, but this was more related to anti-persistence (negative persistence) than positive persistence.

In a study that focuses on equity style as a source of performance persistence, Scher and Muller (2005) use funds from the following categories: Domestic Equity General, Domestic Equity Growth, Domestic Equity Value, Domestic Equity Large Cap, Domestic Equity Smaller Companies, Domestic Equity Mining and Resources, Domestic Equity Financial and Industrial, Domestic Equity Financial and Domestic Equity Other for period January 1990 to December 2002. The number of funds grew from 14 funds at the start to 106 at the end of the period. Monthly returns gross of fees with dividends reinvested were used to evaluate performance. Using Sharpe's returns-based method for style analysis, individual funds are categorised into four style portfolios of

156 data points each. As a risk-adjusted performance measure, the alpha from the style-adjusted Fama and French (1993) three-factor model was used for the returns of average "style" portfolios. Persistence was based on regressing calendar-year performances onto subsequent years' performances for the same style portfolios (without adjusting the portfolios). They find that small cap and value funds have negative persistence over at least two years while there was some evidence of persistence among large cap funds. Van Rensburg and Robertson (2003) provide support to the Scher and Muller (2005) study since they show that there should be at least two style-based factors in a model of JSE returns. However, in a later study, van Rensburg and Robertson (2004) show that an asset pricing model for the JSE is better specified by (possibly more up-to-date) attribute values than factor loadings (that are based on historic estimates).

2.2.2.2 Review summary

In the literature reviewed above, South African equity unit trust data over the period January 1979 to March 2004 (approximately 25 years) have been studied with most of the data being monthly total net returns (price plus dividends but excluding fees). The exceptions were Oldham and Kroeger (2005) who used a higher data frequency (weekly) and only price to calculate returns, and Scher and Muller (2005) who used monthly total gross returns. The number of funds used range from a low of seven in 1980 to a high of 106 in 2002 but most of the studies used less than 50 equity funds over the periods of their study (the exception was Scher and Muller, 2005). The performance measures used in the reviewed literature include:

- Nominal (absolute and excess) returns
- Jensen's alpha based on CAPM, 2-factor APT model and 3-factor APT model
- Sharpe ratio
- Fama and French (1993) 3-factor model

Most of the studies used various rankings of performance measures, with Oldham and Kroeger (2005) as the exception since they use absolute performance figures to test for persistence. The aspects of the methods and methodologies used include:

- Contingency tables of winner and losers
- Methodologies of Goetzmann and Ibbotson (1994), Hendricks, Patel and Zeckhauser (1993) and Kahn and Rudd (1995)
- Spearman rank correlation
- Runs test
- Binomial probabilities
- z-test

- Cross-product ratio
- Chi-squared test

Formation periods range from 1 month to 4 years and holding periods range from 1 month to 5 years. Of particular interest is the formation period of three months and holding periods of 3, 6, 9 and 12 months since this is the focus of this study. The study by Firer *et al*. (2001) is closest to the focus of this study (in terms of formation and holding periods) and their results show evidence of persistence for a formation period of 3 months and holding periods of 3, 6 and 12 months. Their study shows winner-winner and loser-loser persistence with the former being stronger.

The results of the studies are mixed but largely support the existence of performance persistence among equity funds. In particular, there is evidence of performance persistence for top quartile funds and bottom quartile funds. Meyer (1998), Collinet and Firer (2003) and Von Wieligh and Smit (2003) find a greater prevalence of the loser phenomenon. In contrast, Firer *et al*. (2001), Gopi, Bradfield and Maritz (2004) and Wessels and Krige (2005) find stronger evidence for the winner phenomenon. Scher and Muller (2005) find a lack of positive persistence among funds but find anti-persistence (negative persistence) among small cap and value funds.

2.2.3 Alternative persistence sources

Oosthuizen and Smit (2002) consider performance persistence in terms of performance of the investor's portfolio by investigating the ability of investors to move away from inferior performers to superior performers and their ability to direct new cash flows to the better managers. This contrasts with the other studies that focus on the performance of funds offered by asset managers. The study uses funds from the general equity (49), growth (13) and value (10) categories for the period September 1997 to June 2001. The data consists of monthly price (selling) data and controls for fund name changes, mergers or discontinuations. The Grinblatt and Titman (1993) performance measure (which excludes dividends and transaction costs) is used to evaluate investors' selection ability. The results show that there is weak evidence of fund selection ability. Raw returns, excess returns and risk-adjusted returns of different trading strategies are used to investigate information effects. Risk-adjusted returns are calculated using Jensen's alpha which is calculated with a minimum of 30 months. Trading strategies are identified according to the direction of new cash flows that are assumed to flow at the end of each quarter. The results provide no evidence that investors can outperform the market by investing new money into funds. The implication of this study is that while fund selection is based on the existence of performance persistence, new cash flows to funds (more precisely, investors' decisions about directing new cash flows) are not sources of persistence. Our study assumes cash flows occur mid-quarter and are either invested in, or disinvested from, equity holdings. We do not investigate cash flows in totality or that part that may be invested in non-equity financial instruments. Therefore, we do not consider size, source or the direction of cash flows in our investigation.

This study and the studies referred to above, focus on fund performance – the collective holdings of individual securities. While the contribution of this study distinguishes itself through the isolation of the equity holdings in funds, it does not distinguish funds from managers. Kahn and Rudd (1995) suggest that "[p]ersistence could be more a property of managers, not funds, even though most funds have a characteristics approach to investing." More precisely, the distinction should suggest that fund performance persistence may be influenced differently as a result of manager characteristics and fund characteristics. In addition, ergonomical (environmental) characteristics such as business cycles, individual stock characteristics, financial market quality, etc., are different and separate from manager and fund characteristics and may also influence fund persistence. Therefore, we turn our attention, briefly, to financial markets as a source of performance persistence. We also do this in response to Phelps and Detzel (1997) who believe that "…the positive persistence found by others is the result of persistence in broad equity classes (macropersistence) rather than sustainable managerial ability (micropersistence)."

In a study that does not use fund data, Wright (1999) analyzed market stock (equity) returns for emerging markets and found considerable persistence in returns for some of those markets. South Africa was not included in the analysis. Bendel, Smit and Hamman (1996) focused on determining whether long-term persistence is present in South African financial markets. Twenty South African financial time series over the period January 1960 to September 1994 were used. This includes seven financial variables with daily, weekly, monthly and quarterly data series extending over varying sub-periods. Three of the financial variables relate directly to share prices on the JSE – the All Share, Industrial and Gold indices. The method used for the persistence investigation is the Rescaled Range Analysis as described by Peters (1994). The results of the analysis strongly suggest evidence of long-term persistence in share returns.

Van Rensburg (1999) provides evidence that supports the macroeconomic underpinnings for prices on the JSE, identifying the different sector’s sensitivities to the Dow-Jones industrial index, short term interest rates, Rand gold price, long term interest rates, the level of gold and foreign reserves and the balance on the current account. Considering only the risk component of performance (of which the other component is "return"), the findings of van Rensburg (1999) suggest that persistent systematic risk is not the only source of performance persistence (as implied by the CAPM).

However, by the process of elimination, Wilcox and Gebbie (2007) assist us in "closing in" on potential persistence sources. Using shares listed on the Johannesburg Stock Exchange for the period January 1993 to December 2002, Wilcox and Gebbie (2007) show that statistical risk factors in South African equities show little stability but marginal persistence when applying methods of Rescaled Range Analysis, Detrended Fluctuation Analysis and Variance Ratio.

2.2.4 Survivorship bias

A number of prominent researchers of developed (predominantly US) markets including Grinblatt and Titman (1989), Brown, Goetzmann, Ibbotson and Ross (1992), Malkiel (1995), Elton, Gruber and Blake (1996), Carhart (1997) and Wermers (1997) have highlighted the negative implications of the presence of survivorship bias among samples used in analysis of investment funds and markets.

Carpenter and Lynch (1999) note that survivorship leads to biases in persistence measures. Brown *et al.* (1992) show that survivorship imparts an upward bias to persistence measures while Brown *et al.* (1992), Grinblatt and Titman (1992) and Hendricks *et al.* (1993) argue that survivorship imparts reversals in persistence measures.

Survivorship bias in investment funds data refers to incompleteness of a dataset due to funds that have ceased to exist and that have been excluded from the dataset. The inference drawn from results of an analysis based on data that has survivorship bias may not be considered reliable.

Survivorship bias among samples used in studies of the South African unit trust performance has received relatively scant attention. Meyer (1998) suggests that survivorship bias is not a material problem in South Africa since only a few funds had closed down over the data period, June 1985 to June 1995, used in her study. Similarly, Oldham and Kroeger (2005) suggest that since very few funds disappeared during the data period for their study, January 1998 to December 2002, survivorship bias is not a problem. Oosthuizen and Smit (2002) mention that one of the limiting factors related to collecting longer data series for South African funds is that data prior to 1997 was collected on hard copy.

Pawley (2006) investigates the impact of survivorship bias on South African Unit Trusts. The bias results in increasing overstatement of returns over time and in reported average performance statistics that are "…grossly exaggerated and any inferences would be invalid… ". Also, the study finds that the average survivorship rate of funds over a ten-year period is 62.08%. Our study uses data that extends over eleven years to calculate fund performances over nine years and does not include all funds that failed over that period. Therefore, the data used in this study is exposed to potential survivorship bias.

In order to minimize the effects of survivorship bias, we do not use the absolute performance numbers for funds in our analysis. Rather we use rankings of funds at each quarter. We compare correlations of actual rankings over quarters (using Spearman rank correlation) rather than quartile or decile rankings. With respect to contingency tables, we use the median of funds' rankings to distinguish between winners and losers, thereby also avoiding the use of absolute numbers.

Carhart (1997) uses Spearman’s test on the decile rankings of performance measures and suggests that since the ordering of each decile portfolio is treated equally, the Spearman test "…lacks the power against the hypothesis that predictability in performance is concentrated in the tails of the distribution of mutual fund returns". Carpenter and Lynch (1999) find that while the "…Spearman test is very powerful… [the]…Chi-squared test is the most robust to the presence of survivorship bias". We use the Spearman test in conjunction with other tests to get a coherent result that indicates that there is evidence of persistence across the entire distribution of returns as well as the existence of a concentration in the tails (as evidenced by results for repeat winners and losers).

2.2.5 Aspects of this study

The financial markets as a source of persistence have little direct impact on our study. Although we re-construct "equity-only" funds using only the Johannesburg Stock Exchange-listed shares in unit trust portfolios, our analysis focuses on the relative performances of funds, not their absolute performances.

We use quarterly fund holdings and return data for the period 03/1993 to 12/2004 from General Equity, Value and Growth unit trusts categories. The number of funds at each quarter varies between 13 and 53 over the period with 11 funds having less than 12 observations. The quarterly returns for the reconstructed funds were calculated using the Dietz method. Since the new funds are constructed using the quantities and prices of individual share holdings, the performance calculations do not account for transaction costs, fees and dividends.

Rankings of fund performances are based on raw excess returns, Jensen's alpha, the Sharpe ratio, Treynor ratio, Sortino ratio and the Omega statistic. Parameters used in the calculation were estimated using 12 data points. Performance persistence was evaluated according to different methodologies used by Malkiel (1995), Kahn and Rudd (1995) and Brown and Goetzmann (1995). These include the z-test, Pearson Chi-squared test and 2x1 and 2x2 contingency tables. We also use Spearman Rank correlation.

The horizons for this study's persistence tests are based on a formation period of 1 quarter for the return while the holding periods extend over 1, 2, 3, and 4 subsequent quarters. These periods overlap with those for the Hendricks, Patel and Zeckhauser (1993) study that finds evidence of performance persistence for superior and inferior performing funds over these horizons, and with the Chan, Jegadeesh and Lakonishok (1996) study that finds evidence of performance persistence for stocks over these horizons.

Our investigation does not consider performance measurement based on multi-factor models such as Fama and French's (1992) three-factor or Carhart's (1997) four-factor model as alternatives to traditional performance measures such as Jensen's alpha and the Sharpe, Treynor and Sortino ratios. We consider the identification of performance persistence using the Omega statistic as an alternative to traditional measures. The Omega statistic was introduced by Shadwick and Keating in 2002 and is, therefore, a relatively new performance measure. To the best of our knowledge, performance persistence among South African funds has not formally been investigated using the Omega statistic as a measure of fund performance.

Performance measures that are based on a single risk-factor, such as Jensen’s alpha and the Sharpe, Treynor and Sortino ratios, are often criticized since some are only appropriate when the return distribution is symmetrical and none capture higher moments in a mean-variance framework. The Omega statistic captures the first two moments (mean and variance) as well as the higher moments of skewness and kurtosis, making it a more relevant measure of performance from which to make investment decisions.

This study will use contingency tables and correlations to investigate persistence of return and risk-adjusted performance for equity-only South African funds across four quarters over 9, 5 and 3-year horizons, using data for the period Mar 1993 to Dec 2004.

2.3 Methodology

We test for persistence in fund performance rankings that are based on six performance measures:

- Raw excess returns
- Jensen’s alpha

- Sharpe ratio
- Treynor ratio
- Sortino ratio
- Omega statistic

This study uses four tests: the z-test, Chi-squared test, the Cross-product Ratio test and Spearman rank correlation test.

The z-test follows that used by Malkiel (1995), the Chi-squared test follows that used by Kahn and Rudd (1995) and the Cross-product ratio test (CPR) follows that used by Malkiel (1995) and Brown and Goetzmann (1995) in their investigation into performance persistence. For the performance-ranked portfolio methodology, Spearman rank correlations are used to indicate whether there is a relationship between a fund's performance rankings for the previous quarter and subsequent quarters.

For Spearman's rank test, persistence is evaluated using the current ranking of a fund and its subsequent 1, 2, 3, and 4 quarters' rankings. So, there are four separate horizons over which persistence is tested, for each fund. Following Firer *et al*. (2001), the test periods are rolled forward one quarter at a time providing a more thorough measure of persistence than simple time periods.

In the following two sections we define and describe the performance measures and analysis methods used in our analysis.

2.4 Performance measures

We begin this section with a definition of raw excess returns, followed by definitions of two measures considered as risk measures. Thereafter, the remaining five risk-adjusted performance measures are defined.

2.4.1 Raw excess returns

Raw excess returns (R) for each fund are the equity portfolio returns (R_i) in excess of the risk free rate (R_f):

$$R = R_i - R_f$$

Our study considers persistence in the rankings of funds. It should be noted that the rankings of funds according to either raw excess returns or equity portfolio returns are the same. In our definition of excess returns, the same amount (R_f) is deducted from the returns at each period. By reducing the returns by an equal amount at each period the ranking of the adjusted returns (raw excess returns) remains the same as the unadjusted returns (equity portfolio returns).

We use the 3-month Treasury Bill rate as the risk-free rate when calculating excess returns.

2.4.2 Standard deviation

Standard deviation is the square root of the variance of returns over the period of measurement:

$$\sigma = \sqrt{\sum_{i=1}^{n} \frac{(R_i - \overline{R}_i)^2}{n-1}}$$

$\overline{R}_i$ is the average of the equity portfolio returns (R_i). Bacon (2004) notes that for large sample size n there will be little difference whether n or $n-1$ in the denominator is used, and that the majority of performance analysts use n in the denominator. Given that some of the funds in our analysis have less than 30 data points, we use $n-1$ in the denominator and calculate standard deviation over 3 years using quarterly data i.e. we use $n = 12$.

Casarin, Lazzarin, Pelizzon and Sartore (2005) provide an alternative approach to dealing with the relatively small data set of returns for Italian funds, considered in their study. They compute an exponentially weighted standard deviation by exponentially weighting the observations so that the latest observations carry a higher weighting in the computation. The authors note two advantages to using the method of an exponentially weighted moving average as opposed to the equal weighting used in our formula. Firstly, volatility reacts faster to market shocks because of the higher weighting to the more recent data and, secondly, following a shock, the volatility declines exponentially as the data window shifts forward and the weighting to the shock observation declines.

2.4.3 Downside deviation

We measure downside deviation (σ_D) as the variability of returns below the risk free rate (negative excess returns).

$$\sigma_D = \sqrt{\sum_{i=1}^{n} \frac{\min(R_i - R_f, 0)^2}{n-1}}$$

It should be noted that the number of observations, *n*, is the total number of negative, zero and positive returns over the period of measurement. This contrasts with other variations of this measure where only the number of negative excess returns is used as the n in the denominator.

2.4.4 Jensen's alpha

Jensen's alpha is a risk-adjusted return that, along with some of the ratios mentioned below, is a commonly used measure for risk-adjusted performance. Similar to Meyer (1998), we do not take all the precautions for using Jensen's alpha, for instance problems due to non-stationarity of various distributions are not adjusted for. Jensen's alpha (α) is the raw excess return adjusted for systematic risk (β) and can be obtained by re-arranging the following:

$$R = R_i - R_f = \beta(R_m - R_f) + \alpha$$

where R_m is the return for the market portfolio. Similar to our calculation for standard deviation, we use n = 12 for calculating β. Also, we use the Johannesburg Stock Exchange's All Share Index as the market portfolio. We use quarterly changes in the index (i.e. without dividends) to get a capital return that will be comparable to the performance of our "new" equity-only portfolios (the performance of these portfolios also excludes dividends).

Firer *et al.* (2001) find evidence of instability and non-stationarity of betas for equity funds and to avoid these problems use the Sharpe ratio as a risk-adjusted performance measure. We do not test for beta stability or stationarity but we do incorporate the Sharpe ratio in this study.

2.4.5 Sharpe ratio

The Sharpe ratio (*SR*) is the most popular measure of risk-adjusted performance and measures the excess return per unit of total portfolio risk (σ):

$$SR = \frac{R}{\sigma}$$

In this performance measure, risk is defined as the standard deviation of equity portfolio returns.

Collinet and Firer (2003) use the Sharpe ratio as a performance measure in their study of South African Equity Unit Trusts since it eliminates the risks of misspecification inherent in the Jensen's and Treynor measures (beta instability and non-stationarity). They use 3 years (36 observations) of monthly returns to calculate the Sharpe ratio and note that using a smaller number of returns is likely to result in an unreliable point estimate for the standard deviation of returns. In contrast to this, and as mentioned above (see Section 2.4.2 on Standard deviation), our study bases standard deviation calculations on returns over 3 years of quarterly returns (12 observations).

2.4.6 Treynor ratio

The Treynor ratio (TR) is similar to SR except that TR uses the fund's beta as a measure of risk:

$$TR = \frac{R}{\beta}$$

2.4.7 Sortino ratio

The Sortino ratio (*SortR*) is another performance measure that is similar to *SR* except that instead of standard deviation of equity portfolio as a risk measure, *SortR* uses downside deviation of raw excess returns:

$$SortR = \frac{R}{\sigma_D}$$

In its original form, the numerator in *SortR* is the fund's return in excess of a minimum target rate and the risk measure in the denominator is the downside deviation of these excess returns. Our study uses the risk free rate as the minimum target rate.

None of the studies in our review of South African literature made use of the Sortino ratio when investigating persistence.

2.4.8 Omega statistic

Shadwick and Keating (2002) introduced the Omega function as a performance measure:

$$\Omega(L) = \frac{\int_L^b [1 - F(x)]dx}{\int_a^L F(x)dx}$$

where *F(x)* is the cumulative density function (CDF) of random single-period returns, *x*, over the interval *(a,b)* with *a* and *b* as lower and upper bounds respectively. *L* is a threshold return, or hurdle rate, selected by the investor. A simple explanation is to consider the Omega as a ratio of the separate probabilities of the value weighted gains and losses for the returns above and below a threshold - a ratio of gains to losses. Unlike many of the other risk-adjusted measures, the Omega statistic is not dependent on return distribution assumptions.

In order to calculate the Omega statistic, we develop a probability function based on a discrete distribution that approximates the continuous probability distribution.

Following from the Shadwick and Keating (2002) presentation above, let *f(x)* be the probability density function (PDF). The probability that $a \le x \le b$ is:

$$\Pr[a \le x \le b] = F(b) - F(a) = \int_a^b f(x)dx .$$

We divide the continuous domain over *(a, b)* into *n* intervals with the width of the interval $h = (b - a)/n$. The number of returns *x* in interval *i* is *f(i)* and the summation of *f(i)* over *j* consecutive intervals, *j* = 1, 2, ...*n*, of width *h* is

$$\sum_{i=1}^{j} f(i)h$$

We are now able to approximate,

$$\int_a^b F(x)dx \quad \text{with} \quad \sum_{j=1}^{n}\sum_{i=1}^{j} f(i)h$$

and

$$\int_a^b [1-F(x)]dx \quad \text{with} \quad \sum_{j=1}^{n}[h-\sum_{i=1}^{j} f(i)h].$$

Now, for L an element of interval k and cancelling h in the numerator and denominator, we can replace the continuous function presented by Shadwick and Keating (2002) by:

$$\Omega(L) = \frac{\sum_{j=k+1}^{n}[1-\sum_{i=1}^{j} f(i)]}{\sum_{j=1}^{k}\sum_{i=1}^{j} f(i)}$$

The practical implementation of the Omega calculation can be cumbersome depending on the approach taken. For example, if one uses discrete intervals (as we use) for which frequencies for the quarterly returns are calculated, the size and number of the intervals will influence the accuracy of the cumulative distribution at each point of accumulation of prior frequencies. The constructed cumulative distribution becomes increasingly smoother as the number of intervals increases and the size of those intervals decreases. A consequence of a variable number and size of intervals is that the numerator and denominator in the Omega statistic will vary, influencing the accuracy of the statistic. We have calculated the Omega statistic using one thousand intervals between the upper and lower bounds of the range of rolling twelve consecutive quarterly returns considered. The upper and lower bounds are, respectively, the maximum and minimum quarterly returns over the period considered. Also, the Omega statistic is more reliable for an increasing number of single-period returns. For example, the Omega for one year is more reliable if 12 months of returns are used for its calculation than when returns for 4 quarters are used. We calculate the 3-year Omega statistic using returns for 12 quarters.

2.5 Methods for analysis

2.5.1 Spearman rank correlation

We use Spearman rank correlation to test the strength and direction of the relationship between performance rankings in one period with performance rankings in subsequent periods. We do this for rankings based on each of the performance measures. The null hypothesis is that there is no relationship between the performance rankings for the funds in one period and the rankings in subsequent periods. The Spearman correlation coefficient is calculated as:

$$r_s = 1 - 6\sum_i \frac{(r_i - s_i)^2}{n(n^2 - 1)}$$

where n is the number of funds being ranked, r_i are the rankings for the funds in one period and s_i are the fund rankings in a subsequent period.

The statistic ranges between 1 and –1 where 1 indicates that the rankings in the two periods are identical (persistence) and –1 indicates that the rankings are opposite (anti-persistence). We have segmented the results into 4 categories: correlations greater than 0.5 are "strongly positive", positive correlations less than or equal to 0.5 are "weak positive", negative correlations greater than or equal to –0.5 are "weak negative" and correlations less than –0.5 are "strongly negative".

The Spearman correlation coefficient is a measure of the variability in the ranks of the two data sets. Another measure that is well suited for examining relationships between sets of ordinal data is the Kendall correlation coefficient. This measure is conceptually different since it indicates the probabilities that the variables vary in the same or opposite direction. While we do not show the Kendall correlation coefficient, its inclusion as confirmation (or contradiction) of the results obtained using the Spearman correlation coefficient, is likely to improve the evaluation of the persistence investigation.

Because the number of funds vary over time, Collinet and Firer (2003) use percentile rankings as a measure of relative performance rather than absolute rankings to facilitate comparisons from one period to the next. Also, they argue that the use of percentile rankings prevents the loss of information that occurs when quartile and decile fund groupings are used. They use the slope of the regression as a measure of the relationship in rankings at different times. However, similar to Meyer (1998), we rank funds *vis à vis* one another, i.e. absolute ranking of performance.

2.5.2 Cross product ratio test

The odds ratio is a ratio of two odds and the cross-product ratio (*CPR*) is one way to calculate it. The *CPR* is used to calculate the ratio between the numbers of funds that are repeat performers to those who experience performance reversals. The ratio is calculated using:

$$CPR = \frac{(WWxLL)}{(WLxLW)}$$

where *WW* = winner for one period and the immediate subsequent period,
LL = loser for one period and the immediate subsequent period,
WL = winner in one period and loser in the immediate subsequent period and
LW = loser in one period and winner in the immediate subsequent period.

CPR = 1 would imply that the number of repeat performers is equal to the number of performance reversals. *CPR* = 1 means that there is no collective persistence among the repeat performers or performance reversals – it does not distinguish whether repeat winners, repeat losers or the two groups of performance reversals each possess persistence. For example, *CPR* = (100 x 10)/(20 x 50)= 1 would suggest that there is no collective persistence between the two groups of (*WW, LL*) and (*WL, LW*). However, it is clear that *WW* = 100 and *LW*= 50 enjoy a higher level of persistence than the other two groups, *LL* and *LW*. Therefore, *CPR* = 1 does not imply that the expected frequencies for *WW, WL, LW*, and *LL* are N/4, i.e. the probability of occurrence for each category is not 25%. (This line of reasoning is misplaced in its use in the Kahn and Rudd (2000) study.) However, *WW* = *WL* = *LW* = *LL* = N/4 implies that *CPR* = 1 and no evidence of performance persistence exists.

CPR > 1 indicates persistence among repeat performers. *CPR* < 1 indicates persistence among funds with performance reversals or, alternatively, it indicates anti-persistence in the performance of funds.

To test for the null hypothesis that *CPR* is statistically equal to 1 (equivalently, ln(*CPR*) = 0), we use:

$$z = \frac{(\ln(CPR) - \ln(1))}{\sigma_{\ln(CPR)}} = \frac{\ln(CPR)}{\sigma_{\ln(CPR)}}$$

where the standard error of ln(*CPR*) is (see Christensen, 1990):

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

For large samples z is distributed normally (0, 1) but conclusions about significance tests for small sample sizes must be considered tentative (Hallahan and Faff, 2001).

2.5.3 Chi-squared test

Different researchers test for performance persistence by applying the Chi-squared test differently. The presentations for the calculation of Chi-squared differ depending on the desired application. We will discuss two popular applications (tests for independency and homogeneity) of the Chi-squared test in research into performance persistence (where contingency tables are used) and the different presentations of the formula. The discussion is intended to provide clarity on the application of the Chi-squared test in this study and facilitate easier replication of this and other studies in performance persistence.

Contingency tables are used to organise categorical data for analysis and the Chi-squared test can be used to test whether distributions of categorical variables differ from each other. The Chi-squared test can be used to test whether two, or more, variables are independent or homogeneous.

Table 2.1.1: Example - 2X2 contingency table

	Data type 1	Data type 2	Totals
Category 1	a	b	a + b
Category 2	c	d	c+ d
Totals	a + c	b + d	a + b + c + d = N

Consider the above 2X2 contingency table. The contents of the cells are indicated by a, b, c, and d. For tests of association/independence, the Chi-squared statistic for this 2X2 contingency table is:

$$X^2 = \frac{N(ad - bc)^2}{(a+b)(c+d)(b+d)(a+c)}$$

This formula is also known as the Pearson Chi-squared, named after its proposer Karl Pearson who presented the formula in 1900. The Pearson Chi-squared statistic is used in a test for independence

– to determine whether the value of one variable helps estimate the value of another variable. Kahn and Rudd (1995) and Agarwal and Naik (2000) used this test of independence in their investigations into performance persistence.

Kahn and Rudd (1995) used contingency tables to analyse performance persistence. To test for statistical significance, they calculate Chi-squared (X^2) with

$$X^2 = \sum \left(\frac{(O_i - E_i)^2}{E_i} \right)$$

where O_i is the observed frequency of *WW, WL, LW*, and *LL* respectively for each fund and E_i is the expected frequency. X^2 follows a Chi-squared distribution with 1 degree of freedom for a 2X2 contingency table (degrees of freedom = (number of rows minus one) x (number of columns minus one)). The null hypothesis of independence is rejected if X^2 exceeds the critical value of 3.841 for a 5% significance test.

For tests of association/independence the expected frequencies are:

$$E_i = \frac{(Row\,Total\ x\ Column\,Total)}{Grand\ Total}$$

The Kahn and Rudd (1995) study distinguishes between winners and losers in two consecutive periods and the associations between each over those two periods. The persistence tests refer to the status of winners and losers at one period and their status at the subsequent period. In this study, we follow the descriptions of the cells of the 2X2 contingency tables used in prior investigations into performance persistence and let *WW* = repeat winners, *LL* = repeat losers, *WL* = winner-losers and *LW* = loser-winners. We define a winner as an above median performer, and a loser is one who performs at median or below median. To illustrate, consider the following table:

Table 2.1.2: 2X2 winner/loser contingency table

	Period 2 Winner	Period 2 Loser	Totals
Period 1 Winner	WW	WL	WW + WL
Period 1 Loser	LW	LL	LW + LL
Totals	WW + LW	WL + LL	WW + WL + LW + LL = N

Suppose that the number of repeat winners (*WW*) is 234, the number of repeat losers (*LL*) is 269, *WL* = 268 and *LW* = 269. The Pearson Chi-squared is 1.193 (p = 0.275) and less than 3.841 indicating that the null hypothesis of independence cannot be rejected.

This method for calculating the Pearson Chi-squared statistic, used by Kahn and Rudd (1995), provides the same results as that for the general example using two data types and two categories, provided above. Argawal and Naik (2000) present the method for calculating Pearson Chi-squared differently:

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

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

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

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

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

The Agarwal and Naik (2000) presentation of the formula for Pearson Chi-squared offers transparency and is easy to implement. With the same inputs, the formula produces the same results as those provided by the Kahn and Rudd (1995) method.

Another approach to investigating performance persistence is to test for homogeneity: whether populations have the same proportion of observations with a common population characteristic. Carpenter and Lynch (1999) and Tonks (2005) used the Chi-squared test of homogeneity in their investigations into performance persistence.

In their investigation into performance persistence, Carpenter and Lynch (1999) use

$$X^2 = \frac{(WW - \frac{N}{4})^2 + (WL - \frac{N}{4})^2 + (LW - \frac{N}{4})^2 + (LL - \frac{N}{4})^2}{N}$$

This formula is based on the assumption of a multinomial distribution where the expected frequencies are the same for each of the outcomes i.e. $WW = WL = LW = LL = N/4$. However, using such an assumption implies that the denominator should then be N/4 - different to that presented (above) by Carpenter and Lynch (1999). Substituting for the numerical values used in the example above, this method yields a Chi-squared of 0.867 (p = 0.352), less than the Pearson Chi-squared of 1.193 presented earlier.

In his study of UK pension fund managers, Tonks (2005) uses the same calculation method as Carpenter and Lynch (1999) except that he correctly replaces the "N" in the denominator with "N/4". Substituting for the numerical values used in the example above, this method yields a Chi-squared of 3.469 (p = 0.063), larger than either 0.867 or 1.193. The formula is consistent with that used for goodness-of-fit tests. In this case the test is to determine whether the 2X2 table's frequencies follow a multinomial distribution where the probability of occurrence for each cell equals N/4. This is essentially a test for homogeneity. If homogeneity in fund performance for two periods is rejected then one may conclude that performance persistence exits.

Other performance persistence studies using contingency tables present alternative calculation methods for Chi-squared to those discussed above. Casarin *et al.* (2005) analyse Italian equity funds in their search for evidence of performance persistence. They compute the Chi-squared as:

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

where $D1 = \frac{\tilde{N}_{W.}\tilde{N}_{.W}}{N}$, $D2 = \frac{\tilde{N}_{W.}\tilde{N}_{.L}}{N}$, $D3 = \frac{\tilde{N}_{L.}\tilde{N}_{.W}}{N}$ and $D4 = \frac{\tilde{N}_{L.}\tilde{N}_{.L}}{N}$.

$\tilde{N}$ indicates the theoretical distribution of funds.

While Casarin *et al*. (2005) identify this calculation method as that for the Pearson statistic and their test is the same as Agarwal and Naik (2000), the formula yields different results to the Pearson Chi-squared formula shown earlier. The numerical results of the Casarin *et al.* (2005) study are precisely the same as those when the Carpenter and Lynch (1999) formula is used for the same input variables, indicating that the Casarin *et al.* (2005) study is a test for homogeneity and not for independence as it suggests. The test is, therefore, not the same as that used by Agarwal and Naik (2000). However, there should be concern for the use of "*N*" in the denominator (as seen in the

Carpenter and Lynch (1999) and Casarin *et al.* (2005) studies), instead of the correct "$N/4$" when testing for homogeneity.

Our study follows the Kahn and Rudd (1995) and Agarwal and Naik (2000) application of the Pearson Chi-squared and is therefore a test of independence. The test is part of the investigation into whether a fund's status of either a winner or loser in one period will determine their status as a winner or loser in a subsequent period. If the future status is dependent on the prior status then we may conclude that fund performance persists i.e. we reject the null hypothesis.

The Pearson Chi-squared statistic can also be used in the analysis of 2X1 contingency tables. The cells of the table show the frequencies of occurrence, y and $N - y$, of two categories whose expected frequencies of p and $1 - p$ follow a binomial distribution. The Pearson Chi-squared statistic is calculated using:

$$X^2 = \frac{(y - Np)^2}{Np(1 - p)}$$

which follows a Chi-squared distribution with 1 degree of freedom. When comparing the Pearson Chi-squared statistic against a Chi-squared distribution, the binomial distribution can be approximated as a Normal distribution. This was the basis for its application in the Malkiel (1995) study of equity mutual funds where a Z-statistic was calculated to test for performance persistence.

2.5.4 Z-Statistic

This study follows the Malkiel (1995) application of the Z-statistic to investigate performance persistence among repeat winners and repeat losers.

This test considers the ratio of repeat winners to winner-losers: $WW / (WW + WL)$. The probability of a winner continuing to win in a subsequent period should be greater than 0.5 to indicate persistence and less than 0.5 indicates anti-persistence which are reversals in performance. The Z-test of significance for the null hypothesis of $p = 0.5$, assuming a binomial distribution of successive winners, uses:

$$Z = \frac{(WW - (WW + WL)p)}{\sqrt{(WW + WL)p(1 - p)}}$$

For large (*WW* + *WL*), Z is normally distributed (Z ~ N(0,1)).

We apply the Z-test to the results for the entire data set applicable to the 3 different time frames. Meyer (1998) distinguishes between sample sizes and applies the Z-test to samples larger than 20 while calculating the binomial probabilities for samples smaller than 20.

2.5.5 Yates's continuity correction

The Pearson Chi-squared statistic is usually used when the expected cell frequencies are 5 or more in 80% of the cells of a contingency table and 1 or more in the remaining 20% of the cells. Therefore, for a 2X2 table, the expected cell frequencies should be greater than 5 for each of the cells. When the expected frequencies in any of the cells of a 2X2 contingency table are less than 5, Yates's continuity correction should be used to calculate the Chi-squared statistic. Yates's continuity correction is an adjustment to the Pearson Chi-squared calculation, providing a conservative, downward adjusted value for Chi-squared with a higher p-value. The adjustment reduces the absolute difference between the observed and expected frequencies for the 2X2 table by 0.5:

$$X^2 = \sum \left(\frac{(|O_i - E_i| - 0.5)^2}{E_i} \right),$$

or equivalently,

$$X^2 = \frac{N(|ad - bc| - \frac{N}{2})^2}{(a+b)(c+d)(b+d)(a+c)}$$

(A brief discussion paper on Yates's continuity correction may be obtained from http://faculty.london.edu/cstefanscu/Yates.pdf)

Following Everitt (1999), researchers have used Yates's continuity correction to reduce the negative impact of small sample bias. Cortez, Paxon and Armada (1999) used the Yates correction in their small sample of 12 Portuguese mutual funds and Lee (2003) used the Yates correction when examining real estate funds for which the sample size grew from 16 to 27 funds over the eleven year period to 2001. In comparison, our analysis uses data that starts with 13 funds in the first quarter of 1996 and ends with 50 funds in the last quarter of 2004.

Since the data set used in this study consists of a small number of observations for some of the funds (see Table 1.3 in Appendix 1), we use Yates's continuity correction to compute the Chi-squared statistic for the 2X2 contingency tables for each of the funds. However, our results call into question our conclusions with respect to small sample sizes since we do not apply Yates's continuity correction to our application of the method used in the Malkiel (1995) analysis of repeat winners i.e. in the test statistic for 2X1 contingency tables under the assumption of a binomial distribution. This contrasts with the Meyer (1998) study in which small sample sizes are addressed.

2.6 Results

Section 2.6.1 focuses on the Spearman rank correlations, Section 2.6.2 on the contingency tables, Section 2.6.3 is a discussion on the presence of small sample bias and Section 2.6.4 summarizes the discussion.

2.6.1 Cross-sectional Spearman correlations

We define raw excess returns as the difference between the actual return and the risk-free rate. For the risk-free rate we use the 3-month Treasury Bill rate. The ranking of raw excess returns and equity portfolio returns will be exactly the same and therefore the results of this analysis apply to both sets of returns. Table 2.1.8 in Appendix 2 shows that the rankings of raw excess returns have high correlations with the rankings based on the Sharpe, Treynor and Sortino ratios and relatively lower, sometimes negative, ranking correlations with the Jensen's alpha and Omega measures. The results indicate that performance evaluation based on the ranking of raw excess returns and traditional performance ratios, such as those for the Sharpe, Treynor and Sortino measures, will yield very different results (with higher overall significance levels) to those obtained by considering Jensen's alpha and the Omega statistic (where p-values are generally higher). As a consequence, it can be expected that the results for our persistence investigation into fund performance rankings based on the Sharpe, Treynor and Sortino ratios will be more closely aligned with those for raw excess returns than will be the case for the Jensen's alpha and the Omega rankings.

The persistence in the ranking of the measures indicates a level of determinism in the ranking over subsequent periods and hence the probability of realizing future expectations of performance, based on historical performance rankings. Tables 2.2.1 – 2.2.6 in Appendix 2 show the first set of results for persistence.

Tables 2.2.1 – 2.2.6 show the correlations for the rankings of performance based on the different measures at a particular date with the subsequent four quarters' rankings. In the top portion of Table 2.2.1 correlations between the rankings of raw excess returns for each quarter and those for the first subsequent quarter are at the lowest levels over the second and third quarters (respectively –56% and –62%) of 1998. This indicates anti-persistence over that period, while relatively high positive correlations occur over the later three quarters of 2002. Average correlations across the quarters over the 9-year period are mildly positive with a high of 20% over the first subsequent quarter and low of 9% over two subsequent quarters. The average correlations over three and four subsequent quarters are 18% and 12% respectively.

The section at the bottom of Table 2.2.1 shows further interpretation of results (that appear in the top portion) for the 9, 5 and 3-year horizons. Over the 9-year period to Dec 2004, 71% of the correlations between two consecutive quarters were positive with 11 of the 35 correlations between 50% and 100% ("strongly positive"), and 14 between 0% and 50% ("weak positive"). "Weak negative" (from 0% to –50%) and "strongly negative" (between –50% and -100%) together were less than a third of the correlations. The percentage of positive correlations increased as the horizon decreased for each of the subsequent quarters. For example, the 71% positive correlations for the two consecutive quarters for the 9-year period increased to 80% for the 3-year period. However, most of the positive correlations over the different horizons and across the subsequent quarters are between 0% and 50%, suggesting weak persistence for raw excess returns.

For Jensen's alpha (Table 2.2.2), the correlations are all positive and significant (5% level) over the subsequent first and second quarters. Weak, positive correlations over the third and fourth subsequent quarters occur in 1996 and 2000 while p-values were above 5% showing no significance.

The results for the Sharpe, Treynor and Sortino ratios (Tables 2.2.3, 2.2.4 and 2.2.5) are similar to that for raw excess returns – predominantly weak, positive correlations. However, the 9-year horizon shows relatively lower levels of positive correlations for the Sortino ratio with the subsequent two quarters' correlations showing more negative correlations than positive ones (positive correlations of 48%).

Table 2.2.6 indicates that the results for the Omega statistic largely reflect those for Jensen's alpha. However, the Omega correlations show a fewer number of "weak positive" and a higher number that are significant at the 5% level. The periods of lower correlations between quarters occur in 1996 and 2000 – the same as for Jensen's alpha.

The results in Tables 2.2.1 – 2.2.6 indicate that all the measures show persistence over four subsequent quarters. Persistence is weaker for raw excess returns, the Sharpe ratio, Treynor ratio and Sortino ratio than that for Jensen's alpha and Omega which show higher levels of persistence.

2.6.2 Contingency tables

Tables 2.3.1 – 2.3.6 in Appendix 2 show relationships between above and below median performing funds at each quarter with performance in subsequent quarters using the six different performance measures mentioned earlier.

Table 2.3.1 shows the results for raw excess returns. As an aid to interpreting the table, we copy the table that focuses on the 9-year period, in parts, and discuss each part separately.

Table 2.1.3: Raw excess return - Winner and loser counts

9 years	1 Quarter	2 Quarters	3 Quarters	4 Quarters
No. of WW	351	317	318	289
No. of LL	369	332	325	289
No. of WL	262	271	246	243
No. of LW	261	271	253	255
Total	1243	1191	1142	1076

Table 2.1.3 indicates the number combinations of successive winners and losers for the entire data set for the period.

Table 2.1.4: Raw excess return - CPR

9 years	1 Quarter	2 Quarters	3 Quarters	4 Quarters
Stdev	11%	12%	12%	12%
CPR	1.89	1.43	1.66	1.35
z	5.56	3.09	4.25	2.44
p-value for z	0.00	0.00	0.00	0.01
% WW	28%	27%	28%	27%
%LL	30%	28%	28%	27%

Over the 9-year period the CPR, shown in Table 2.1.4, is significantly greater than one (at the 5% level) across the four quarters (ranging from 1.89 to 1.35), indicating persistence. The z statistic indicates the value of the statistic test with the null hypothesis of CPR=1. The value of z is the log of CPR divided by the standard deviation, e.g. z = ln(1.89) / 11% = 5.56. The p-values refer to the z test where a p-value lower than 5% indicates a rejection of the null hypothesis. *%WW* indicates the percentage of total funds that were winners in one period and in the subsequent period. For example, 28% of winners at the end of one quarter were winners in the subsequent quarter too. Similarly, *%LL* indicates losers that were losers in subsequent periods. In the absence of any persistence, we would expect *WW* = *LL* = *WL* = *LW* = 25%. This is same approach that Gopi, Bradfield and Maritz (2004) used to test for randomness in performance that can be expected in the absence of any skill. The results suggest that 58% (= 28% + 30%) of the funds are repeat winners or repeat losers and that these two categories are the dominant source of the persistence (as opposed to the categories of *WL* and *LW*) among the funds.

Table 2.1.5: Raw excess return - Pearson Chi-squared statistic with Yates' adjustment

9 years	1 Quarter	2 Quarters	3 Quarters	4 Quarters
Pearson Statistic	31.15	9.58	18.16	5.97
p-value for Pearson	0.00	0.00	0.00	0.01
Yates adjustment	25.94	8.36	15.68	5.34
p-value for Yates	0.00	0.00	0.00	0.02

The Pearson Chi-squared statistic in Table 2.1.5 supports the rejection of the null hypothesis of independence across the quarters since all the p-values are less than 5%. The Yates adjustment yields a more conservative value for the Chi-squared test and is used as an indicator for small sample bias. While the p-values are also less than 5% and support a rejection of the null hypothesis, where they are greater at the second decimal than the p-values for the Pearson Chi-squared statistic, we infer the presence of small sample bias. For example, the p-value for the test of persistence in ranking at one quarter with that of the subsequent four quarters is 0.02 for Yates adjustment which is greater than the Pearson Chi-squared statistic of 0.01 indicating the presence of small sample bias.

Table 2.1.6: Raw excess return - Repeat winners

9 years	1 Quarter	2 Quarters	3 Quarters	4 Quarters
Repeat Winner z	3.59	1.90	3.03	1.99
p-value for RW	0.00	0.06	0.00	0.05
RW	57%	54%	56%	54%

The repeat winner z shown in Table 2.1.6 is calculated according to that indicated in the section called "Z-statistic" above and is the same as the Pearson Chi-squared statistic for a binomial distribution. In this case we consider all the winners in one period and their destiny (winner or loser) in subsequent periods. Persistence for the repeat winners is supported for two consecutive quarters (z = 3.59) and those that are separated by three quarters (z = 3.03) and four quarters (z = 1.99), where the p-values are less than or equal to 5%. The p-values are lowest where 57% and 56% of the winners in the one period are also winners in the respective subsequent period. We may not reject the null hypothesis, at the 5% level of significance, for the one remaining test period since the p-value of 0.06 is greater than 5%.

Table 2.1.7: Raw excess return - Repeat losers

9 years	1 Quarter	2 Quarters	3 Quarters	4 Quarters
Repeat Loser z	4.30	2.48	2.99	1.46
p-value for RL	0.00	0.01	0.00	0.14
RL	59%	55%	56%	53%

Following the explanation given for Table 2.1.6, Table 2.1.7 shows that persistence for repeat losers is supported across 1, 2 and 3 quarters. From Table 2.3.1 in Appendix 2, persistence over the 5 and 3-year horizons is also evident except for repeat losers over four quarters.

The results from the Sharpe and Treynor ratios (Tables 2.3.3 and 2.3.4) are similar to each other with support for persistence of the measures across 1, 2 and 4 quarters (except for repeat winners and losers over the 9-year period for Treynor) but no support for persistence across three quarters. Table 2.3.5 shows persistence in the Sortino ratio over all periods and across all quarters except for repeat winners over the 9-year period.

Results for Jensen's alpha and the Omega statistic are shown in Tables 2.3.2 and 2.3.6. Persistence is evident over all periods and across all quarters with all p-values less than 1%.

In summary, the analysis based on contingency tables suggests that performance persistence exists for each of the six measures used in our analysis. Depending on which measure is used, there will be greater or less evidence suggesting that persistence is stronger for either winners or losers. The analysis also suggests that persistence in Jensen's alpha and the Omega statistic is greater than for the other measures. The results using contingency tables are supported by the results from the Spearman Correlations.

2.6.3 Small sample bias

Pearson Chi-squared values are more reliable for large sample sizes (they are valid asymptotically). For small samples the Chi-squared distribution gives approximations to the discrete probabilities (associated with the small sample) with the p-values generally underestimating the true p-values. Yates's continuity correction provides more conservative estimates for the p-values, correcting for the lack of continuity in the distribution that is a better approximation for large sample sizes. To evaluate the possible existence of a small sample bias, we compare the p-values for the Pearson statistic with those for the Yates continuity correction.

Where the values for the two sets of p-values differ on the second decimal, those for the Yates continuity correction are higher than those for the Pearson statistic indicating a presence of small sample bias. However, all the adjustments were small and did not contradict any indications of significance by the p-values for the Pearson statistic.

2.6.4 Summary

The Spearman correlations and contingency tables have been used to analyse the persistence in performance measures. The results support each other in certain instances while in other instances the evidence for significant relationships is sparse.

An analysis using contingency tables provides a measure for an entire data set that contrasts with an analysis using Spearman correlation where averages of cross-correlations are obtained. The averages of these averages are then calculated. As an aid to comparing the different outputs we conservatively segmented the evaluation of the results on the basis of "strongly positive", "weak positive", "weak negative" and "strongly negative". We attempt to do similar with the results for the contingency tables. Significance of the Pearson statistic and repeat winner and loser z-statistics indicates "strongly" positive, or negative, while that for the Pearson statistics alone indicates "weak" positive, or negative.

The analysis suggested different degrees of persistence in the rankings between the different performance measures. The results for the raw excess return, Sharpe, Treynor and Sortino measures were similar where the Spearman correlations suggest a weak positive level of persistence while the contingency tables suggest a mixture of weak and strong levels of persistence.

The results of the persistence analysis for Jensen's alpha and the Omega statistic were coherent in their suggestion (without exception) of strong persistence in the ranking of the two performance measures for up to four quarters.

2.7 Conclusion

We examine the performance ranking persistence of equity-only portfolios. Therefore, we investigate a specific source of performance persistence within a fund. Unlike Jegadeesh and Titman (1993) who focus on persistence among individual stocks, we focus on persistence in the collective stock position within a fund (excluding instruments that are not equity shares). Also, we consider the level of determinism among different performance measures.

We find evidence of performance persistence for each of the six measures used in this study. However, the Sharpe, Treynor and Sortino ratios are weak alternatives to raw excess returns as a measure for confirming persistence – they provide similar results to those for raw excess returns. The use of Jensen's alpha and the Omega statistic as performance measures provides stronger evidence of performance persistence and are more distinct alternatives to raw excess returns.

The evidence of persistence in the equity position of portfolios supports investor's reliance on past performance when formulating expectations for future performance of equity funds. The probability associated with the different future outcomes – the conversion of uncertainty into risk, will depend on the performance measure used to evaluate funds' past performance.

2.8 References

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2.9 Appendix 2

2.9.1 Figures and tables

Table 2.1.8: Correlations of raw excess returns with other performance measures

	J-alpha		Sharpe		Treynor		Sortino		Omega	
Quarter	Correlation	p-values	Correlation	p-values	Correlation	p-values	Correlation	p-values	Correlation	p-values
03/96	-27%	0.349	75%	0.003	80%	0.001	63%	0.018	-14%	0.617
06/96	41%	0.148	94%	0.000	96%	0.000	92%	0.000	15%	0.561
09/96	39%	0.168	71%	0.006	74%	0.004	43%	0.126	25%	0.312
12/96	53%	0.045	78%	0.001	83%	0.000	41%	0.128	51%	0.029
03/97	36%	0.185	93%	0.000	91%	0.000	86%	0.000	40%	0.089
06/97	47%	0.077	94%	0.000	97%	0.000	95%	0.000	56%	0.014
09/97	11%	0.681	84%	0.000	69%	0.005	72%	0.003	12%	0.606
12/97	35%	0.204	83%	0.000	85%	0.000	85%	0.000	32%	0.169
03/98	64%	0.010	86%	0.000	91%	0.000	81%	0.000	68%	0.001
06/98	56%	0.025	99%	0.000	99%	0.000	96%	0.000	67%	0.000
09/98	-51%	0.037	18%	0.488	50%	0.040	61%	0.011	-44%	0.034
12/98	25%	0.316	97%	0.000	97%	0.000	97%	0.000	30%	0.143
03/99	41%	0.088	44%	0.069	63%	0.006	79%	0.000	43%	0.032
06/99	-44%	0.062	99%	0.000	100%	0.000	100%	0.000	-34%	0.088
09/99	-18%	0.457	98%	0.000	99%	0.000	98%	0.000	-18%	0.336
12/99	58%	0.008	85%	0.000	88%	0.000	83%	0.000	3%	0.845
03/00	49%	0.028	88%	0.000	94%	0.000	90%	0.000	18%	0.285
06/00	15%	0.511	92%	0.000	94%	0.000	96%	0.000	16%	0.335
09/00	26%	0.261	99%	0.000	99%	0.000	100%	0.000	6%	0.732
12/00	62%	0.002	96%	0.000	98%	0.000	97%	0.000	47%	0.002
03/01	55%	0.007	98%	0.000	99%	0.000	97%	0.000	49%	0.001
06/01	16%	0.440	66%	0.000	73%	0.000	53%	0.008	27%	0.082
09/01	35%	0.084	92%	0.000	91%	0.000	80%	0.000	48%	0.001
12/01	46%	0.015	90%	0.000	90%	0.000	85%	0.000	39%	0.009
03/02	67%	0.000	98%	0.000	98%	0.000	92%	0.000	48%	0.001
06/02	13%	0.448	99%	0.000	99%	0.000	99%	0.000	10%	0.529
09/02	42%	0.012	94%	0.000	88%	0.000	81%	0.000	40%	0.007
12/02	22%	0.188	99%	0.000	100%	0.000	99%	0.000	30%	0.043
03/03	2%	0.909	30%	0.068	-27%	0.100	12%	0.467	17%	0.266
06/03	6%	0.709	96%	0.000	91%	0.000	92%	0.000	17%	0.261
09/03	34%	0.028	97%	0.000	93%	0.000	92%	0.000	42%	0.003
12/03	19%	0.219	73%	0.000	64%	0.000	62%	0.000	19%	0.186
03/04	36%	0.016	98%	0.000	97%	0.000	97%	0.000	20%	0.166
06/04	53%	0.000	99%	0.000	97%	0.000	97%	0.000	51%	0.000
09/04	-16%	0.305	58%	0.000	39%	0.009	52%	0.000	-16%	0.259
12/04	72%	0.000	98%	0.000	96%	0.000	97%	0.000	59%	0.000

Table 2.2.1: Spearman rank correlations - Raw excess return

Spearman's rank correlations and p-values for each quarter and each of the subsequent 4 quarters								
	1 Quarter		2 Quarters		3 Quarters		4 Quarters	
Starting date	Correlation	p-values	Correlation	p-values	Correlation	p-values	Correlation	p-values
03/96	-8%	0.754	-14%	0.586	1%	0.977	-20%	0.427
06/96	27%	0.273	40%	0.103	-4%	0.882	-15%	0.558
09/96	60%	0.008	30%	0.210	30%	0.213	40%	0.090
12/96	8%	0.729	-2%	0.951	35%	0.138	-8%	0.748
03/97	68%	0.001	-8%	0.748	33%	0.159	48%	0.035
06/97	9%	0.693	11%	0.637	46%	0.041	24%	0.307
09/97	-24%	0.299	6%	0.789	20%	0.387	-28%	0.237
12/97	23%	0.310	6%	0.795	8%	0.722	-34%	0.128
03/98	73%	0.000	-54%	0.007	15%	0.485	36%	0.081
06/98	-56%	0.005	6%	0.773	58%	0.004	-62%	0.002
09/98	-62%	0.001	-53%	0.008	45%	0.024	59%	0.002
12/98	24%	0.230	8%	0.699	-27%	0.186	16%	0.433
03/99	-38%	0.045	-46%	0.015	27%	0.171	29%	0.133
06/99	79%	0.000	-29%	0.132	-29%	0.134	46%	0.012
09/99	-48%	0.004	-31%	0.068	70%	0.000	52%	0.002
12/99	45%	0.006	-27%	0.115	-27%	0.107	-22%	0.203
03/00	-12%	0.496	-2%	0.885	-16%	0.338	-38%	0.022
06/00	54%	0.000	82%	0.000	54%	0.000	1%	0.929
09/00	44%	0.004	32%	0.042	18%	0.262	1%	0.974
12/00	47%	0.002	6%	0.699	17%	0.268	39%	0.010
03/01	44%	0.004	61%	0.000	19%	0.217	31%	0.043
06/01	53%	0.000	-3%	0.863	-3%	0.854	15%	0.333
09/01	-15%	0.323	-2%	0.923	53%	0.000	62%	0.000
12/01	56%	0.000	-62%	0.000	-63%	0.000	-62%	0.000
03/02	-44%	0.003	-13%	0.412	-19%	0.222	-30%	0.052
06/02	69%	0.000	74%	0.000	63%	0.000	41%	0.005
09/02	83%	0.000	50%	0.000	11%	0.477	59%	0.000
12/02	60%	0.000	33%	0.023	60%	0.000	31%	0.036
03/03	43%	0.002	36%	0.012	43%	0.003	25%	0.087
06/03	3%	0.860	48%	0.001	10%	0.486	28%	0.049
09/03	33%	0.022	31%	0.029	9%	0.540	-20%	0.159
12/03	18%	0.200	28%	0.055	-19%	0.202	44%	0.002
03/04	56%	0.000	-26%	0.070	61%	0.000		
06/04	-35%	0.013	81%	0.000				
09/04	-51%	0.000						
Average	20%	0.151	9%	0.313	18%	0.258	12%	0.191
9 Years								
% positive correlations	71%		58%		72%		68%	
Strongly positive	11		4		7		4	
Weak positive	14		16		17		18	
Weak negative	7		11		8		8	
Strongly negative	3		3		1		2	
5 Years								
% positive correlations	78%		71%		75%		80%	
Strongly positive	7		4		5		2	
Weak positive	8		9		8		11	
Weak negative	3		4		3		2	
Strongly negative	1		1		1		1	
3 Years								
% positive correlations	80%		89%		88%		86%	
Strongly positive	4		2		3		1	
Weak positive	5		7		5		6	
Weak negative	1		1		1		1	
Strongly negative	1		0		0		0	

Table 2.2.2: Spearman rank correlations – Jensen's alpha

Spearman's rank correlations and p-values for each quarter and each of the subsequent 4 quarters								
	1 Quarter		2 Quarters		3 Quarters		4 Quarters	
Starting date	Correlation	p-values	Correlation	p-values	Correlation	p-values	Correlation	p-values
03/96	99%	0.000	60%	0.024	53%	0.051	73%	0.004
06/96	64%	0.016	59%	0.028	78%	0.001	83%	0.000
09/96	94%	0.000	86%	0.000	72%	0.005	42%	0.130
12/96	85%	0.000	65%	0.010	35%	0.194	40%	0.139
03/97	81%	0.000	67%	0.007	61%	0.017	57%	0.028
06/97	83%	0.000	74%	0.002	78%	0.001	66%	0.008
09/97	85%	0.000	88%	0.000	78%	0.001	79%	0.001
12/97	87%	0.000	72%	0.003	74%	0.002	56%	0.032
03/98	95%	0.000	96%	0.000	87%	0.000	84%	0.000
06/98	99%	0.000	93%	0.000	90%	0.000	90%	0.000
09/98	93%	0.000	90%	0.000	89%	0.000	88%	0.000
12/98	99%	0.000	96%	0.000	89%	0.000	85%	0.000
03/99	96%	0.000	88%	0.000	84%	0.000	82%	0.000
06/99	94%	0.000	85%	0.000	84%	0.000	74%	0.000
09/99	86%	0.000	83%	0.000	78%	0.000	66%	0.003
12/99	92%	0.000	82%	0.000	68%	0.001	54%	0.014
03/00	91%	0.000	74%	0.000	60%	0.006	11%	0.628
06/00	90%	0.000	77%	0.000	38%	0.097	12%	0.619
09/00	91%	0.000	63%	0.003	41%	0.063	30%	0.191
12/00	70%	0.000	50%	0.014	38%	0.068	34%	0.106
03/01	92%	0.000	88%	0.000	85%	0.000	83%	0.000
06/01	94%	0.000	94%	0.000	93%	0.000	88%	0.000
09/01	97%	0.000	94%	0.000	94%	0.000	85%	0.000
12/01	99%	0.000	98%	0.000	89%	0.000	93%	0.000
03/02	97%	0.000	88%	0.000	93%	0.000	91%	0.000
06/02	96%	0.000	96%	0.000	94%	0.000	89%	0.000
09/02	96%	0.000	94%	0.000	92%	0.000	86%	0.000
12/02	99%	0.000	94%	0.000	87%	0.000	70%	0.000
03/03	97%	0.000	90%	0.000	76%	0.000	61%	0.000
06/03	97%	0.000	86%	0.000	74%	0.000	74%	0.000
09/03	93%	0.000	83%	0.000	84%	0.000	68%	0.000
12/03	94%	0.000	92%	0.000	82%	0.000	69%	0.000
03/04	97%	0.000	92%	0.000	83%	0.000		
06/04	91%	0.000	81%	0.000				
09/04	93%	0.000						
Average	92%	0.000	83%	0.003	76%	0.015	68%	0.059
9 Years								
% positive correlations	100%		100%		100%		100%	
Strongly positive	35		33		29		26	
Weak positive	0		1		4		6	
Weak negative	0		0		0		0	
Strongly negative	0		0		0		0	
5 Years								
% positive correlations	100%		100%		100%		100%	
Strongly positive	19		17		14		13	
Weak positive	0		1		3		3	
Weak negative	0		0		0		0	
Strongly negative	0		0		0		0	
3 Years								
% positive correlations	100%		100%		100%		100%	
Strongly positive	11		10		9		8	
Weak positive	0		0		0		0	
Weak negative	0		0		0		0	
Strongly negative	0		0		0		0	

Table 2.2.3: Spearman rank correlations – Sharpe ratio

Spearman's rank correlations and p-values for each quarter and each of the subsequent 4 quarters								
	1 Quarter		2 Quarters		3 Quarters		4 Quarters	
Starting date	Correlation	p-values	Correlation	p-values	Correlation	p-values	Correlation	p-values
03/96	27%	0.353	-2%	0.964	-11%	0.704	0%	1.000
06/96	13%	0.654	16%	0.568	-10%	0.727	-13%	0.648
09/96	63%	0.019	42%	0.139	48%	0.082	45%	0.106
12/96	-11%	0.705	-3%	0.923	65%	0.010	1%	0.969
03/97	78%	0.001	17%	0.545	63%	0.015	39%	0.147
06/97	9%	0.758	31%	0.262	30%	0.274	6%	0.827
09/97	-1%	0.964	-8%	0.783	14%	0.616	31%	0.251
12/97	61%	0.017	0%	1.000	26%	0.344	-18%	0.532
03/98	64%	0.009	40%	0.124	-12%	0.664	-23%	0.391
06/98	10%	0.709	-17%	0.534	9%	0.742	-51%	0.046
09/98	-24%	0.362	-42%	0.095	-30%	0.235	10%	0.705
12/98	-15%	0.547	5%	0.827	-32%	0.200	23%	0.363
03/99	35%	0.149	22%	0.386	28%	0.266	-6%	0.824
06/99	72%	0.001	25%	0.308	-49%	0.034	50%	0.029
09/99	-27%	0.265	-73%	0.001	50%	0.032	51%	0.026
12/99	61%	0.005	29%	0.218	-10%	0.686	-9%	0.719
03/00	-14%	0.547	-45%	0.050	-20%	0.389	-62%	0.004
06/00	36%	0.123	63%	0.003	48%	0.032	24%	0.313
09/00	18%	0.434	21%	0.351	38%	0.093	-34%	0.133
12/00	37%	0.072	27%	0.192	-50%	0.015	48%	0.019
03/01	66%	0.001	15%	0.493	66%	0.001	41%	0.050
06/01	4%	0.845	62%	0.001	32%	0.116	-23%	0.259
09/01	-34%	0.088	-13%	0.522	60%	0.001	76%	0.000
12/01	78%	0.000	-52%	0.005	-52%	0.005	-54%	0.003
03/02	-53%	0.003	-27%	0.150	-41%	0.026	29%	0.121
06/02	69%	0.000	82%	0.000	-19%	0.283	52%	0.001
09/02	85%	0.000	-33%	0.051	31%	0.067	61%	0.000
12/02	-16%	0.335	41%	0.014	74%	0.000	71%	0.000
03/03	10%	0.528	-14%	0.391	-21%	0.200	-2%	0.918
06/03	16%	0.306	58%	0.000	9%	0.581	33%	0.038
09/03	62%	0.000	43%	0.005	11%	0.467	25%	0.108
12/03	34%	0.026	38%	0.012	16%	0.308	58%	0.000
03/04	56%	0.000	6%	0.697	62%	0.000		
06/04	6%	0.691	83%	0.000				
09/04	-3%	0.871						
Average	25%	0.297	13%	0.312	13%	0.249	15%	0.299
9 Years								
% positive correlations	71%		64%		63%		65%	
Strongly positive	12		5		6		7	
Weak positive	13		17		15		14	
Weak negative	9		9		11		8	
Strongly negative	1		2		1		3	
5 Years								
% positive correlations	78%		71%		69%		73%	
Strongly positive	6		5		4		5	
Weak positive	9		8		8		7	
Weak negative	3		4		4		3	
Strongly negative	1		1		1		1	
3 Years								
% positive correlations	80%		78%		75%		86%	
Strongly positive	4		3		2		4	
Weak positive	5		5		5		3	
Weak negative	2		2		2		1	
Strongly negative	0		0		0		0	

Table 2.2.4: Spearman rank correlations – Treynor ratio

Spearman's rank correlations and p-values for each quarter and each of the subsequent 4 quarters

	1 Quarter		2 Quarters		3 Quarters		4 Quarters	
Starting date	Correlation	p-values	Correlation	p-values	Correlation	p-values	Correlation	p-values
03/96	13%	0.665	-3%	0.916	13%	0.643	-19%	0.522
06/96	24%	0.395	28%	0.329	-21%	0.473	-33%	0.253
09/96	53%	0.051	45%	0.103	39%	0.168	39%	0.163
12/96	-15%	0.584	-7%	0.812	45%	0.090	5%	0.858
03/97	74%	0.002	29%	0.292	56%	0.033	42%	0.121
06/97	19%	0.486	30%	0.280	31%	0.262	-1%	0.964
09/97	24%	0.386	28%	0.317	21%	0.454	32%	0.245
12/97	63%	0.014	3%	0.929	28%	0.311	-22%	0.434
03/98	62%	0.011	13%	0.621	-7%	0.797	-12%	0.656
06/98	-34%	0.204	-16%	0.556	37%	0.160	-51%	0.048
09/98	-27%	0.299	-27%	0.294	5%	0.857	27%	0.283
12/98	-16%	0.525	5%	0.827	-29%	0.249	16%	0.511
03/99	15%	0.561	15%	0.555	15%	0.538	8%	0.751
06/99	75%	0.000	11%	0.649	-29%	0.229	52%	0.025
09/99	-27%	0.256	-55%	0.016	58%	0.010	51%	0.029
12/99	75%	0.000	16%	0.507	-12%	0.599	-3%	0.896
03/00	-15%	0.530	-37%	0.105	-20%	0.400	-60%	0.006
06/00	33%	0.151	71%	0.001	59%	0.008	18%	0.451
09/00	23%	0.310	25%	0.276	31%	0.177	-32%	0.163
12/00	36%	0.083	23%	0.267	-51%	0.013	47%	0.022
03/01	66%	0.001	17%	0.423	72%	0.000	44%	0.031
06/01	14%	0.502	53%	0.007	25%	0.218	-15%	0.463
09/01	-25%	0.217	-14%	0.488	60%	0.001	64%	0.001
12/01	79%	0.000	-46%	0.014	-29%	0.137	-46%	0.015
03/02	-58%	0.001	-14%	0.468	-46%	0.013	74%	0.000
06/02	56%	0.001	81%	0.000	-66%	0.000	60%	0.000
09/02	71%	0.000	-52%	0.001	22%	0.193	52%	0.001
12/02	-70%	0.000	52%	0.001	79%	0.000	77%	0.000
03/03	-41%	0.011	-66%	0.000	-69%	0.000	-35%	0.029
06/03	33%	0.035	66%	0.000	23%	0.152	21%	0.191
09/03	75%	0.000	46%	0.002	2%	0.873	47%	0.001
12/03	44%	0.003	26%	0.098	50%	0.001	63%	0.000
03/04	51%	0.001	18%	0.231	67%	0.000		
06/04	7%	0.629	73%	0.000				
09/04	15%	0.326						
Average	22%	0.207	13%	0.305	14%	0.244	16%	0.254
9 Years								
% positive correlations	71%		70%		66%		65%	
Strongly positive	12		6		8		8	
Weak positive	13		18		14		13	
Weak negative	8		7		8		9	
Strongly negative	2		3		3		2	
5 Years								
% positive correlations	78%		71%		69%		73%	
Strongly positive	6		6		6		6	
Weak positive	9		7		6		6	
Weak negative	2		3		2		4	
Strongly negative	2		2		3		0	
3 Years								
% positive correlations	80%		78%		75%		86%	
Strongly positive	4		4		3		4	
Weak positive	5		4		4		3	
Weak negative	1		0		0		1	
Strongly negative	1		2		2		0	

Table 2.2.5: Spearman rank correlations – Sortino ratio

Spearman's rank correlations and p-values for each quarter and each of the subsequent 4 quarters								
	1 Quarter		2 Quarters		3 Quarters		4 Quarters	
Starting date	Correlation	p-values	Correlation	p-values	Correlation	p-values	Correlation	p-values
03/96	40%	0.153	-8%	0.785	-27%	0.341	14%	0.632
06/96	-13%	0.660	-26%	0.374	-3%	0.928	-12%	0.682
09/96	76%	0.002	-9%	0.773	4%	0.898	42%	0.139
12/96	-31%	0.265	-22%	0.434	49%	0.068	-20%	0.482
03/97	88%	0.000	-50%	0.060	18%	0.528	50%	0.059
06/97	-29%	0.295	4%	0.898	44%	0.105	-9%	0.743
09/97	-38%	0.165	-26%	0.347	27%	0.324	21%	0.438
12/97	62%	0.015	-20%	0.474	-38%	0.161	-23%	0.404
03/98	35%	0.182	-85%	0.000	0%	1.000	22%	0.401
06/98	-62%	0.013	-8%	0.780	63%	0.011	-49%	0.059
09/98	2%	0.947	-33%	0.198	59%	0.014	64%	0.007
12/98	-4%	0.863	10%	0.689	-25%	0.318	7%	0.783
03/99	-3%	0.895	-12%	0.644	42%	0.087	36%	0.139
06/99	75%	0.000	14%	0.558	-37%	0.123	51%	0.029
09/99	-18%	0.466	-61%	0.006	53%	0.022	45%	0.053
12/99	48%	0.033	14%	0.540	-4%	0.866	-1%	0.967
03/00	-34%	0.137	-47%	0.038	-34%	0.147	-69%	0.001
06/00	39%	0.091	60%	0.006	51%	0.022	54%	0.014
09/00	24%	0.289	19%	0.414	51%	0.020	-43%	0.052
12/00	34%	0.107	29%	0.173	-57%	0.004	47%	0.023
03/01	66%	0.001	5%	0.820	56%	0.005	32%	0.132
06/01	-20%	0.348	74%	0.000	43%	0.032	-33%	0.108
09/01	-53%	0.006	-34%	0.093	63%	0.001	78%	0.000
12/01	69%	0.000	-44%	0.019	-76%	0.000	-50%	0.008
03/02	-65%	0.000	-57%	0.002	-46%	0.013	-17%	0.385
06/02	65%	0.000	84%	0.000	-25%	0.153	58%	0.000
09/02	82%	0.000	-3%	0.878	32%	0.059	53%	0.001
12/02	-27%	0.110	50%	0.002	76%	0.000	76%	0.000
03/03	-6%	0.738	-40%	0.011	-41%	0.010	-26%	0.113
06/03	32%	0.041	65%	0.000	21%	0.181	26%	0.097
09/03	71%	0.000	46%	0.002	10%	0.514	32%	0.038
12/03	42%	0.005	30%	0.053	41%	0.007	66%	0.000
03/04	56%	0.000	20%	0.188	65%	0.000		
06/04	24%	0.123	75%	0.000				
09/04	28%	0.067						
Average	19%	0.201	0%	0.302	14%	0.211	16%	0.218
9 Years								
% positive correlations	59%		48%		63%		61%	
Strongly positive	10		6		9		8	
Weak positive	11		11		12		12	
Weak negative	11		14		10		11	
Strongly negative	3		3		2		1	
5 Years								
% positive correlations	72%		71%		69%		67%	
Strongly positive	6		6		6		6	
Weak positive	8		7		6		5	
Weak negative	3		4		3		5	
Strongly negative	2		1		2		0	
3 Years								
% positive correlations	80%		78%		75%		86%	
Strongly positive	4		4		2		4	
Weak positive	5		4		5		3	
Weak negative	2		2		2		1	
Strongly negative	0		0		0		0	

Table 2.2.6: Spearman rank correlations – Omega

Spearman's rank correlations and p-values for each quarter and each of the subsequent 4 quarters								
	1 Quarter		2 Quarters		3 Quarters		4 Quarters	
Starting date	Correlation	p-values	Correlation	p-values	Correlation	p-values	Correlation	p-values
03/96	96%	0.000	67%	0.005	64%	0.009	68%	0.005
06/96	64%	0.005	50%	0.035	47%	0.048	66%	0.004
09/96	93%	0.000	77%	0.000	66%	0.003	51%	0.031
12/96	80%	0.000	49%	0.033	41%	0.079	51%	0.028
03/97	76%	0.000	76%	0.000	77%	0.000	67%	0.002
06/97	89%	0.000	65%	0.003	67%	0.002	53%	0.020
09/97	79%	0.000	90%	0.000	79%	0.000	82%	0.000
12/97	82%	0.000	82%	0.000	83%	0.000	73%	0.000
03/98	93%	0.000	90%	0.000	89%	0.000	91%	0.000
06/98	87%	0.000	94%	0.000	93%	0.000	83%	0.000
09/98	87%	0.000	81%	0.000	65%	0.001	59%	0.003
12/98	89%	0.000	84%	0.000	83%	0.000	83%	0.000
03/99	94%	0.000	86%	0.000	85%	0.000	79%	0.000
06/99	96%	0.000	92%	0.000	87%	0.000	79%	0.000
09/99	91%	0.000	86%	0.000	81%	0.000	75%	0.000
12/99	95%	0.000	86%	0.000	76%	0.000	38%	0.023
03/00	94%	0.000	86%	0.000	49%	0.003	60%	0.000
06/00	95%	0.000	63%	0.000	70%	0.000	51%	0.002
09/00	76%	0.000	74%	0.000	56%	0.000	31%	0.059
12/00	72%	0.000	45%	0.004	51%	0.001	36%	0.020
03/01	68%	0.000	68%	0.000	52%	0.000	49%	0.001
06/01	59%	0.000	78%	0.000	81%	0.000	80%	0.000
09/01	85%	0.000	77%	0.000	75%	0.000	82%	0.000
12/01	96%	0.000	94%	0.000	82%	0.000	85%	0.000
03/02	96%	0.000	82%	0.000	87%	0.000	86%	0.000
06/02	89%	0.000	93%	0.000	93%	0.000	83%	0.000
09/02	85%	0.000	89%	0.000	90%	0.000	86%	0.000
12/02	95%	0.000	87%	0.000	84%	0.000	75%	0.000
03/03	94%	0.000	89%	0.000	75%	0.000	65%	0.000
06/03	98%	0.000	85%	0.000	79%	0.000	75%	0.000
09/03	91%	0.000	86%	0.000	82%	0.000	76%	0.000
12/03	95%	0.000	94%	0.000	87%	0.000	75%	0.000
03/04	98%	0.000	94%	0.000	83%	0.000		
06/04	94%	0.000	88%	0.000				
09/04	91%	0.000						
Average	88%	0.000	80%	0.002	75%	0.004	69%	0.006
9 Years								
% positive correlations	100%		100%		100%		100%	
Strongly positive	35		32		30		28	
Weak positive	0		2		3		4	
Weak negative	0		0		0		0	
Strongly negative	0		0		0		0	
5 Years								
% positive correlations	100%		100%		100%		100%	
Strongly positive	19		17		17		13	
Weak positive	0		1		0		3	
Weak negative	0		0		0		0	
Strongly negative	0		0		0		0	
3 Years								
% positive correlations	100%		100%		100%		100%	
Strongly positive	11		10		9		8	
Weak positive	0		0		0		0	
Weak negative	0		0		0		0	
Strongly negative	0		0		0		0	

Table 2.3.1: 2X2 contingency tables - Raw excess return

9 years	1 Quarter	2 Quarters	3 Quarters	4 Quarters
No. of WW	351	317	318	293
No. of LL	369	332	325	297
No. of WL	262	271	246	247
No. of LW	261	271	253	256
Total	1243	1191	1142	1093
Stdev	11%	12%	12%	12%
CPR	1.89	1.43	1.66	1.38
z	5.56	3.09	4.25	2.63
p-value for z	0.00	0.00	0.00	0.01
% WW	28%	27%	28%	27%
%LL	30%	28%	28%	27%
Pearson Statistic	31.15	9.58	18.16	6.94
p-value for Pearson	0.00	0.00	0.00	0.01
Yates adjustment	25.94	8.36	15.68	6.16
p-value for Yates	0.00	0.00	0.00	0.01
Repeat Winner z	3.59	1.90	3.03	1.98
p-value for RW	0.00	0.06	0.00	0.05
RW	57%	54%	56%	54%
Repeat Loser z	4.30	2.48	2.99	1.74
p-value for RL	0.00	0.01	0.00	0.08
RL	59%	55%	56%	54%
5 years	1 Quarter	2 Quarters	3 Quarters	4 Quarters
No of WW	254	237	214	195
No of LL	263	243	216	192
No of WL	171	163	162	157
No of LW	173	166	168	167
N	861	809	760	711
Stdev	14%	14%	15%	15%
CPR	2.26	2.13	1.70	1.43
z	5.85	5.28	3.62	2.36
p-value for z	0.00	0.00	0.00	0.02
% WW	30%	29%	28%	27%
%LL	31%	30%	28%	27%
Pearson Statistic	34.73	28.18	13.17	5.61
p-value for Pearson	0.00	0.00	0.00	0.02
Yates adjustment	28.03	23.03	11.24	4.92
p-value for Yates	0.00	0.00	0.00	0.03
Repeat Winner z	4.03	3.70	2.68	2.03
p-value for RW	0.00	0.00	0.01	0.04
RW	60%	59%	57%	55%
Repeat Loser z	4.31	3.81	2.45	1.32
p-value for RL	0.00	0.00	0.01	0.19
RL	60%	59%	56%	53%
3 years	1 Quarter	2 Quarters	3 Quarters	4 Quarters
No of WW	153	151	126	114
No of LL	157	154	126	111
No of WL	107	84	85	73
No of LW	110	86	89	79
N	527	475	426	377
Stdev	18%	19%	20%	21%
CPR	2.04	3.22	2.10	2.19
z	4.03	6.11	3.76	3.74
p-value for z	0.00	0.00	0.00	0.00
% WW	29%	32%	30%	30%
%LL	30%	32%	30%	29%
Pearson Statistic	16.41	38.37	14.30	14.17
p-value for Pearson	0.00	0.00	0.00	0.00
Yates adjustment	13.33	28.94	11.58	11.50
p-value for Yates	0.00	0.00	0.00	0.00
Repeat Winner z	2.85	4.37	2.82	3.00
p-value for RW	0.00	0.00	0.00	0.00
RW	59%	64%	60%	61%
Repeat Loser z	2.88	4.39	2.52	2.32
p-value for RL	0.00	0.00	0.01	0.02
RL	59%	64%	59%	58%

Table 2.3.2: 2X2 contingency tables - Jensen's alpha

9 years	1 Quarter	2 Quarters	3 Quarters	4 Quarters
No. of WW	388	348	316	284
No. of LL	402	362	327	294
No. of WL	45	63	73	83
No. of LW	46	64	77	88
Total	881	837	793	749
Stdev	22%	19%	18%	17%
CPR	75.35	31.24	18.38	11.43
z	19.52	17.86	16.05	13.99
p-value for z	0.00	0.00	0.00	0.00
% WW	44%	42%	40%	38%
%LL	46%	43%	41%	39%
Pearson Statistic	554.53	405.98	306.46	221.15
p-value for Pearson	0.00	0.00	0.00	0.00
Yates adjustment	302.90	233.97	185.79	140.94
p-value for Yates	0.00	0.00	0.00	0.00
Repeat Winner z	16.48	14.06	12.32	10.49
p-value for RW	0.00	0.00	0.00	0.00
RW	90%	85%	81%	77%
Repeat Loser z	16.82	14.44	12.44	10.54
p-value for RL	0.00	0.00	0.00	0.00
RL	90%	85%	81%	77%
5 years	1 Quarter	2 Quarters	3 Quarters	4 Quarters
No of WW	273	241	210	180
No of LL	281	251	219	190
No of WL	34	44	53	61
No of LW	33	41	51	58
N	621	577	533	489
Stdev	26%	24%	22%	21%
CPR	68.37	33.53	17.01	9.67
z	16.33	14.94	12.96	10.76
p-value for z	0.00	0.00	0.00	0.00
% WW	44%	42%	39%	37%
%LL	45%	44%	41%	39%
Pearson Statistic	381.88	287.05	198.11	128.76
p-value for Pearson	0.00	0.00	0.00	0.00
Yates adjustment	209.20	162.92	119.05	81.51
p-value for Yates	0.00	0.00	0.00	0.00
Repeat Winner z	13.64	11.67	9.68	7.67
p-value for RW	0.00	0.00	0.00	0.00
RW	89%	85%	80%	75%
Repeat Loser z	14.00	12.29	10.22	8.38
p-value for RL	0.00	0.00	0.00	0.00
RL	89%	86%	81%	77%
3 years	1 Quarter	2 Quarters	3 Quarters	4 Quarters
No of WW	195	168	141	117
No of LL	200	172	144	118
No of WL	19	24	29	31
No of LW	19	25	31	35
N	433	389	345	301
Stdev	34%	31%	28%	28%
CPR	108.03	48.16	22.59	12.72
z	13.78	12.68	10.97	9.12
p-value for z	0.00	0.00	0.00	0.00
% WW	45%	43%	41%	39%
%LL	46%	44%	42%	39%
Pearson Statistic	294.32	217.68	146.75	94.98
p-value for Pearson	0.00	0.00	0.00	0.00
Yates adjustment	157.67	121.87	87.00	59.99
p-value for Yates	0.00	0.00	0.00	0.00
Repeat Winner z	12.03	10.39	8.59	7.07
p-value for RW	0.00	0.00	0.00	0.00
RW	91%	88%	83%	79%
Repeat Loser z	12.23	10.47	8.54	6.71
p-value for RL	0.00	0.00	0.00	0.00
RL	91%	87%	82%	77%

Table 2.3.3: 2X2 contingency tables - Sharpe ratio

9 years	1 Quarter	2 Quarters	3 Quarters	4 Quarters
No. of WW	253	227	211	212
No. of LL	266	237	219	218
No. of WL	180	184	178	155
No. of LW	182	189	185	164
Total	881	837	793	749
Stdev	14%	14%	14%	15%
CPR	2.05	1.55	1.40	1.82
z	5.26	3.14	2.38	4.04
p-value for z	0.00	0.00	0.02	0.00
% WW	29%	27%	27%	28%
%LL	30%	28%	28%	29%
Pearson Statistic	27.92	9.88	5.66	16.47
p-value for Pearson	0.00	0.00	0.02	0.00
Yates adjustment	22.81	8.47	4.91	13.89
p-value for Yates	0.00	0.00	0.03	0.00
Repeat Winner z	3.51	2.12	1.67	2.98
p-value for RW	0.00	0.03	0.09	0.00
RW	58%	55%	54%	58%
Repeat Loser z	3.97	2.33	1.69	2.76
p-value for RL	0.00	0.02	0.09	0.01
RL	59%	56%	54%	57%
5 years	1 Quarter	2 Quarters	3 Quarters	4 Quarters
No of WW	179	166	142	148
No of LL	185	170	143	147
No of WL	128	119	121	93
No of LW	129	122	127	101
N	621	577	533	489
Stdev	16%	17%	17%	18%
CPR	2.01	1.94	1.32	2.32
z	4.27	3.94	1.60	4.54
p-value for z	0.00	0.00	0.11	0.00
% WW	29%	29%	27%	30%
%LL	30%	29%	27%	30%
Pearson Statistic	18.42	15.64	2.58	20.93
p-value for Pearson	0.00	0.00	0.11	0.00
Yates adjustment	15.01	12.85	2.18	16.97
p-value for Yates	0.00	0.00	0.14	0.00
Repeat Winner z	2.91	2.78	1.29	3.54
p-value for RW	0.00	0.01	0.20	0.00
RW	58%	58%	54%	61%
Repeat Loser z	3.16	2.81	0.97	2.92
p-value for RL	0.00	0.00	0.33	0.00
RL	59%	58%	53%	59%
3 years	1 Quarter	2 Quarters	3 Quarters	4 Quarters
No of WW	124	117	95	101
No of LL	128	118	95	98
No of WL	90	75	75	47
No of LW	91	79	80	55
N	433	389	345	301
Stdev	19%	21%	22%	24%
CPR	1.94	2.33	1.50	3.83
z	3.40	4.08	1.89	5.50
p-value for z	0.00	0.00	0.06	0.00
% WW	29%	30%	28%	34%
%LL	30%	30%	28%	33%
Pearson Statistic	11.63	16.89	3.57	31.43
p-value for Pearson	0.00	0.00	0.06	0.00
Yates adjustment	9.37	13.40	2.92	23.63
p-value for Yates	0.00	0.00	0.09	0.00
Repeat Winner z	2.32	3.03	1.53	4.44
p-value for RW	0.02	0.00	0.13	0.00
RW	58%	61%	56%	68%
Repeat Loser z	2.50	2.78	1.13	3.48
p-value for RL	0.01	0.01	0.26	0.00
RL	58%	60%	54%	64%

Table 2.3.4: 2X2 contingency tables - Treynor ratio

9 years	1 Quarter	2 Quarters	3 Quarters	4 Quarters
No. of WW	242	222	202	213
No. of LL	255	233	213	224
No. of WL	191	188	187	154
No. of LW	193	194	191	158
Total	881	837	793	749
Stdev	14%	14%	14%	15%
CPR	1.67	1.42	1.20	1.96
z	3.79	2.52	1.31	4.54
p-value for z	0.00	0.01	0.19	0.00
% WW	27%	27%	25%	28%
%LL	29%	28%	27%	30%
Pearson Statistic	14.45	6.35	1.71	20.82
p-value for Pearson	0.00	0.01	0.19	0.00
Yates adjustment	12.20	5.49	1.45	17.12
p-value for Yates	0.00	0.02	0.23	0.00
Repeat Winner z	2.45	1.68	0.76	3.08
p-value for RW	0.01	0.09	0.45	0.00
RW	56%	54%	52%	58%
Repeat Loser z	2.93	1.89	1.09	3.38
p-value for RL	0.00	0.06	0.27	0.00
RL	57%	55%	53%	59%
5 years	1 Quarter	2 Quarters	3 Quarters	4 Quarters
No of WW	175	162	135	145
No of LL	180	166	138	148
No of WL	132	122	128	96
No of LW	134	127	132	100
N	621	577	533	489
Stdev	16%	17%	17%	18%
CPR	1.78	1.74	1.10	2.24
z	3.56	3.28	0.56	4.36
p-value for z	0.00	0.00	0.57	0.00
% WW	28%	28%	25%	30%
%LL	29%	29%	26%	30%
Pearson Statistic	12.75	10.82	0.32	19.25
p-value for Pearson	0.00	0.00	0.57	0.00
Yates adjustment	10.60	9.06	0.22	15.44
p-value for Yates	0.00	0.00	0.64	0.00
Repeat Winner z	2.45	2.37	0.43	3.16
p-value for RW	0.01	0.02	0.67	0.00
RW	57%	57%	51%	60%
Repeat Loser z	2.60	2.28	0.37	3.05
p-value for RL	0.01	0.02	0.72	0.00
RL	57%	57%	51%	60%
3 years	1 Quarter	2 Quarters	3 Quarters	4 Quarters
No of WW	117	118	88	100
No of LL	121	119	88	99
No of WL	97	73	82	48
No of LW	98	79	87	54
N	433	389	345	301
Stdev	19%	21%	22%	24%
CPR	1.49	2.43	1.09	3.82
z	2.06	4.28	0.38	5.50
p-value for z	0.04	0.00	0.70	0.00
% WW	27%	30%	26%	33%
%LL	28%	31%	26%	33%
Pearson Statistic	4.26	18.62	0.15	31.36
p-value for Pearson	0.04	0.00	0.70	0.00
Yates adjustment	3.50	14.76	0.07	23.28
p-value for Yates	0.06	0.00	0.79	0.00
Repeat Winner z	1.37	3.26	0.46	4.27
p-value for RW	0.17	0.00	0.65	0.00
RW	55%	62%	52%	68%
Repeat Loser z	1.55	2.84	0.08	3.64
p-value for RL	0.12	0.00	0.94	0.00
RL	55%	60%	50%	65%

Table 2.3.5: 2X2 contingency tables - Sortino ratio

9 years	1 Quarter	2 Quarters	3 Quarters	4 Quarters
No. of WW	245	224	214	213
No. of LL	258	235	226	225
No. of WL	188	187	175	154
No. of LW	190	191	178	157
Total	881	837	793	749
Stdev	14%	14%	14%	15%
CPR	1.77	1.47	1.55	1.98
z	4.19	2.79	3.08	4.61
p-value for z	0.00	0.01	0.00	0.00
% WW	28%	27%	27%	28%
%LL	29%	28%	28%	30%
Pearson Statistic	17.69	7.82	9.51	21.48
p-value for Pearson	0.00	0.01	0.00	0.00
Yates adjustment	14.81	6.72	8.09	17.58
p-value for Yates	0.00	0.01	0.00	0.00
Repeat Winner z	2.74	1.83	1.98	3.08
p-value for RW	0.01	0.07	0.05	0.00
RW	57%	55%	55%	58%
Repeat Loser z	3.21	2.13	2.39	3.48
p-value for RL	0.00	0.03	0.02	0.00
RL	58%	55%	56%	59%
5 years	1 Quarter	2 Quarters	3 Quarters	4 Quarters
No of WW	181	173	149	148
No of LL	186	177	152	150
No of WL	126	112	114	93
No of LW	128	115	118	98
N	621	577	533	489
Stdev	16%	17%	17%	19%
CPR	2.09	2.38	1.68	2.44
z	4.51	5.08	2.98	4.80
p-value for z	0.00	0.00	0.00	0.00
% WW	29%	30%	28%	30%
%LL	30%	31%	29%	31%
Pearson Statistic	20.55	26.22	8.94	23.44
p-value for Pearson	0.00	0.00	0.00	0.00
Yates adjustment	16.70	20.88	7.48	18.63
p-value for Yates	0.00	0.00	0.01	0.00
Repeat Winner z	3.14	3.61	2.16	3.54
p-value for RW	0.00	0.00	0.03	0.00
RW	59%	61%	57%	61%
Repeat Loser z	3.27	3.63	2.07	3.30
p-value for RL	0.00	0.00	0.04	0.00
RL	59%	61%	56%	60%
3 years	1 Quarter	2 Quarters	3 Quarters	4 Quarters
No of WW	131	124	105	100
No of LL	134	125	106	98
No of WL	83	68	65	48
No of LW	85	72	69	55
N	433	389	345	301
Stdev	20%	21%	22%	24%
CPR	2.49	3.17	2.48	3.71
z	4.62	5.45	4.11	5.39
p-value for z	0.00	0.00	0.00	0.00
% WW	30%	32%	30%	33%
%LL	31%	32%	31%	33%
Pearson Statistic	21.73	30.57	17.21	30.11
p-value for Pearson	0.00	0.00	0.00	0.00
Yates adjustment	16.99	23.19	13.46	22.59
p-value for Yates	0.00	0.00	0.00	0.00
Repeat Winner z	3.28	4.04	3.07	4.27
p-value for RW	0.00	0.00	0.00	0.00
RW	61%	65%	62%	68%
Repeat Loser z	3.31	3.78	2.80	3.48
p-value for RL	0.00	0.00	0.01	0.00
RL	61%	63%	61%	64%

Table 2.3.6: 2X2 contingency tables - Omega

9 years	1 Quarter	2 Quarters	3 Quarters	4 Quarters
No. of WW	504	459	420	379
No. of LL	525	479	442	403
No. of WL	88	109	124	141
No. of LW	84	105	117	131
Total	1201	1152	1103	1054
Stdev	16%	15%	15%	14%
CPR	35.80	19.21	12.80	8.27
z	21.71	19.50	17.48	15.00
p-value for z	0.00	0.00	0.00	0.00
% WW	42%	40%	38%	36%
%LL	44%	42%	40%	38%
Pearson Statistic	611.41	454.88	349.49	246.64
p-value for Pearson	0.00	0.00	0.00	0.00
Yates adjustment	347.75	272.00	216.32	159.59
p-value for Yates	0.00	0.00	0.00	0.00
Repeat Winner z	17.10	14.69	12.69	10.44
p-value for RW	0.00	0.00	0.00	0.00
RW	85%	81%	77%	73%
Repeat Loser z	17.87	15.48	13.75	11.77
p-value for RL	0.00	0.00	0.00	0.00
RL	86%	82%	79%	75%
5 years	1 Quarter	2 Quarters	3 Quarters	4 Quarters
No of WW	355	321	291	261
No of LL	362	324	291	261
No of WL	62	72	78	84
No of LW	64	77	85	90
N	843	794	745	696
Stdev	19%	18%	18%	18%
CPR	32.39	18.76	12.77	9.01
z	18.00	16.12	14.36	12.55
p-value for z	0.00	0.00	0.00	0.00
% WW	42%	40%	39%	38%
%LL	43%	41%	39%	38%
Pearson Statistic	414.32	309.90	235.77	174.08
p-value for Pearson	0.00	0.00	0.00	0.00
Yates adjustment	240.48	189.69	150.87	115.71
p-value for Yates	0.00	0.00	0.00	0.00
Repeat Winner z	14.35	12.56	11.09	9.53
p-value for RW	0.00	0.00	0.00	0.00
RW	85%	82%	79%	76%
Repeat Loser z	14.44	12.33	10.62	9.13
p-value for RL	0.00	0.00	0.00	0.00
RL	85%	81%	77%	74%
3 years	1 Quarter	2 Quarters	3 Quarters	4 Quarters
No of WW	228	197	173	144
No of LL	233	200	175	144
No of WL	28	35	35	40
No of LW	28	36	36	42
N	517	468	419	370
Stdev	28%	26%	26%	25%
CPR	67.76	31.27	24.03	12.34
z	14.90	13.36	12.21	10.04
p-value for z	0.00	0.00	0.00	0.00
% WW	44%	42%	41%	39%
%LL	45%	43%	42%	39%
Pearson Statistic	317.25	227.08	183.13	114.71
p-value for Pearson	0.00	0.00	0.00	0.00
Yates adjustment	174.44	131.64	108.40	72.65
p-value for Yates	0.00	0.00	0.00	0.00
Repeat Winner z	12.50	10.64	9.57	7.67
p-value for RW	0.00	0.00	0.00	0.00
RW	89%	85%	83%	78%
Repeat Loser z	12.69	10.68	9.57	7.48
p-value for RL	0.00	0.00	0.00	0.00
RL	89%	85%	83%	77%

Chapter 3: Performance Persistence Refined

3.1 Introduction

Finding evidence of ranked performance persistence is useful for investment decision-making since the presence of positive persistence supports the use of historical fund performance for selecting winning funds that are expected to continue to win in the future. Similarly, positive persistence can be used to avoid funds that are expected to perform poorly in the future.

Contingency tables are a popular method for examining performance persistence. 2X2 tables are relatively easy to analyse and the associated Chi-squared computations are readily calculated using a calculator. However, analysing higher order contingency tables uses longer and more complex formulae and is best done using greater computing power than that provided by a simple calculator.

In the previous section we examined performance persistence using 2X2 contingency tables. We find that positive performance persistence is evident among winning and losing equity funds when ranking fund performance using raw excess returns, Jensen's alpha, thye Sharpe ratio, Sortino ratio, Treynor ratio and the Omega statistic. We defined winners as above-median performers and losers as median and below-median performers. Moreover, we find that persistence is strongest when using Jensen's alpha and the Omega statistic as measures of performance persistence. Further analysis is required if we wish to uncover any concentration of fund persistence within the two groups of winners and losers.

From the review of South African literature provided in the previous section, Firer, Beale, Edwards, Hendrie and Scheppening (2001) use 2X2 and 4X4 contingency tables to investigate performance persistence. For their monthly data consisting of 43 unit trusts from the general equity category over the period January 1989 to December 1999, they find that persistence exists for funds ranked in one quarter and holdings periods of 1, 2 and 4 quarters when using both methods of 2X2 and 4X4 contingency tables. While their results show greater persistence for repeat losers (worst performing quartile) than repeat winners over one quarter, the reverse is apparent for the holding periods over two and four quarters.

In this section we use 5X5 contingency tables to investigate ranked performance persistence. We find that risk-adjusted performance persistence exists for equity funds ranked in one quarter and holding periods of 1, 2, 3 and 4 quarters and that repeat winners (best performing quintile) show greater persistence than repeat losers.

3.2 Methodology

We use precisely the same data used in the previous analysis except that we rank the funds performances according to quintiles. The funds with the 1st quartile performance are the best performing funds and are ranked number 1 while the worst performers are ranked number 5. We also use the same methodology as used in the previous analysis, testing for association of a fund's ranking at one quarter with those for the subsequent four quarters. The method used is implemented using XLSTAT, an EXCEL "add-in" statistical package that is sold by Addinsoft, USA (see website at http://www.xlstat.com). In order to check that the analysis results produced by XLSTAT are correct, we compared them with the 2X2 and 5X5 results calculated by ourselves and the 5X5 results obtained by using a web-based tool that can be accessed on http://faculty.vassar.edu/lowry/newcs.html .

The analysis for the six measures is considered over four quarters (one quarter with 1, 2, 3 and 4 subsequent quarters) and for three different horizons: 9-year, 5-year and 3-year. As with the previous 2X2 analysis this requires 6 x 4 x 3 = 72 examinations and outputs for the 5X5 analysis. The input components of the 5X5 contingency tables for the three different analysis periods can be found in Tables 3.2.1 – 3.2.3 in Appendix 3.

We first provide a relatively detailed discussion of the first analysis output for excess returns and thereafter a summary of the rest of the output which will highlight key results.

In each of the 72 examinations we test for independence between the rankings at each quarter and the rankings in subsequent quarters. We state the hypothesis accordingly:

H0: Quarterly rankings are independent of prior quarter's rankings.

H1: There is an association between quarterly rankings.

A rejection of H0 implies that there is sufficient evidence to indicate the existence of ranked performance persistence among equity funds.

3.3 Results

3.3.1 Analysis 1 for raw excess returns

The first analysis for excess returns over the 9-year period considers the association that a fund's ranking in a quarter has with its ranking in the first subsequent quarter. Table 3.1.1 reflects the top portion of Table 3.2.1 in Appendix 3.

Table 3.1.1: The 5X5 contingency table for the first analysis

Observed frequencies						
Quintiles	1	2	3	4	5	Total
1	82	57	33	42	41	255
2	54	75	36	45	34	244
3	32	40	72	51	45	240
4	39	40	57	62	46	244
5	43	34	44	50	89	260
Total	250	246	242	250	255	1243

The cell contents in Table 3.1.1 are interpreted as follows: the number of times that a fund ranked number 1 in a quarter and ranked number 1 in the subsequent quarter is 82; the number of times that a fund is ranked number 1 in a quarter and ranked number two in the subsequent quarter is 57. The total number of number 1 rankings (excluding the last quarter in the data set) is 255, while the total number of quarters with rankings used in the analysis is 1243. Our first set of summary output results (Tables 3.3.1 – 3.3.6 in Appendix 3) will refer to the totals for the rows. Inputs for these 5X5 contingency tables may be found in Tables 3.2.1 – 3.2.3 in Appendix 3.

Suspicions of persistence concentration develop when viewing the 5X5 contingency table in 3D below. Potential persistence concentration occurs when funds maintain their quarterly rankings from one quarter to the next quarter. Of particular interest are the repeat first rankers and last rankers where the highest concentration is shown.

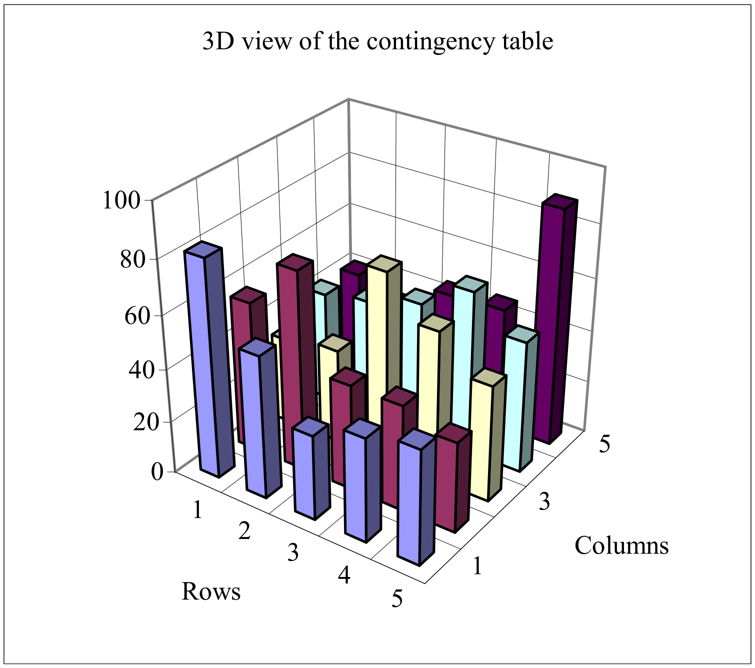

Figure 3.1: 3D diagram of the 5X5 contingency table

Table 3.1.2 below shows the proportions of the observed cell frequencies and, again, highlights the concentration of repeat rankings compared to changes in rankings. 32% of funds that ranked in the first quintile also ranked in the first quintile in the subsequent quarter and 34% of worst quintile performers remain so in the subsequent quarter. Our first set of results (Tables 3.3.1 – 3.3.6 in Appendix 3) will focus on repeat 1st and 5th quintile performers.

Table 3.1.2: The proportions of observed cell frequencies

Proportions / Row						
Quintiles	1	2	3	4	5	Total
1	32%	22%	13%	16%	16%	100%
2	22%	31%	15%	18%	14%	100%
3	13%	17%	30%	21%	19%	100%
4	16%	16%	23%	25%	19%	100%
5	17%	13%	17%	19%	34%	100%
Total	20%	20%	19%	20%	21%	100%

The degrees of freedom for the Chi-squared test of the analysis results using the 5X5 contingency tables, is (5 - 1) rows x (5 – 1) columns = 16. The Chi-squared critical value at the 5% level of significance with 16 degrees of freedom is 26.296.

We now extend the formulae used in the 2X2 contingency table calculations for expected frequencies, the Chi-squared statistic and the Yates continuity correction, by providing a generalised version of the formulae that may be used to for the associated 5X5 contingency table calculations.

Let the number of columns be *C* and the number of rows be *R*, then the total number of rankings in each C_i and R_i are

$$R_i = \sum_{j=1}^{C} n_{ij} \text{ and } C_j = \sum_{i=1}^{R} n_{ij} \text{ respectively.}$$

The expected frequencies are

$$E_{ij} = \left(\frac{\sum_{i=1}^{R} n_{ij} \sum_{j=1}^{C} n_{ij}}{\sum_{i=1}^{R} \sum_{j=1}^{C} n_{ij}} \right) \text{ and}$$

the Pearson Chi-squared statistic is

$$X^2 = \sum_{i=1}^{r} \sum_{j=1}^{c} \left(\frac{(O_{ij} - E_{ij})^2}{E_{ij}} \right).$$

The adjustment to the Pearson Chi-squared statistic using Yates's continuity correction is

$$X^2 = \sum_{i=1}^{r} \sum_{j=1}^{c} \left(\frac{(\left|O_{ij} - E_{ij}\right| - 0.5)^2}{E_{ij}} \right).$$

In Table 3.3.1 in Appendix 3 we show that the Chi-squared statisticfor the first analysis for excess returns is 115 and the p-value is less than 0.0001. The Chi-squared value is greater than the critical value at the 5% significance level and, therefore, we reject H0 and accept H1. Since the p-value is less than 1% we may also reject H0 at the 1% level of significance. We do not consider results using the Yates continuity correction in this analysis.

We first describe the contents of Tables 3.3.1 – 3.3.6 in Appendix 3. These tables are a summary of the output for part of our discussion which begins with test results for each of the six performance measures and then focuses on results for repeat 1st and 5th quintile rankers (or dwellers), which we will also refer to as repeat best and worst performers respectively.

The second area of our focus is on interpreting broader trends relating to equity performance persistence among the best and worst performers (Section 3.3.3). We use aggregate results for the different performance measures over the three different horizons and across the four different holding periods.

Finally, we examine repeat rankings and changes in rankings for each of the quintiles by counting events that suggest probabilities of outcomes (Section 3.3.4). A part of the analysis repeats an earlier focus on 1st and 5th quintile performers but considers the number of observations rather than the earlier consideration of average percentages.

3.3.2 Evidence for persistence

Table 3.3.1 shows the results when raw excess returns are used as a measure of performance for equity funds. For the 9-year period where the holding period is one quarter, the number of times that the funds starting with a ranking in the 1st quintile is 255 while 260 are 5th quintile rankers at the start. The number of 2nd and 4th quintile rankers at the start of the holding period is each 244 while the 3rd quintile rankers are 240 of the total 1243 ranked positions.

Similarly, the number of funds starting in the 1st quintile for the holding period of four quarters is 225 and the number of 5th quintile starters for the same holding period is 228. The number of 2nd and 4th quintile starters is each 215 while the number of 3rd quintile starters is 210 of the total of 1093 ranked positions.

The lists of quintile starters for each of the performance measures (alternatively, each of the Tables 3.3.1 – 3.3.6) and over the 9, 5 and 3-year horizons display a common pattern in that they all have the highest number for the 1st and 5th quintile starters, followed by those for the 2nd and 4th quintile starters and the lowest number for 3rd quintile starters.

One explanation for a best and worst quintile concentration of persistence may be that the spread of performances at each quarter is greater at the tails of the distributions than in the centre and hence the number of rankings in the best and worst quintiles is greater than those for the other (middle) quintiles. In this situation it is reasonable to expect that the worst of the 5th quintile performers would have greater difficulty in changing their ranking than the better 5th quintile performers (since they would be furthest away from the fourth quintile rank). The number of 1st quintile starters is less than the 5th quintile starters across most of the output which suggests that the performance spread among 5th quintile performers may be wider than that for 1st quintile performers. Moreover, since there is only one immediate quintile neighbour (4th quintile) to which 5th quintile dwellers could move, they have a lower probability of changing ranks than the funds ranked in, say, the 3rd quintile who have two potential neighbours to which they could move (2nd and 4th quintiles). The same reasoning as applied to 5th quintile rankers, applies to those ranked in the 1st quintile. A simple conclusion that may be drawn is that the degree of performance ranking persistence will depend on the spread of returns within a percentile ranking (for which this is likely to be greater for the lowest rankings) and the number of immediate adjacent ranking categories to the starting rank.

The Pearson statistics for all outputs (Tables 3.3.1 – 3.3.6 in Appendix 3) are greater than the relevant Chi-squared critical values and we reject the null hypothesis at the 5% level of significance. Considering the p-values we also reject the null hypothesis at the 1% level of significance, except for the Treynor ratio (see Table 3.3.5), for three subsequent quarters over the 3-year period. This is strong evidence supporting the existence of an association between quintile rankings in one quarter with those of the subsequent 1, 2, 3 and 4 quarters. It is also interesting that the observed Pearson statistics for the Jensen's alpha and the Omega statistic are substantially higher than those for the other performance measures. This suggests that the degree of performance persistence when using these two measures is greater than when using the other measures. Also, the Pearson statistic declines (on average) over an increasing number of subsequent quarters for performances based on raw excess returns, Jensen's alpha and the Omega statistic. For the Sharpe, Sortino and Treynor ratios, the Pearson statistic declines over the subsequent three quarters but increases after four quarters. We address these last two points in the next section where we focus on broader persistence trends for the best and worst performing funds.

The last section of the output for each period (Tables 3.3.1 – 3.3.6) shows the percentage of repeat performers for those funds ranked in the 1st and 5th quintiles. For the 9-year period, the number of quarters in which the funds' raw excess returns are ranked in the 1st quintile and ranked in one of the quintiles in the subsequent quarters is 255. However, 32% of funds ranked in the 1st quintile repeat that ranking in the subsequent quarter i.e. 32% x 255 = 82 repeat 1st quintile rankings over one quarter. This is the number that appears in the top left hand cell of the 5X5 contingency table for the analysis of raw excess returns over the 9-year period. Similarly, the percentage repeat 5th quintile rankings over one quarter is 34% and the bottom right hand cell in the contingency table is 89. If the

1st and 5th quintile rankings were homogeneously distributed in the subsequent quarter then it can be expected that the number of repeat performers for these rankings would each be 20% - less that the observed frequencies of 32% and 34% for the repeat 1st and 5th quintile rankers.

Examining the 1st and 5th quintile percentage repeat performers for all performance measures over the 9, 5 and 3-year periods, we observe that all are equal to or greater than 25% except for the 5th quintile for the Sortino ratio over 3 quarters in the 3-year period is 21%. This suggests that most of the inertia in performance persistence is from the 1st and 5th quintile ranks. More notable is the substantially higher percentages for the Jensen's alpha and the Omega statistic than for any of the other measures, suggesting that repeat best and worst performers are the great force behind the higher levels of persistence shown when these performance measures are used.

We may consider the number of times that the percentage of repeat 1st quintile performers is higher than the repeat 5th quintile performers as an indication of the relative strength of persistence between these two groups. When raw excess returns are used to measure performance, the number of times that the percentage repeat 1st quintile performers exceeds that for the repeat 5th quintile performers is one half (six of the twelve occasions over the three periods). In contrast, the percentage of repeat 1st quintile performers exceeds the percentage of repeat 5th quintile performers for the other measures over the three horizons except on three occasions. This suggests that, except for performance measurement based on raw excess returns, the best performing funds are more likely to remain the best than the worst performing funds are likely to remain the worst. This contrasts with our earlier suspicion that since the spread of performances among the worst funds may be the wider; these funds are less likely to show greater persistence than the best performers. However, the differences between the percentages of 1st and 5th quintile repeaters is, on average, lower for Jensen's alpha and the Omega measures than for the Sharpe, Sortino and Treynor measures. Therefore, while the three traditional measures may suggest that persistence inertia is higher for repeat best performers than for worst performers, the outputs for the Jensen's alpha and Omega measures are less convincing when distinguishing between the best and worst performers for the 9 and 5-year periods.

3.3.3 Broader persistence trends for best and worst performers

Considering averages of averages may result in tentative or spurious conclusions but has the advantage of enabling us to provide a simple form to the bigger picture, which we may later evaluate relative to more detailed findings.

Has the evidence and/or nature of persistence changed over the 9, 5 and 3-year periods? To answer this question, we aggregate percentages obtained from the results of the output for repeat best and worst performers and highlight three different persistence trends that emerge from these averages. We examine trends in the 1st and 5th quintile repeat performers over the three horizons.

Table 3.1.3 below shows the averages of the repeat 1st and 5th quintile performers over the four quarters. For example, the percentage repeat best performers ranked according to raw excess returns for the 9-year period (shown in the top portion of Table 3.3.1 in Appendix 3 as 1st quintile repeaters) are: 32% over one quarter, 27% over two quarters, 33% over three quarters and 32% over four quarters. The average of these four numbers is 31% as shown in Table 3.1.3 below.

From Table 3.1.3 below we note that the trend from the 9-year period to the 3-year period is one of increasing levels of repeat 1st and 5th quintile rankers for almost all performance measures. Also, the average percentage of repeat best performers is higher over the 9, 5 and 3-year periods than the corresponding figures for worst performers and increases at a higher rate over shorter horizons than that for the worst performers. This result supports our earlier suggestion that there is a greater level of persistence among the best performing funds than the worst and that this has increased in more recent periods.

Table 3.1.3: Persistence trends for best and worst funds over different periods and measures

	Raw excess returns	J-alpha	Sharpe	Sortino	Treynor	Omega
Best performers						
9-years	31%	69%	34%	33%	35%	67%
5-years	31%	72%	37%	37%	37%	71%
3-years	34%	79%	41%	42%	41%	81%
Worst performers						
9-years	31%	67%	30%	30%	31%	67%
5-years	34%	71%	31%	32%	33%	68%
3-years	32%	70%	32%	33%	35%	73%

Our second examination of trends begins with a consideration of the averages of repeat 1st and 5th quintile performers over the performance measures. For example, the percentage repeat best performers for the 9-year period and over one quarter for each of the six (rounded off) performance measures is 32%, 83%, 41%, 37%, 41% and 81% (see top portions of Tables 3.3.1 – 3.3.6) for which the average is 52% and is shown in Table 3.1.4 below.

An increasing trend in repeat best and worst performers (alternatively, a strengthening in levels of persistence) in more recent periods for each of the quarters is consistent with the trend observed in the table immediately above. Examining the average percentages across the cells in the table below, we observe a decreasing trend over an increasing number of quarters suggesting that persistence is highest in immediate subsequent quarters and fades over increasing subsequent quarters. Also, the fade in persistence over an increasing holding period is slower in the recent 3-year period than over the 9-year period, confirming our earlier observation of a strengthening in persistence in more recent periods.

Table 3.1.4: Persistence trends for best and worst funds over different periods and quarters

	Q1	Q2	Q3	Q4
Best performers				
9-years	52%	44%	42%	42%
5-years	54%	49%	45%	43%
3-years	56%	53%	50%	51%
Worst performers				
9-years	47%	43%	40%	39%
5-years	49%	47%	42%	41%
3-years	49%	50%	40%	44%

Our third examination of trends considers averages in 1st and 5th quintile performers over the 9, 5 and 3-year periods. For example, the percentage 1st quintile repeat performers over the 9, 5 and 3-year periods are 32%, 34% and 36% for which the average is 34% and is shown in Table 3.1.5 below.

The decline (in aggregate) in the percentage repeat 1st and 5th quintile performers across the quarters and for each of the measures, confirms our above observation of an overall fading of persistence over an increasing number of quarters. However, there is an increase in the aggregate percentages for the Sharpe, Sortino and Treynor ratios over four quarters. This increase is more prevalent for the worst performing funds. The percentages for the Sortino and Treynor ratios break trend at each of the subsequent quarters, reaching their high points after four quarters. The Sharpe ratio shows the least changes in levels of repeat best and worst performers across the quarters.

When we consider the levels of repeat best and worst performers according to the different performance measures, we notice that those for the Jensen's alpha and the Omega statistic remain substantially higher than the others at all stages. These results show that the Sharpe, Sortino and Treynor performance measures will downplay the intensity of persistence among repeat best and worst performers over 1, 2, 3 and 4 quarters when compared to that indicated by the Jensen's alpha and Omega measures.

Table 3.1.5: Persistence trends for best and worst funds over different ratios and quarters

	Q1	Q2	Q3	Q4
Best performers				
Raw excess returns	34%	31%	34%	29%
J-alpha	84%	75%	69%	65%
Sharpe	42%	36%	36%	36%
Sortino	39%	39%	33%	38%
Treynor	42%	36%	33%	41%
Omega	84%	75%	69%	63%
Worst performers				
Raw excess returns	34%	36%	33%	26%
J-alpha	81%	74%	66%	55%
Sharpe	32%	32%	27%	33%
Sortino	32%	32%	24%	38%
Treynor	31%	33%	28%	40%
Omega	80%	73%	67%	58%

The analysis above supports conclusions for the earlier persistence analysis that was based on 2X2 contingency tables. The results for Jensen's alpha and the Omega statistic are similar to each other while those for the Sharpe, Sortino and Treynor ratios are more similar to each other. Moreover, the results for Jensen's alpha and the Omega statistic are substantially more different to those for raw excess returns than is the case for the other three ratio measures.

3.3.4 Changes in rankings

Apart from the repeat best and worst performers, we are interested in examining the direction of change in funds' rankings in one period to rankings in subsequent periods. In contrast to the above discussion where we consider aggregated percentages, in this examination we count the number of times we observe an event and infer probabilities for those events. For each of the 9, 5 and 3-year periods, we discuss the events surrounding the 1st and 5th quintiles first (and confirm findings noted in the previous section) and then the events surrounding the 2nd, 3rd and 4th quintiles. We will continue to refer to the two groups of performance measures (Jensen's alpha and Omega versus Sharpe, Sortino and Treynor), highlighting differences between the two sets of results.

Tables 3.4.1 – 3.4.6 in Appendix 3 show the results for percentage repeats, changes and direction of changes in rankings for each of the six performance measures over the 9, 5 and 3-year periods. For example, Table 3.4.1 considers the 9-year period and shows that the number of 1st quintile repeats when using raw excess returns is 32.2% (as noted earlier in Table 3.1.2) while the percentage changes to an immediate neighbour (in this case only one neighbour, the 2nd quintile) is 22.4%. For all those funds starting the period as first quintile rankers, 54.5% (= 33.2% + 22.4%) either stayed in the 1st quintile or moved to its immediate neighbour.

Table 3.4.2, also, considers the 9-year period with the repeat quintile performers but shows this for the centre quintiles (2nd, 3rd and 4th quintiles) and indicates the direction of changes to immediate neighbouring quintiles. The table provides improved transparency for the movements in the centre quintiles to "neighbour" quintiles as indicated in Table 3.4.1. The top left hand section of the table shows the results when using raw excess returns for portfolio performance measurement. The percentage repeats for the 2nd quintile rankers is 30.7% (also shown in Table 3.4.1) while 15% of all funds that were ranked in the second quintile moved to the 3rd quintile and 22% moved to the 1st quintile after one quarter (see corresponding entries in Table 3.1.2 above). In this case we assume that second quintiles were more likely to move to an improved ranking than experience deterioration in ranking. The right hand side of Table 3.4.2 shows the number of times a change in rank favoured an improvement or deterioration across the six measures (first column), across Jensen's alpha and Omega together (the second column) and across raw excess returns, Sharpe ratio, Sortino ratio and Treynor ratio (third column). The number of times that a 2nd quintile starter was more likely to move to a better performing immediate quintile (across all measures), after one quarter, is 2 (raw excess returns and Sortino ratio) while the number of times that they were more likely to move to a worse performing immediate quintile is 4 (Jensen's alpha, Sharpe ratio, Treynor ratio and Omega statistic). The totals at the bottom of the three columns provide an overall picture for changes in rankings for funds that start as middle rankers and differences between two groups of performance measures.

We consider results over the four holding periods and across the various performance measures, for the 9-year period (Tables 3.4.1 and 3.4.2 in Appendix 3). Thereafter, we repeat this approach (to interpreting the 9-year results) for the 5-year and 3-year periods.

We first consider those funds that start in the 1st and 5th quintiles and their subsequent movements (Table 3.4.1).

- 19 of the 24 sets of results for the 9-year period show that the repeat best performers were higher than the repeat worst performers. This was noted in the previous section.
- The movements to the immediate neighbour are evenly divided between best and worst performers. On 12 occasions the percentage movement from best performers to the 2nd quintile

was higher than the worst performers moving to the 4th quintile. The number of deteriorations and improvements are similar for the best and worst performers.

- Combining the above (i.e. percentage of repeat rankings plus the percentage movement to the immediate neighbour), the best performing funds show a higher concentration in direction of movement within these two quintiles with 18 of the 24 sets of results higher than those for the worst performers.

We next consider those funds that have 2nd, 3rd and 4th quintile rankings at the start of the period and their subsequent movements (Table 3.4.2).

- From the 24 sets of results, 2nd quintile repeats are highest on seven occasions, 3rd quintile repeats are highest on nine occasions and 4th quintile repeats are highest on ten occasions.
- The subsequent movements to neighbouring quintiles are marginally different. The total number of movements to a worse quintile neighbour was 34 while that to a better quintile neighbour was 36 (see bottom right of Table 3.4.2 in "All Measures" column). However, the amounts attributable to two groups of the various measures are substantially different. The number of movements to a worse quintile indicated by the Jensen's alpha and Omega performance measures is 20, almost seven times the movements to a better quintile neighbour of 3. In contrast, the raw excess return and Sharpe, Sortino and Treynor measures of performance show movements to a worse quintile neighbour of 14, less than half that of the 33 for movements in the opposite direction. On two occasions the percentage movements up and down for each of the two groups of measures were equal.
- These results suggest that the percentage repeat rankings among the middle quintile funds increase according to the fund's ranking – 4th quintile rankers are more likely to remain so than 2nd quintile rankers are to remain as 2nd quintile rankers. Also, the probability of moving to a worse or better immediate quintile neighbour depends on what performance measure is used. The Jensen's alpha and Omega measures suggest movements from these middle quintiles are more likely to be to a worse quintile than a better one, while the remaining four of the six measures suggest the opposite.

We consider aggregate results over the four holding periods and across the various performance measures, for the 5-year period (Tables 3.4.3 and 3.4.4).

Consider funds that start in the 1st and 5th quintiles and their subsequent movements (Table 3.4.3).

- 19 of the 24 sets of results for the 5-year period show that the repeat best performers were higher than the worst repeat performers - the same as for 9-year period discussed above.

- The movements to the immediate neighbour are not evenly divided between best and worst performers (unlike for the 9-year period). On 8 occasions the percentage movement from best performers to the 2nd quintile were higher than the worst performers moving to the 4th quintile. The number of deteriorations is lower for the best performers than the improvements for the worst performers.
- Combining the above, the best performing funds show a slightly higher concentration in direction of movement within these two quintiles with 15 of the 24 sets of results higher than those for the worst performers.

Next, consider those funds that have 2nd, 3rd and 4th quintile rankings at the start of the period and their subsequent movements (Table 3.4.4).

- From the 24 sets of results, 2nd quintile repeats are highest on eight occasions, 3rd quintile repeats are highest on six occasions (reverse of that for 9-year) and 4th quintile repeats are highest on nine occasions (one count is for a "tie").
- The subsequent movements to neighbouring quintiles are substantially different (more different than that suggested by the 9-year results). The total number of movements to a better quintile neighbour was 42, while that to a worse quintile neighbour was two-thirds of that number at 27. However, the amounts attributable to the two groups of performance measures are substantially different from each other, but are the same as the result indicated for the 9-year period. The number of movements to a worse quintile indicated by the Jensen's alpha and Omega performance measures is 15, substantially higher than the movements to a better quintile neighbour of 9. In contrast, the raw excess return, Sharpe, Sortino and Treynor measures of performance show movements to a worse quintile neighbour of 12, almost a third of the 33 movements in the opposite direction.
- These results suggest that for the percentage repeat rankings among the middle quintile dwellers, the 4th quintile rankers are slightly more likely to remain so than 2nd quintile rankers are to remain as 2nd quintile rankers (although a weaker indication, it is similar to that for 9-year). Again, the probability of moving to a worse or better immediate quintile neighbour depends on what performance measure is used. Similar to that indicated by the results for the 9-year period, the Jensen's alpha and Omega measures suggest movements from these middle quintiles are more likely to be to a worse quintile than a higher one, while the remaining four of the six measures suggest the opposite. Across all subsequent quarters the Jensen's alpha and Omega measures suggest that the non-repeating 2nd and 3rd quintile rankers are more likely to move to a worse ranking than to a better one, while the non-repeating 4th quintile rankers are more likely to do the opposite. The measure for the remaining performance measures contrasts with those for the Jensen's and Omega measures for the 2nd and 3rd quintile non-repeaters but

strongly confirm that for the non-repeating 4th quintile rankers, providing some evidence that a coherent indication between the two measurement groups exists.

We consider aggregate results over the four holding periods and across the various performance measures, for the 3-year period (Tables 3.4.5 and 3.4.6).

Consider funds that start in the 1st and 5th quintiles and their subsequent movements (Table 3.4.5).

- 22 of the 24 sets of results for the 3-year period show that the repeat best performers were higher than the worst repeat performers – the same as for 5-year and 9-year and noted in the previous section.
- The movements to the immediate neighbour are different between best and worst performers. On 7 occasions the percentage movement from best performers to the 2nd quintile were higher than the worst performers moving to the 4th quintile. The number of deteriorations for best performers is lower than the improvements for worst performers.
- Combining the above i.e. considering the percentage of repeat rankings plus the percentage movement to the immediate neighbour, the best performing funds show a higher concentration in direction of movement within these two quintiles with 21 of the 24 sets of results higher than those for the worst performers (same as for 5-year and 9-year). Some evidence of a coherent indication between the two measurement groups exists. Across all subsequent quarters the Jensen's alpha and Omega measures suggest that the non-repeating 2nd and 3rd quintile rankers are more likely to move to a lower ranking than to a higher one, while the non-repeating 4th quintile rankers are more likely to do the opposite. The results for the remaining performance measures contrast with those of the Jensen's alpha and Omega measures for the 2nd and 3rd quintile non-repeaters, but strongly confirm that for the non-repeating 4th quintile rankers who are more likely to move to a better ranking than to a worse one.

Next, consider those funds that have 2nd, 3rd and 4th quintile rankings at the start of the period and their subsequent movements (Table 3.4.6).

- From the 24 sets of results, 2nd quintile repeats are highest on ten occasions, 3rd quintile repeats are highest on five occasions and 4th quintile repeats are highest on nine occasions (the reverse of that for 5-year).
- The subsequent movements to neighbouring quintiles are slightly different. The total number of movements to a worse quintile neighbour was 30 while that to a better quintile neighbour was 36. However, the amounts attributable to two groups of the various measures are substantially different as was indicated for the 5-year and 9-year results. The number of movements to a worse quintile indicated by the Jensen's alpha and Omega performance measures is 16, twice

the movements to a better quintile neighbour of 8. In contrast and as indicated for the 5-year and 9-year results, the raw excess return, Sharpe, Sortino and Treynor measures of performance show movements to a worse quintile neighbour of 14, half that of the 28 for movements in the opposite direction. On six occasions the percentage movements up and down were equal.

- These results contrast, albeit weakly, with the results indicated for the 5-year and 9-year periods. They suggest that, for the percentage repeat rankings among the middle quintile funds, the 4th quintile rankers are less likely to remain so than 2nd quintile rankers are to remain as 2nd quintile rankers while the 3rd quintile rankers are the least likely to repeat their ranking. Also, the probability of moving to a worse or better immediate quintile neighbour depends on what performance measure is used. The Jensen's alpha and Omega measures suggest movements from these middle quintiles are more likely to be to a worse quintile than a better one, while the remaining four of the six measures suggest the opposite.

3.3.5 Summary

- Equity performance persistence exists in quintile rankings over 1, 2, 3 and 4 quarters. The degree of persistence, indicated by the Chi-squared statistic, is greater for the Jensen's alpha and Omega statistic as measures of performance than for raw excess returns and the Sharpe, Sortino and Treynor ratios.

- Most of the inertia in overall performance persistence results from repeat 1st and 5th quintile performers, particularly in the cases where Jensen's alpha and the Omega statistic are used.

- Best performers are more likely to repeat their quintile ranking than are worst performers. This likelihood has increased in more recent periods.

- Persistence among best and worst performers is higher in immediate subsequent quarters, fades over increasing subsequent quarters and is largely independent of the performance measure used. The fade over an increasing numbers of quarters has slowed in recent periods.

- Worst performers are more likely to move to a better immediate ranking than best performers are likely to move to a worse immediate ranking.

- The best performers are more likely to remain within the 1st and 2nd quintiles than the worst performers are likely to remain in the 5th and 4th quintile.

- Aggregate results for 2nd, 3rd and 4th repeat rankings suggest that 4th quintile performers are more likely to repeat their ranking followed by 2nd and 3rd quintile performers respectively. The detailed results are less revealing than the aggregate results.

- The likely direction of changes in rankings for 2nd, 3rd and 4th quintile performers differs according to the performance measures used. Rankings based on Jensen's alpha and the Omega statistic are more likely to deteriorate, while those based on raw excess returns and the Sharpe, Sortino and Treynor ratios are more likely to deteriorate. Some evidence of complementary results among the two groups of performance measures is that 4th quintile performers are more likely to improve than deteriorate over the 5-year and 3-year periods.

- Between 85% and 90% of 2nd, 3rd and 4th quintile rankers whose performance is based on Jensen's alpha or Omega repeat their ranking or move to an immediate quintile. By comparison, the other performance measures indicate a corresponding result of an average between 65% and 70%.

3.4 Conclusion

Equity performance persistence exists with the highest concentration occurring in the best and worst performing funds. The persistence exists over four quarters, but is strongest over one quarter, weakening over subsequent quarters.

Best performing equity funds are most likely to remain the best while the worst performers are more likely to improve than the best are to deteriorate. Equity funds ranked in the centre are more likely to see an improvement among their poorer rankings than their better rankings. However, the equity performance persistence results are dependent on the performance measure used.

Rankings based on the Jensen's alpha and Omega performance measures indicate substantially higher levels of equity performance persistence than that indicated by raw excess returns and Sharpe, Sortino and Treynor measures.

3.5 References

Firer, C, Beale, J P, Edwards, M D, Hendrie, J N and Scheppening, D C (2001): "The Persistence of Performance of South Africa Unit Trusts", *South African Journal of Business Management*, 32(2), 1-8.

3.6 Appendix 3

3.6.1 Figures and tables

Table 3.2.1: Inputs: 9-year period - 5X5 contingency tables

	Raw Excess Returns					Jensen's alpha				
	1st Quintile	2nd Quintile	3rd Quintile	4th Quintile	5th Quintile	1st Quintile	2nd Quintile	3rd Quintile	4th Quintile	5th Quintile
One quarter holding period										
1st Quintile	82	57	33	42	41	149	28	3	0	0
2nd Quintile	54	75	36	45	34	26	105	39	3	1
3rd Quintile	32	40	72	51	45	4	33	92	36	2
4th Quintile	39	40	57	62	46	1	5	34	98	35
5th Quintile	43	34	44	50	89	1	1	3	35	147
Two quarters holding period										
1st Quintile	66	56	37	41	45	124	37	8	2	0
2nd Quintile	55	48	45	48	38	34	77	40	12	2
3rd Quintile	39	47	49	49	45	11	33	74	34	7
4th Quintile	44	46	55	53	37	2	10	36	80	36
5th Quintile	35	42	45	47	79	1	6	8	38	125
Three quarters holding period										
1st Quintile	78	55	23	35	44	104	43	8	7	0
2nd Quintile	45	52	43	47	37	36	63	43	7	7
3rd Quintile	38	46	55	52	30	14	29	63	37	8
4th Quintile	36	46	49	53	40	8	13	33	65	36
5th Quintile	34	34	52	42	76	2	6	12	42	107
Four quarters holding period										
1st Quintile	72	41	33	41	38	88	44	11	9	1
2nd Quintile	50	40	49	42	34	32	55	36	16	8
3rd Quintile	34	46	60	36	34	20	22	56	31	13
4th Quintile	33	47	38	46	51	12	14	32	52	37
5th Quintile	31	50	36	54	57	3	10	17	43	87

	Sharpe ratio					Sortino ratio				
	1st Quintile	2nd Quintile	3rd Quintile	4th Quintile	5th Quintile	1st Quintile	2nd Quintile	3rd Quintile	4th Quintile	5th Quintile
One quarter holding period										
1st Quintile	73	36	31	12	28	67	30	36	16	31
2nd Quintile	37	37	38	36	26	39	47	32	26	30
3rd Quintile	29	37	31	39	31	21	34	41	45	26
4th Quintile	19	30	42	43	39	26	30	39	41	37
5th Quintile	23	36	26	44	58	27	34	24	43	59
Two quarters holding period										
1st Quintile	55	38	24	20	34	51	33	23	24	40
2nd Quintile	38	28	37	32	30	32	37	31	29	36
3rd Quintile	34	44	26	33	21	35	31	35	45	12
4th Quintile	17	26	45	43	34	23	33	41	33	35
5th Quintile	26	34	29	38	51	31	32	36	31	48
Three quarters holding period										
1st Quintile	50	37	20	22	33	49	36	19	24	34
2nd Quintile	34	26	31	34	31	36	34	25	30	31
3rd Quintile	31	35	34	28	23	28	33	40	27	23
4th Quintile	18	34	40	37	26	28	30	35	32	30
5th Quintile	28	29	29	36	47	22	24	38	42	43
Four quarters holding period										
1st Quintile	52	27	27	22	25	52	27	32	19	23
2nd Quintile	28	42	25	33	19	26	43	22	34	22
3rd Quintile	27	25	35	31	25	26	29	34	33	21
4th Quintile	14	38	29	33	32	23	28	36	26	33
5th Quintile	30	21	30	28	51	25	23	25	32	55

	Treynor ratio					Omega				
`	1st Quintile	2nd Quintile	3rd Quintile	4th Quintile	5th Quintile	1st Quintile	2nd Quintile	3rd Quintile	4th Quintile	5th Quintile
One quarter holding period										
1st Quintile	73	34	28	13	32	199	35	7	4	1
2nd Quintile	33	34	42	43	22	29	136	62	8	2
3rd Quintile	20	47	31	39	30	5	47	120	54	4
4th Quintile	22	35	38	38	41	4	15	40	130	47
5th Quintile	33	27	28	40	58	1	6	6	46	193
Two quarters holding period										
1st Quintile	56	32	24	25	34	166	50	14	6	0
2nd Quintile	39	33	32	29	32	45	94	60	26	2
3rd Quintile	24	44	31	37	22	6	59	92	53	11
4th Quintile	26	30	39	37	33	6	20	53	99	48
5th Quintile	26	32	32	37	51	0	11	10	52	169
Three quarters holding period										
1st Quintile	50	33	23	18	38	141	57	23	5	0
2nd Quintile	32	36	25	33	30	42	86	54	28	7
3rd Quintile	25	35	41	30	20	16	47	82	51	16
4th Quintile	27	33	38	31	26	10	24	47	91	44
5th Quintile	28	26	22	44	49	1	10	16	56	149
Four quarters holding period										
1st Quintile	57	23	26	22	25	119	65	21	10	1
2nd Quintile	32	40	28	27	20	37	68	61	33	8
3rd Quintile	20	31	29	38	25	20	47	62	52	21
4th Quintile	18	37	31	30	31	16	25	47	67	52
5th Quintile	25	25	23	31	55	3	11	23	62	123

Table 3.2.2: Inputs: 5-year period - 5X5 contingency tables

	Raw Excess Returns					Jensen's alpha				
	1st Quintile	2nd Quintile	3rd Quintile	4th Quintile	5th Quintile	1st Quintile	2nd Quintile	3rd Quintile	4th Quintile	5th Quintile
One quarter holding period										
1st Quintile	61	39	24	26	27	106	19	1	0	0
2nd Quintile	42	57	20	28	22	19	70	32	1	1
3rd Quintile	22	25	55	37	28	0	26	63	28	2
4th Quintile	26	28	40	46	29	0	5	25	72	20
5th Quintile	25	22	29	35	68	1	0	2	21	107
Two quarters holding period										
1st Quintile	53	42	22	24	26	88	23	5	1	0
2nd Quintile	46	32	28	33	20	23	51	31	8	1
3rd Quintile	27	35	39	29	26	5	22	51	27	6
4th Quintile	21	27	42	40	30	0	10	26	58	19
5th Quintile	18	26	28	33	62	0	4	4	22	92
Three quarters holding period										
1st Quintile	50	36	12	27	32	74	26	4	4	0
2nd Quintile	38	33	27	30	21	23	40	33	5	4
3rd Quintile	24	31	40	33	20	6	18	40	31	8
4th Quintile	22	30	37	35	25	4	11	26	45	18
5th Quintile	21	26	34	23	53	1	5	8	23	76
Four quarters holding period										
1st Quintile	41	27	25	26	28	61	28	5	4	1
2nd Quintile	45	27	22	27	19	21	29	28	12	6
3rd Quintile	26	28	38	24	21	8	10	37	28	11
4th Quintile	19	32	27	33	29	6	13	24	37	16
5th Quintile	18	32	27	31	39	2	10	11	20	61

	Sharpe ratio					Sortino ratio				
	1st Quintile	2nd Quintile	3rd Quintile	4th Quintile	5th Quintile	1st Quintile	2nd Quintile	3rd Quintile	4th Quintile	5th Quintile
One quarter holding period										
1st Quintile	53	24	20	10	19	50	23	22	12	19
2nd Quintile	27	26	27	23	20	25	36	22	16	24
3rd Quintile	19	26	25	27	22	18	20	31	31	19
4th Quintile	13	23	30	31	25	16	24	29	29	24
5th Quintile	15	25	18	31	42	17	21	19	32	42
Two quarters holding period										
1st Quintile	43	25	15	9	25	46	21	14	13	23
2nd Quintile	26	21	29	22	16	23	32	21	17	21
3rd Quintile	22	32	20	23	13	18	23	30	32	7
4th Quintile	6	19	32	33	24	12	20	30	26	26
5th Quintile	19	21	16	27	39	18	20	21	22	41
Three quarters holding period										
1st Quintile	39	23	11	13	22	35	21	11	16	25
2nd Quintile	23	14	24	24	20	26	24	17	18	20
3rd Quintile	16	28	24	18	17	16	24	27	21	15
4th Quintile	13	25	28	23	15	19	19	27	21	18
5th Quintile	18	18	17	27	33	14	19	24	27	29
Four quarters holding period										
1st Quintile	34	18	21	10	16	36	16	22	9	16
2nd Quintile	22	27	18	15	14	19	29	13	21	14
3rd Quintile	19	17	22	22	15	16	20	24	23	12
4th Quintile	7	26	19	24	19	14	20	24	19	18
5th Quintile	18	11	18	24	33	15	15	16	20	38

	Treynor ratio					Omega				
	1st Quintile	2nd Quintile	3rd Quintile	4th Quintile	5th Quintile	1st Quintile	2nd Quintile	3rd Quintile	4th Quintile	5th Quintile
One quarter holding period										
1st Quintile	53	22	20	11	20	143	21	5	3	1
2nd Quintile	21	24	31	29	18	22	97	42	4	1
3rd Quintile	14	31	24	26	24	4	34	83	41	1
4th Quintile	15	28	28	26	26	3	12	32	90	28
5th Quintile	24	20	16	30	40	1	4	3	30	138
Two quarters holding period										
1st Quintile	42	19	14	17	25	120	30	8	5	0
2nd Quintile	25	28	25	20	16	34	66	39	17	0
3rd Quintile	16	32	26	23	13	5	43	63	35	8
4th Quintile	12	20	29	29	24	4	16	40	68	27
5th Quintile	21	20	16	25	40	0	6	8	35	117
Three quarters holding period										
1st Quintile	35	22	14	9	28	102	33	14	4	0
2nd Quintile	20	23	16	28	18	31	62	33	17	3
3rd Quintile	15	27	30	19	12	13	30	55	36	11
4th Quintile	16	24	26	22	16	7	20	35	62	21
5th Quintile	22	15	14	28	34	1	7	13	32	103
Four quarters holding period										
1st Quintile	38	18	17	13	13	87	38	12	5	1
2nd Quintile	25	27	16	13	15	28	52	32	19	5
3rd Quintile	14	16	22	28	15	16	23	45	35	16
4th Quintile	9	25	23	21	18	10	19	35	50	22
5th Quintile	13	17	12	22	39	2	10	17	34	83

Table 3.2.3: Inputs: 3-year period - 5X5 contingency tables

	Raw Excess Returns					Jensen's alpha				
	1st Quintile	2nd Quintile	3rd Quintile	4th Quintile	5th Quintile	1st Quintile	2nd Quintile	3rd Quintile	4th Quintile	5th Quintile
One quarter holding period										
1st Quintile	39	22	17	14	17	75	13	0	0	0
2nd Quintile	25	32	14	19	13	13	50	21	1	1
3rd Quintile	12	16	29	22	24	0	18	45	19	1
4th Quintile	17	20	20	28	18	0	3	18	50	14
5th Quintile	16	15	24	21	33	0	0	2	14	75
One quarter holding period										
1st Quintile	35	27	14	11	12	62	15	2	0	0
2nd Quintile	25	22	22	16	8	16	37	19	4	1
3rd Quintile	18	21	19	14	20	2	15	35	20	3
4th Quintile	11	14	23	28	18	0	6	20	37	13
5th Quintile	9	11	17	23	37	0	2	2	16	62
One quarter holding period										
1st Quintile	33	21	9	12	14	53	17	0	0	0
2nd Quintile	23	21	13	15	11	15	28	19	4	2
3rd Quintile	11	13	23	21	16	4	9	29	19	6
4th Quintile	10	17	21	21	14	1	9	16	30	11
5th Quintile	12	14	20	13	28	0	2	7	15	49
One quarter holding period										
1st Quintile	21	17	17	12	12	46	14	1	0	0
2nd Quintile	27	18	11	12	6	13	20	14	9	3
3rd Quintile	15	13	20	10	15	4	6	26	12	10
4th Quintile	7	14	12	23	18	3	8	15	24	9
5th Quintile	10	15	16	16	20	0	7	8	15	34

	Sharpe ratio					Sortino ratio				
	1st Quintile	2nd Quintile	3rd Quintile	4th Quintile	5th Quintile	1st Quintile	2nd Quintile	3rd Quintile	4th Quintile	5th Quintile
One quarter holding period										
1st Quintile	38	18	14	4	14	36	19	15	7	11
2nd Quintile	19	16	18	17	16	17	23	17	11	18
3rd Quintile	17	13	19	23	11	16	13	20	24	10
4th Quintile	7	18	20	21	19	10	16	20	20	19
5th Quintile	8	21	14	19	29	9	15	15	22	30
One quarter holding period										
1st Quintile	31	18	11	3	16	37	13	8	6	15
2nd Quintile	20	12	22	13	10	15	23	17	9	13
3rd Quintile	14	25	12	14	9	11	17	21	19	6
4th Quintile	4	13	22	24	14	8	15	18	21	15
5th Quintile	11	11	10	20	30	10	10	14	18	30
One quarter holding period										
1st Quintile	28	14	8	6	14	25	13	5	9	18
2nd Quintile	15	11	13	15	14	16	21	13	7	11
3rd Quintile	11	16	18	12	10	13	14	17	11	12
4th Quintile	8	15	16	15	13	11	9	20	15	12
5th Quintile	12	13	13	17	18	8	12	14	24	15
One quarter holding period										
1st Quintile	25	13	12	4	7	27	11	11	6	6
2nd Quintile	15	19	11	6	8	12	21	9	11	6
3rd Quintile	12	13	15	13	6	10	13	16	13	7
4th Quintile	4	11	13	17	13	8	10	16	13	11
5th Quintile	11	4	10	16	23	10	6	8	13	27

	Treynor ratio					Omega				
	1st Quintile	2nd Quintile	3rd Quintile	4th Quintile	5th Quintile	1st Quintile	2nd Quintile	3rd Quintile	4th Quintile	5th Quintile
One quarter holding period										
1st Quintile	38	15	13	6	16	95	12	0	0	0
2nd Quintile	12	14	23	23	14	10	68	22	2	0
3rd Quintile	12	20	19	20	12	1	17	57	24	1
4th Quintile	10	23	17	16	20	1	5	19	62	14
5th Quintile	17	14	12	20	27	0	0	3	14	90
One quarter holding period										
1st Quintile	30	13	10	10	16	80	16	1	0	0
2nd Quintile	15	20	20	11	11	16	49	19	8	0
3rd Quintile	11	24	15	16	8	1	20	42	24	4
4th Quintile	11	12	20	19	15	0	7	26	45	13
5th Quintile	13	10	10	19	30	0	1	5	16	75
One quarter holding period										
1st Quintile	25	12	9	5	19	68	18	1	0	0
2nd Quintile	11	18	12	14	13	17	35	19	9	2
3rd Quintile	10	14	20	15	8	2	17	36	21	6
4th Quintile	12	15	13	15	12	0	11	21	38	11
5th Quintile	15	11	12	17	18	0	3	6	16	62
One quarter holding period										
1st Quintile	28	11	10	7	5	57	18	2	0	0
2nd Quintile	19	18	10	6	6	14	26	16	12	4
3rd Quintile	6	13	17	15	8	4	14	27	17	10
4th Quintile	7	13	12	15	12	1	12	19	30	10
5th Quintile	6	7	7	13	30	0	5	10	15	47

Table 3.3.1: 5X5 contingency tables - Raw excess return

9 years	1 Quarter	2 Quarters	3 Quarters	4 Quarters
1st Quintile starters	255	245	235	225
2nd Quintile starters	244	234	224	215
3rd Quintile starters	240	229	221	210
4th Quintile starters	244	235	224	215
5th Quintile starters	260	248	238	228
Total	1243	1191	1142	1093
Pearson Statistic	115	43	79	54
p-value for Pearson	< 0.0001	0.0002	< 0.0001	< 0.0001
1st Quintile repeaters	32%	27%	33%	32%
5th Quintile repeaters	34%	32%	32%	25%
5 years	1 Quarter	2 Quarters	3 Quarters	4 Quarters
1st Quintile starters	177	167	157	147
2nd Quintile starters	169	159	149	140
3rd Quintile starters	167	156	148	137
4th Quintile starters	169	160	149	140
5th Quintile starters	179	167	157	147
Total	861	809	760	711
Pearson Statistic	124	80	65	38
p-value for Pearson	< 0.0001	< 0.0001	< 0.0001	0.0016
1st Quintile repeaters	34%	32%	32%	28%
5th Quintile repeaters	38%	37%	34%	27%
3 years	1 Quarter	2 Quarters	3 Quarters	4 Quarters
1st Quintile starters	109	99	89	79
2nd Quintile starters	103	93	83	74
3rd Quintile starters	103	92	84	73
4th Quintile starters	103	94	83	74
5th Quintile starters	109	97	87	77
Total	527	475	426	377
Pearson Statistic	52	70	48	37
p-value for Pearson	< 0.0001	< 0.0001	< 0.0001	0.0020
1st Quintile repeaters	36%	35%	37%	27%
5th Quintile repeaters	30%	38%	32%	26%

Table 3.3.2: 5X5 contingency tables - Jensen's alpha

9 years	1 Quarter	2 Quarters	3 Quarters	4 Quarters
1st Quintile starters	180	171	162	153
2nd Quintile starters	174	165	156	147
3rd Quintile starters	167	159	151	142
4th Quintile starters	173	164	155	147
5th Quintile starters	187	178	169	160
Total	881	837	793	749
Pearson Statistic	1403	921	659	439
p-value for Pearson	< 0.0001	< 0.0001	< 0.0001	< 0.0001
1st Quintile repeaters	83%	73%	64%	58%
5th Quintile repeaters	79%	70%	63%	54%
5 years	1 Quarter	2 Quarters	3 Quarters	4 Quarters
1st Quintile starters	126	117	108	99
2nd Quintile starters	123	114	105	96
3rd Quintile starters	119	111	103	94
4th Quintile starters	122	113	104	96
5th Quintile starters	131	122	113	104
Total	621	577	533	489
Pearson Statistic	1021	696	486	321
p-value for Pearson	< 0.0001	< 0.0001	< 0.0001	< 0.0001
1st Quintile repeaters	84%	75%	69%	62%
5th Quintile repeaters	82%	75%	67%	59%
3 years	1 Quarter	2 Quarters	3 Quarters	4 Quarters
1st Quintile starters	88	79	70	61
2nd Quintile starters	86	77	68	59
3rd Quintile starters	83	75	67	58
4th Quintile starters	85	76	67	59
5th Quintile starters	91	82	73	64
Total	433	389	345	301
Pearson Statistic	730	498	358	234
p-value for Pearson	< 0.0001	< 0.0001	< 0.0001	< 0.0001
1st Quintile repeaters	85%	78%	76%	75%
5th Quintile repeaters	82%	76%	67%	53%

Table 3.3.3: 5X5 contingency tables - Sharpe ratio

9 years	1 Quarter	2 Quarters	3 Quarters	4 Quarters
1st Quintile starters	180	171	162	153
2nd Quintile starters	174	165	156	147
3rd Quintile starters	167	158	151	143
4th Quintile starters	173	165	155	146
5th Quintile starters	187	178	169	160
Total	881	837	793	749
Pearson Statistic	93	61	41	58
p-value for Pearson	< 0.0001	< 0.0001	0.0007	< 0.0001
1st Quintile repeaters	41%	32%	31%	34%
5th Quintile repeaters	31%	29%	28%	32%
5 years	1 Quarter	2 Quarters	3 Quarters	4 Quarters
1st Quintile starters	126	117	108	99
2nd Quintile starters	123	114	105	96
3rd Quintile starters	119	110	103	95
4th Quintile starters	122	114	104	95
5th Quintile starters	131	122	113	104
Total	621	577	533	489
Pearson Statistic	71	76	48	48
p-value for Pearson	< 0.0001	< 0.0001	< 0.0001	< 0.0001
1st Quintile repeaters	42%	37%	36%	34%
5th Quintile repeaters	32%	32%	29%	32%
3 years	1 Quarter	2 Quarters	3 Quarters	4 Quarters
1st Quintile starters	88	79	70	61
2nd Quintile starters	86	77	68	59
3rd Quintile starters	83	74	67	59
4th Quintile starters	85	77	67	58
5th Quintile starters	91	82	73	64
Total	433	389	345	301
Pearson Statistic	62	78	29	57
p-value for Pearson	< 0.0001	< 0.0001	0.0226	< 0.0001
1st Quintile repeaters	43%	39%	40%	41%
5th Quintile repeaters	32%	37%	25%	36%

Table 3.3.4: 5X5 contingency tables - Sortino ratio

9 years	1 Quarter	2 Quarters	3 Quarters	4 Quarters
1st Quintile starters	180	171	162	153
2nd Quintile starters	174	165	156	147
3rd Quintile starters	167	158	151	143
4th Quintile starters	173	165	155	146
5th Quintile starters	187	178	169	160
Total	881	837	793	749
Pearson Statistic	84	46	37	62
p-value for Pearson	< 0.0001	< 0.0001	0.0021	< 0.0001
1st Quintile repeaters	37%	30%	30%	34%
5th Quintile repeaters	32%	27%	25%	34%
5 years	1 Quarter	2 Quarters	3 Quarters	4 Quarters
1st Quintile starters	126	117	108	99
2nd Quintile starters	123	114	105	96
3rd Quintile starters	119	110	103	95
4th Quintile starters	122	114	104	95
5th Quintile starters	131	122	113	104
Total	621	577	533	489
Pearson Statistic	71	77	32	55
p-value for Pearson	< 0.0001	< 0.0001	0.0098	< 0.0001
1st Quintile repeaters	40%	39%	32%	36%
5th Quintile repeaters	32%	34%	26%	37%
3 years	1 Quarter	2 Quarters	3 Quarters	4 Quarters
1st Quintile starters	88	79	70	61
2nd Quintile starters	86	77	68	59
3rd Quintile starters	83	74	67	59
4th Quintile starters	85	77	67	58
5th Quintile starters	91	82	73	64
Total	433	389	345	301
Pearson Statistic	58	78	42	62
p-value for Pearson	< 0.0001	< 0.0001	0.0004	< 0.0001
1st Quintile repeaters	41%	47%	36%	44%
5th Quintile repeaters	33%	37%	21%	42%

Table 3.3.5: 5X5 contingency tables - Treynor ratio

9 years	1 Quarter	2 Quarters	3 Quarters	4 Quarters
1st Quintile starters	180	171	162	153
2nd Quintile starters	174	165	156	147
3rd Quintile starters	167	158	151	143
4th Quintile starters	174	165	155	147
5th Quintile starters	186	178	169	159
Total	881	837	793	749
Pearson Statistic	97	44	50	68
p-value for Pearson	< 0.0001	0.0002	< 0.0001	< 0.0001
1st Quintile repeaters	41%	33%	31%	37%
5th Quintile repeaters	31%	29%	29%	35%
5 years	1 Quarter	2 Quarters	3 Quarters	4 Quarters
1st Quintile starters	126	117	108	99
2nd Quintile starters	123	114	105	96
3rd Quintile starters	119	110	103	95
4th Quintile starters	123	114	104	96
5th Quintile starters	130	122	113	103
Total	621	577	533	489
Pearson Statistic	70	58	53	68
p-value for Pearson	< 0.0001	< 0.0001	< 0.0001	< 0.0001
1st Quintile repeaters	42%	36%	32%	38%
5th Quintile repeaters	31%	33%	30%	38%
3 years	1 Quarter	2 Quarters	3 Quarters	4 Quarters
1st Quintile starters	88	79	70	61
2nd Quintile starters	86	77	68	59
3rd Quintile starters	83	74	67	59
4th Quintile starters	86	77	67	59
5th Quintile starters	90	82	73	63
Total	433	389	345	301
Pearson Statistic	56	53	30	80
p-value for Pearson	< 0.0001	< 0.0001	0.0205	< 0.0001
1st Quintile repeaters	43%	38%	36%	46%
5th Quintile repeaters	30%	37%	25%	48%

Table 3.3.6: 5X5 contingency tables – Omega

9 years	1 Quarter	2 Quarters	3 Quarters	4 Quarters
1st Quintile starters	246	236	226	216
2nd Quintile starters	237	227	217	207
3rd Quintile starters	230	221	212	202
4th Quintile starters	236	226	216	207
5th Quintile starters	252	242	232	222
Total	1201	1152	1103	1054
Pearson Statistic	1767	1161	874	589
p-value for Pearson	< 0.0001	< 0.0001	< 0.0001	< 0.0001
1st Quintile repeaters	81%	70%	62%	55%
5th Quintile repeaters	77%	70%	64%	55%
5 years	1 Quarter	2 Quarters	3 Quarters	4 Quarters
1st Quintile starters	173	163	153	143
2nd Quintile starters	166	156	146	136
3rd Quintile starters	163	154	145	135
4th Quintile starters	165	155	145	136
5th Quintile starters	176	166	156	146
Total	843	794	745	696
Pearson Statistic	1277	833	633	431
p-value for Pearson	< 0.0001	< 0.0001	< 0.0001	< 0.0001
1st Quintile repeaters	83%	74%	67%	61%
5th Quintile repeaters	78%	70%	66%	57%
3 years	1 Quarter	2 Quarters	3 Quarters	4 Quarters
1st Quintile starters	107	97	87	77
2nd Quintile starters	102	92	82	72
3rd Quintile starters	100	91	82	72
4th Quintile starters	101	91	81	72
5th Quintile starters	107	97	87	77
Total	517	468	419	370
Pearson Statistic	971	655	479	314
p-value for Pearson	< 0.0001	< 0.0001	< 0.0001	< 0.0001
1st Quintile repeaters	89%	82%	78%	74%
5th Quintile repeaters	84%	77%	71%	61%

Table 3.4.1: 9-years - Repeats and changes for all quintiles

1 Quarter

	Raw Excess Returns			Jensen's alpha			Sharpe ratio			Sortino ratio			Treynor ratio			Omega		
	Same	neighbour	Totals	Same	neighbour	Totals	Same	neighbour	Totals	Same	neighbour	Totals	Same	neighbour	Totals	Same	neighbour	Totals
Q1	32.2%	22.4%	54.5%	82.8%	15.6%	98.3%	40.6%	20.0%	60.6%	37.2%	16.7%	53.9%	40.6%	18.9%	59.4%	80.9%	14.2%	95.1%
Q2	30.7%	36.9%	67.6%	60.3%	37.4%	97.7%	21.3%	43.1%	64.4%	27.0%	40.8%	67.8%	19.5%	43.1%	62.6%	57.4%	38.4%	95.8%
Q3	30.0%	37.9%	67.9%	55.1%	41.3%	96.4%	18.6%	45.5%	64.1%	24.6%	47.3%	71.9%	18.6%	51.5%	70.1%	52.2%	43.9%	96.1%
Q4	25.4%	42.2%	67.6%	56.6%	39.9%	96.5%	24.9%	46.8%	71.7%	23.7%	43.9%	67.6%	21.8%	45.4%	67.2%	55.1%	36.9%	91.9%
Q5	34.2%	19.2%	53.5%	78.6%	18.7%	97.3%	31.0%	23.5%	54.5%	31.6%	23.0%	54.5%	31.2%	21.5%	52.7%	76.6%	18.3%	94.8%

2 Quarters

	Raw Excess Returns			Jensen's alpha			Sharpe ratio			Sortino ratio			Treynor ratio			Omega		
	Same	neighbour	Totals	Same	neighbour	Totals	Same	neighbour	Totals	Same	neighbour	Totals	Same	neighbour	Totals	Same	neighbour	Totals
Q1	26.9%	22.9%	49.8%	72.5%	21.6%	94.2%	32.2%	22.2%	54.4%	29.8%	19.3%	49.1%	32.7%	18.7%	51.5%	70.3%	21.2%	91.5%
Q2	20.5%	42.7%	63.2%	46.7%	44.8%	91.5%	17.0%	45.5%	62.4%	22.4%	38.2%	60.6%	20.0%	43.0%	63.0%	41.4%	46.3%	87.7%
Q3	21.4%	41.9%	63.3%	46.5%	42.1%	88.7%	16.5%	48.7%	65.2%	22.2%	48.1%	70.3%	19.6%	51.3%	70.9%	41.6%	50.7%	92.3%
Q4	22.6%	39.1%	61.7%	48.8%	43.9%	92.7%	26.1%	47.9%	73.9%	20.0%	46.1%	66.1%	22.4%	43.6%	66.1%	43.8%	44.7%	88.5%
Q5	31.9%	19.0%	50.8%	70.2%	21.3%	91.6%	28.7%	21.3%	50.0%	27.0%	17.4%	44.4%	28.7%	20.8%	49.4%	69.8%	21.5%	91.3%

3 Quarters

	Raw Excess Returns			Jensen's alpha			Sharpe ratio			Sortino ratio			Treynor ratio			Omega		
	Same	neighbour	Totals	Same	neighbour	Totals	Same	neighbour	Totals	Same	neighbour	Totals	Same	neighbour	Totals	Same	neighbour	Totals
Q1	33.2%	23.4%	56.6%	64.2%	26.5%	90.7%	30.9%	22.8%	53.7%	30.2%	22.2%	52.5%	30.9%	20.4%	51.2%	62.4%	25.2%	87.6%
Q2	23.2%	39.3%	62.5%	40.4%	50.6%	91.0%	16.7%	41.7%	58.3%	21.8%	39.1%	60.9%	23.1%	36.5%	59.6%	39.6%	44.2%	83.9%
Q3	24.9%	44.3%	69.2%	41.7%	43.7%	85.4%	22.5%	41.7%	64.2%	26.5%	39.7%	66.2%	27.2%	43.0%	70.2%	38.7%	46.2%	84.9%
Q4	23.7%	39.7%	63.4%	41.9%	44.5%	86.5%	23.9%	42.6%	66.5%	20.6%	41.9%	62.6%	20.0%	41.3%	61.3%	42.1%	42.1%	84.3%
Q5	31.9%	17.6%	49.6%	63.3%	24.9%	88.2%	27.8%	21.3%	49.1%	25.4%	24.9%	50.3%	29.0%	26.0%	55.0%	64.2%	24.1%	88.4%

4 Quarters

	Raw Excess Returns			Jensen's alpha			Sharpe ratio			Sortino ratio			Treynor ratio			Omega		
	Same	neighbour	Totals	Same	neighbour	Totals	Same	neighbour	Totals	Same	neighbour	Totals	Same	neighbour	Totals	Same	neighbour	Totals
Q1	32.0%	18.2%	50.2%	57.5%	28.8%	86.3%	34.0%	17.6%	51.6%	34.0%	17.6%	51.6%	37.3%	15.0%	52.3%	55.1%	30.1%	85.2%
Q2	18.6%	46.0%	64.7%	37.4%	46.3%	83.7%	28.6%	36.1%	64.6%	29.3%	32.7%	61.9%	27.2%	40.8%	68.0%	32.9%	47.3%	80.2%
Q3	28.6%	39.0%	67.6%	39.4%	37.3%	76.8%	24.5%	39.2%	63.6%	23.8%	43.4%	67.1%	20.3%	48.3%	68.5%	30.7%	49.0%	79.7%
Q4	21.4%	41.4%	62.8%	35.4%	46.9%	82.3%	22.6%	41.8%	64.4%	17.8%	47.3%	65.1%	20.4%	42.2%	62.6%	32.4%	47.8%	80.2%
Q5	25.0%	23.7%	48.7%	54.4%	26.9%	81.3%	31.9%	17.5%	49.4%	34.4%	20.0%	54.4%	34.6%	19.5%	54.1%	55.4%	27.9%	83.3%

Table 3.4.2: 9-years - Direction of changes for middle quintiles

		Raw Excess Returns				Jensen's alpha				Sharpe ratio			
		up	Same	down	Totals	up	Same	down	Totals	up	Same	down	Totals
1 Quarter	Q2	22.1%	30.7%	14.8%	67.6%	14.9%	60.3%	22.4%	97.7%	21.3%	21.3%	21.8%	64.4%
	Q3	16.7%	30.0%	21.3%	67.9%	19.8%	55.1%	21.6%	96.4%	22.2%	18.6%	23.4%	64.1%
	Q4	23.4%	25.4%	18.9%	67.6%	19.7%	56.6%	20.2%	96.5%	24.3%	24.9%	22.5%	71.7%
2 Quarters	Q2	23.5%	20.5%	19.2%	63.2%	20.6%	46.7%	24.2%	91.5%	23.0%	17.0%	22.4%	62.4%
	Q3	20.5%	21.4%	21.4%	63.3%	20.8%	46.5%	21.4%	88.7%	27.8%	16.5%	20.9%	65.2%
	Q4	23.4%	22.6%	15.7%	61.7%	22.0%	48.8%	22.0%	92.7%	27.3%	26.1%	20.6%	73.9%
3 Quarters	Q2	20.1%	23.2%	19.2%	62.5%	23.1%	40.4%	27.6%	91.0%	21.8%	16.7%	19.9%	58.3%
	Q3	20.8%	24.9%	23.5%	69.2%	19.2%	41.7%	24.5%	85.4%	23.2%	22.5%	18.5%	64.2%
	Q4	21.9%	23.7%	17.9%	63.4%	21.3%	41.9%	23.2%	86.5%	25.8%	23.9%	16.8%	66.5%
4 Quarters	Q2	23.3%	18.6%	22.8%	64.7%	21.8%	37.4%	24.5%	83.7%	19.0%	28.6%	17.0%	64.6%
	Q3	21.9%	28.6%	17.1%	67.6%	15.5%	39.4%	21.8%	76.8%	17.5%	24.5%	21.7%	63.6%
	Q4	17.7%	21.4%	23.7%	62.8%	21.8%	35.4%	25.2%	82.3%	19.9%	22.6%	21.9%	64.4%
Average					65%				89%				65%
Min					62%				77%				58%
Max					69%				98%				74%

		Sortino ratio				Treynor ratio				Omega			
		up	Same	down	Totals	up	Same	down	Totals	up	Same	down	Totals
1 Quarter	Q2	22.4%	27.0%	18.4%	67.8%	19.0%	19.5%	24.1%	62.6%	12.2%	57.4%	26.2%	95.8%
	Q3	20.4%	24.6%	26.9%	71.9%	28.1%	18.6%	23.4%	70.1%	20.4%	52.2%	23.5%	96.1%
	Q4	22.5%	23.7%	21.4%	67.6%	21.8%	21.8%	23.6%	67.2%	16.9%	55.1%	19.9%	91.9%
2 Quarters	Q2	19.4%	22.4%	18.8%	60.6%	23.6%	20.0%	19.4%	63.0%	19.8%	41.4%	26.4%	87.7%
	Q3	19.6%	22.2%	28.5%	70.3%	27.8%	19.6%	23.4%	70.9%	26.7%	41.6%	24.0%	92.3%
	Q4	24.8%	20.0%	21.2%	66.1%	23.6%	22.4%	20.0%	66.1%	23.5%	43.8%	21.2%	88.5%
3 Quarters	Q2	23.1%	21.8%	16.0%	60.9%	20.5%	23.1%	16.0%	59.6%	19.4%	39.6%	24.9%	83.9%
	Q3	21.9%	26.5%	17.9%	66.2%	23.2%	27.2%	19.9%	70.2%	22.2%	38.7%	24.1%	84.9%
	Q4	22.6%	20.6%	19.4%	62.6%	24.5%	20.0%	16.8%	61.3%	21.8%	42.1%	20.4%	84.3%
4 Quarters	Q2	17.7%	29.3%	15.0%	61.9%	21.8%	27.2%	19.0%	68.0%	17.9%	32.9%	29.5%	80.2%
	Q3	20.3%	23.8%	23.1%	67.1%	21.7%	20.3%	26.6%	68.5%	23.3%	30.7%	25.7%	79.7%
	Q4	24.7%	17.8%	22.6%	65.1%	21.1%	20.4%	21.1%	62.6%	22.7%	32.4%	25.1%	80.2%
Average					66%				66%				87%
Min					61%				60%				80%
Max					72%				71%				96%

Event counts

		All Measures		Jensen &Omega		Other Measures	
		up	down	up	down	up	down
1 Quarter	Q2	2	4	0	2	2	2
	Q3	1	5	0	2	1	3
	Q4	3	3	0	2	3	1
2 Quarters	Q2	4	2	0	2	4	0
	Q3	3	3	1	1	2	2
	Q4	5	0	1	0	4	0
3 Quarters	Q2	4	2	0	2	4	0
	Q3	3	3	0	2	3	1
	Q4	5	1	1	1	4	0
4 Quarters	Q2	4	2	0	2	4	0
	Q3	1	5	0	2	1	3
	Q4	1	4	0	2	1	2
Average		14	10	0	8	14	2
Min		8	16	1	7	7	9
Max		14	8	2	5	12	3
		36	34	3	20	33	14

Table 3.4.3: 5-years - Repeats and changes for all quintiles

		Raw Excess Returns			Jensen's alpha			Sharpe ratio		
		Same	neighbour	Totals	Same	neighbour	Totals	Same	neighbour	Totals
1 Quarter	Q1	34.5%	22.0%	56.5%	84.1%	15.1%	99.2%	42.1%	19.0%	61.1%
	Q2	33.7%	36.7%	70.4%	56.9%	41.5%	98.4%	21.1%	43.9%	65.0%
	Q3	32.9%	37.1%	70.1%	52.9%	45.4%	98.3%	21.0%	44.5%	65.5%
	Q4	27.2%	40.8%	68.0%	59.0%	36.9%	95.9%	25.4%	45.1%	70.5%
	Q5	38.0%	19.6%	57.5%	81.7%	16.0%	97.7%	32.1%	23.7%	55.7%
2 Quarters	Q1	31.7%	25.1%	56.9%	75.2%	19.7%	94.9%	36.8%	21.4%	58.1%
	Q2	20.1%	46.5%	66.7%	44.7%	47.4%	92.1%	18.4%	48.2%	66.7%
	Q3	25.0%	41.0%	66.0%	45.9%	44.1%	90.1%	18.2%	50.0%	68.2%
	Q4	25.0%	45.0%	70.0%	51.3%	39.8%	91.2%	28.9%	49.1%	78.1%
	Q5	37.1%	19.8%	56.9%	75.4%	18.0%	93.4%	32.0%	22.1%	54.1%
3 Quarters	Q1	31.8%	22.9%	54.8%	68.5%	24.1%	92.6%	36.1%	21.3%	57.4%
	Q2	22.1%	43.6%	65.8%	38.1%	53.3%	91.4%	13.3%	44.8%	58.1%
	Q3	27.0%	43.2%	70.3%	38.8%	47.6%	86.4%	23.3%	44.7%	68.0%
	Q4	23.5%	41.6%	65.1%	43.3%	42.3%	85.6%	22.1%	41.3%	63.5%
	Q5	33.8%	14.6%	48.4%	67.3%	20.4%	87.6%	29.2%	23.9%	53.1%
4 Quarters	Q1	27.9%	18.4%	46.3%	61.6%	28.3%	89.9%	34.3%	18.2%	52.5%
	Q2	19.3%	47.9%	67.1%	30.2%	51.0%	81.3%	28.1%	41.7%	69.8%
	Q3	27.7%	38.0%	65.7%	39.4%	40.4%	79.8%	23.2%	41.1%	64.2%
	Q4	23.6%	40.0%	63.6%	38.5%	41.7%	80.2%	25.3%	40.0%	65.3%
	Q5	26.5%	21.1%	47.6%	58.7%	19.2%	77.9%	31.7%	23.1%	54.8%

		Sortino ratio			Treynor ratio			Omega		
		Same	neighbour	Totals	Same	neighbour	Totals	Same	neighbour	Totals
1 Quarter	Q1	39.7%	18.3%	57.9%	42.1%	17.5%	59.5%	82.7%	12.1%	94.8%
	Q2	29.3%	38.2%	67.5%	19.5%	42.3%	61.8%	58.4%	38.6%	97.0%
	Q3	26.1%	42.9%	68.9%	20.2%	47.9%	68.1%	50.9%	46.0%	96.9%
	Q4	23.8%	43.4%	67.2%	21.1%	43.9%	65.0%	54.5%	36.4%	90.9%
	Q5	32.1%	24.4%	56.5%	30.8%	23.1%	53.8%	78.4%	17.0%	95.5%
2 Quarters	Q1	39.3%	17.9%	57.3%	35.9%	16.2%	52.1%	73.6%	18.4%	92.0%
	Q2	28.1%	38.6%	66.7%	24.6%	43.9%	68.4%	42.3%	46.8%	89.1%
	Q3	27.3%	50.0%	77.3%	23.6%	50.0%	73.6%	40.9%	50.6%	91.6%
	Q4	22.8%	49.1%	71.9%	25.4%	46.5%	71.9%	43.9%	43.2%	87.1%
	Q5	33.6%	18.0%	51.6%	32.8%	20.5%	53.3%	70.5%	21.1%	91.6%
3 Quarters	Q1	32.4%	19.4%	51.9%	32.4%	20.4%	52.8%	66.7%	21.6%	88.2%
	Q2	22.9%	41.0%	63.8%	21.9%	34.3%	56.2%	42.5%	43.8%	86.3%
	Q3	26.2%	43.7%	69.9%	29.1%	44.7%	73.8%	37.9%	45.5%	83.4%
	Q4	20.2%	43.3%	63.5%	21.2%	40.4%	61.5%	42.8%	38.6%	81.4%
	Q5	25.7%	23.9%	49.6%	30.1%	24.8%	54.9%	66.0%	20.5%	86.5%
4 Quarters	Q1	36.4%	16.2%	52.5%	38.4%	18.2%	56.6%	60.8%	26.6%	87.4%
	Q2	30.2%	33.3%	63.5%	28.1%	42.7%	70.8%	38.2%	44.1%	82.4%
	Q3	25.3%	45.3%	70.5%	23.2%	46.3%	69.5%	33.3%	43.0%	76.3%
	Q4	20.0%	44.2%	64.2%	21.9%	42.7%	64.6%	36.8%	41.9%	78.7%
	Q5	36.5%	19.2%	55.8%	37.9%	21.4%	59.2%	56.8%	23.3%	80.1%

Table 3.4.4: 5-years - Direction of changes for middle quintiles

		Raw Excess Returns up	Same	down	Totals	Jensen's alpha up	Same	down	Totals
1 Quarter	Q2	24.9%	33.7%	11.8%	70.4%	15.4%	56.9%	26.0%	98.4%
	Q3	15.0%	32.9%	22.2%	70.1%	21.8%	52.9%	23.5%	98.3%
	Q4	23.7%	27.2%	17.2%	68.0%	20.5%	59.0%	16.4%	95.9%
2 Quarters	Q2	28.9%	20.1%	17.6%	66.7%	20.2%	44.7%	27.2%	92.1%
	Q3	22.4%	25.0%	18.6%	66.0%	19.8%	45.9%	24.3%	90.1%
	Q4	26.3%	25.0%	18.8%	70.0%	23.0%	51.3%	16.8%	91.2%
3 Quarters	Q2	25.5%	22.1%	18.1%	65.8%	21.9%	38.1%	31.4%	91.4%
	Q3	20.9%	27.0%	22.3%	70.3%	17.5%	38.8%	30.1%	86.4%
	Q4	24.8%	23.5%	16.8%	65.1%	25.0%	43.3%	17.3%	85.6%
4 Quarters	Q2	32.1%	19.3%	15.7%	67.1%	21.9%	30.2%	29.2%	81.3%
	Q3	20.4%	27.7%	17.5%	65.7%	10.6%	39.4%	29.8%	79.8%
	Q4	19.3%	23.6%	20.7%	63.6%	25.0%	38.5%	16.7%	80.2%
Average					67%				89%
Min					64%				80%
Max					70%				98%

		Sharpe ratio up	Same	down	Totals	Sortino ratio up	Same	down	Totals
1 Quarter	Q2	22.0%	21.1%	22.0%	65.0%	20.3%	29.3%	17.9%	67.5%
	Q3	21.8%	21.0%	22.7%	65.5%	16.8%	26.1%	26.1%	68.9%
	Q4	24.6%	25.4%	20.5%	70.5%	23.8%	23.8%	19.7%	67.2%
2 Quarters	Q2	22.8%	18.4%	25.4%	66.7%	20.2%	28.1%	18.4%	66.7%
	Q3	29.1%	18.2%	20.9%	68.2%	20.9%	27.3%	29.1%	77.3%
	Q4	28.1%	28.9%	21.1%	78.1%	26.3%	22.8%	22.8%	71.9%
3 Quarters	Q2	21.9%	13.3%	22.9%	58.1%	24.8%	22.9%	16.2%	63.8%
	Q3	27.2%	23.3%	17.5%	68.0%	23.3%	26.2%	20.4%	69.9%
	Q4	26.9%	22.1%	14.4%	63.5%	26.0%	20.2%	17.3%	63.5%
4 Quarters	Q2	22.9%	28.1%	18.8%	69.8%	19.8%	30.2%	13.5%	63.5%
	Q3	17.9%	23.2%	23.2%	64.2%	21.1%	25.3%	24.2%	70.5%
	Q4	20.0%	25.3%	20.0%	65.3%	25.3%	20.0%	18.9%	64.2%
Average					67%				68%
Min					58%				63%
Max					78%				77%

		Treynor ratio up	Same	down	Totals	Omega up	Same	down	Totals
1 Quarter	Q2	17.1%	19.5%	25.2%	61.8%	13.3%	58.4%	25.3%	97.0%
	Q3	26.1%	20.2%	21.8%	68.1%	20.9%	50.9%	25.2%	96.9%
	Q4	22.8%	21.1%	21.1%	65.0%	19.4%	54.5%	17.0%	90.9%
2 Quarters	Q2	21.9%	24.6%	21.9%	68.4%	21.8%	42.3%	25.0%	89.1%
	Q3	29.1%	23.6%	20.9%	73.6%	27.9%	40.9%	22.7%	91.6%
	Q4	25.4%	25.4%	21.1%	71.9%	25.8%	43.9%	17.4%	87.1%
3 Quarters	Q2	19.0%	21.9%	15.2%	56.2%	21.2%	42.5%	22.6%	86.3%
	Q3	26.2%	29.1%	18.4%	73.8%	20.7%	37.9%	24.8%	83.4%
	Q4	25.0%	21.2%	15.4%	61.5%	24.1%	42.8%	14.5%	81.4%
4 Quarters	Q2	26.0%	28.1%	16.7%	70.8%	20.6%	38.2%	23.5%	82.4%
	Q3	16.8%	23.2%	29.5%	69.5%	17.0%	33.3%	25.9%	76.3%
	Q4	24.0%	21.9%	18.8%	64.6%	25.7%	36.8%	16.2%	78.7%
Average					67%				87%
Min					56%				76%
Max					74%				97%

Event counts

		All Measures up	down	Jensen &Omega up	down	Other Measures up	down
1 Quarter	Q2	2	3	0	2	2	1
	Q3	1	5	0	2	1	3
	Q4	6	0	2	0	4	0
2 Quarters	Q2	2	3	0	2	2	1
	Q3	4	2	1	1	3	1
	Q4	6	0	2	0	4	0
3 Quarters	Q2	3	3	0	2	3	1
	Q3	3	3	0	2	3	1
	Q4	6	0	2	0	4	0
4 Quarters	Q2	4	2	0	2	4	0
	Q3	1	5	0	2	1	3
	Q4	4	1	2	0	2	1
Average		11	11	0	8	11	3
Min		9	15	1	7	8	8
Max		22	1	8	0	14	1
		42	27	9	15	33	12

Table 3.4.5: 3-years - Repeats and changes for all quintiles

1 Quarter

	Raw Excess Returns			Jensen's alpha			Sharpe ratio			Sortino ratio			Treynor ratio			Omega		
	Same	neighbour	Totals	Same	neighbour	Totals	Same	neighbour	Totals	Same	neighbour	Totals	Same	neighbour	Totals	Same	neighbour	Totals
Q1	35.8%	20.2%	56.0%	85.2%	14.8%	100.0%	43.2%	20.5%	63.6%	40.9%	21.6%	62.5%	43.2%	17.0%	60.2%	88.8%	11.2%	100.0%
Q2	31.1%	37.9%	68.9%	58.1%	39.5%	97.7%	18.6%	43.0%	61.6%	26.7%	39.5%	66.3%	16.3%	40.7%	57.0%	66.7%	31.4%	98.0%
Q3	28.2%	36.9%	65.0%	54.2%	44.6%	98.8%	22.9%	43.4%	66.3%	24.1%	44.6%	68.7%	22.9%	48.2%	71.1%	57.0%	41.0%	98.0%
Q4	27.2%	36.9%	64.1%	58.8%	37.6%	96.5%	24.7%	45.9%	70.6%	23.5%	45.9%	69.4%	18.6%	43.0%	61.6%	61.4%	32.7%	94.1%
Q5	30.3%	19.3%	49.5%	82.4%	15.4%	97.8%	31.9%	20.9%	52.7%	33.0%	24.2%	57.1%	30.0%	22.2%	52.2%	84.1%	13.1%	97.2%

2 Quarters

	Raw Excess Returns			Jensen's alpha			Sharpe ratio			Sortino ratio			Treynor ratio			Omega		
	Same	neighbour	Totals	Same	neighbour	Totals	Same	neighbour	Totals	Same	neighbour	Totals	Same	neighbour	Totals	Same	neighbour	Totals
Q1	35.4%	27.3%	62.6%	78.5%	19.0%	97.5%	39.2%	22.8%	62.0%	46.8%	16.5%	63.3%	38.0%	16.5%	54.4%	82.5%	16.5%	99.0%
Q2	23.7%	50.5%	74.2%	48.1%	45.5%	93.5%	15.6%	54.5%	70.1%	29.9%	41.6%	71.4%	26.0%	45.5%	71.4%	53.3%	38.0%	91.3%
Q3	20.7%	38.0%	58.7%	46.7%	46.7%	93.3%	16.2%	52.7%	68.9%	28.4%	48.6%	77.0%	20.3%	54.1%	74.3%	46.2%	48.4%	94.5%
Q4	29.8%	43.6%	73.4%	48.7%	43.4%	92.1%	31.2%	46.8%	77.9%	27.3%	42.9%	70.1%	24.7%	45.5%	70.1%	49.5%	42.9%	92.3%
Q5	38.1%	23.7%	61.9%	75.6%	19.5%	95.1%	36.6%	24.4%	61.0%	36.6%	22.0%	58.5%	36.6%	23.2%	59.8%	77.3%	16.5%	93.8%

3 Quarters

	Raw Excess Returns			Jensen's alpha			Sharpe ratio			Sortino ratio			Treynor ratio			Omega		
	Same	neighbour	Totals	Same	neighbour	Totals	Same	neighbour	Totals	Same	neighbour	Totals	Same	neighbour	Totals	Same	neighbour	Totals
Q1	37.1%	23.6%	60.7%	75.7%	24.3%	100.0%	40.0%	20.0%	60.0%	35.7%	18.6%	54.3%	35.7%	17.1%	52.9%	78.2%	20.7%	98.9%
Q2	25.3%	43.4%	68.7%	41.2%	50.0%	91.2%	16.2%	41.2%	57.4%	30.9%	42.6%	73.5%	26.5%	33.8%	60.3%	42.7%	43.9%	86.6%
Q3	27.4%	40.5%	67.9%	43.3%	41.8%	85.1%	26.9%	41.8%	68.7%	25.4%	37.3%	62.7%	29.9%	43.3%	73.1%	43.9%	46.3%	90.2%
Q4	25.3%	42.2%	67.5%	44.8%	40.3%	85.1%	22.4%	43.3%	65.7%	22.4%	47.8%	70.1%	22.4%	37.3%	59.7%	46.9%	39.5%	86.4%
Q5	32.2%	14.9%	47.1%	67.1%	20.5%	87.7%	24.7%	23.3%	47.9%	20.5%	32.9%	53.4%	24.7%	23.3%	47.9%	71.3%	18.4%	89.7%

4 Quarters

	Raw Excess Returns			Jensen's alpha			Sharpe ratio			Sortino ratio			Treynor ratio			Omega		
	Same	neighbour	Totals	Same	neighbour	Totals	Same	neighbour	Totals	Same	neighbour	Totals	Same	neighbour	Totals	Same	neighbour	Totals
Q1	26.6%	21.5%	48.1%	75.4%	23.0%	98.4%	41.0%	21.3%	62.3%	44.3%	18.0%	62.3%	45.9%	18.0%	63.9%	74.0%	23.4%	97.4%
Q2	24.3%	51.4%	75.7%	33.9%	45.8%	79.7%	32.2%	44.1%	76.3%	35.6%	35.6%	71.2%	30.5%	49.2%	79.7%	36.1%	41.7%	77.8%
Q3	27.4%	31.5%	58.9%	44.8%	31.0%	75.9%	25.4%	44.1%	69.5%	27.1%	44.1%	71.2%	28.8%	47.5%	76.3%	37.5%	43.1%	80.6%
Q4	31.1%	40.5%	71.6%	40.7%	40.7%	81.4%	29.3%	44.8%	74.1%	22.4%	46.6%	69.0%	25.4%	40.7%	66.1%	41.7%	40.3%	81.9%
Q5	26.0%	20.8%	46.8%	53.1%	23.4%	76.6%	35.9%	25.0%	60.9%	42.2%	20.3%	62.5%	47.6%	20.6%	68.3%	61.0%	19.5%	80.5%

Table 3.4.6: 3-years - Direction of changes for middle quintiles

		Raw Excess Returns				Jensen's alpha			
		up	Same	down	Totals	up	Same	down	Totals
1 Quarter	Q2	24.3%	31.1%	13.6%	68.9%	15.1%	58.1%	24.4%	97.7%
	Q3	15.5%	28.2%	21.4%	65.0%	21.7%	54.2%	22.9%	98.8%
	Q4	19.4%	27.2%	17.5%	64.1%	21.2%	58.8%	16.5%	96.5%
2 Quarters	Q2	26.9%	23.7%	23.7%	74.2%	20.8%	48.1%	24.7%	93.5%
	Q3	22.8%	20.7%	15.2%	58.7%	20.0%	46.7%	26.7%	93.3%
	Q4	24.5%	29.8%	19.1%	73.4%	26.3%	48.7%	17.1%	92.1%
3 Quarters	Q2	27.7%	25.3%	15.7%	68.7%	22.1%	41.2%	27.9%	91.2%
	Q3	15.5%	27.4%	25.0%	67.9%	13.4%	43.3%	28.4%	85.1%
	Q4	25.3%	25.3%	16.9%	67.5%	23.9%	44.8%	16.4%	85.1%
4 Quarters	Q2	36.5%	24.3%	14.9%	75.7%	22.0%	33.9%	23.7%	79.7%
	Q3	17.8%	27.4%	13.7%	58.9%	10.3%	44.8%	20.7%	75.9%
	Q4	16.2%	31.1%	24.3%	71.6%	25.4%	40.7%	15.3%	81.4%
Average					68%				89%
Min					59%				76%
Max					76%				99%

		Sharpe ratio				Sortino ratio			
		up	Same	down	Totals	up	Same	down	Totals
1 Quarter	Q2	22.1%	18.6%	20.9%	61.6%	19.8%	26.7%	19.8%	66.3%
	Q3	15.7%	22.9%	27.7%	66.3%	15.7%	24.1%	28.9%	68.7%
	Q4	23.5%	24.7%	22.4%	70.6%	23.5%	23.5%	22.4%	69.4%
2 Quarters	Q2	26.0%	15.6%	28.6%	70.1%	19.5%	29.9%	22.1%	71.4%
	Q3	33.8%	16.2%	18.9%	68.9%	23.0%	28.4%	25.7%	77.0%
	Q4	28.6%	31.2%	18.2%	77.9%	23.4%	27.3%	19.5%	70.1%
3 Quarters	Q2	22.1%	16.2%	19.1%	57.4%	23.5%	30.9%	19.1%	73.5%
	Q3	23.9%	26.9%	17.9%	68.7%	20.9%	25.4%	16.4%	62.7%
	Q4	23.9%	22.4%	19.4%	65.7%	29.9%	22.4%	17.9%	70.1%
4 Quarters	Q2	25.4%	32.2%	18.6%	76.3%	20.3%	35.6%	15.3%	71.2%
	Q3	22.0%	25.4%	22.0%	69.5%	22.0%	27.1%	22.0%	71.2%
	Q4	22.4%	29.3%	22.4%	74.1%	27.6%	22.4%	19.0%	69.0%
Average					69%				70%
Min					57%				63%
Max					78%				77%

		Treynor ratio				Omega			
		up	Same	down	Totals	up	Same	down	Totals
1 Quarter	Q2	14.0%	16.3%	26.7%	57.0%	9.8%	66.7%	21.6%	98.0%
	Q3	24.1%	22.9%	24.1%	71.1%	17.0%	57.0%	24.0%	98.0%
	Q4	19.8%	18.6%	23.3%	61.6%	18.8%	61.4%	13.9%	94.1%
2 Quarters	Q2	19.5%	26.0%	26.0%	71.4%	17.4%	53.3%	20.7%	91.3%
	Q3	32.4%	20.3%	21.6%	74.3%	22.0%	46.2%	26.4%	94.5%
	Q4	26.0%	24.7%	19.5%	70.1%	28.6%	49.5%	14.3%	92.3%
3 Quarters	Q2	16.2%	26.5%	17.6%	60.3%	20.7%	42.7%	23.2%	86.6%
	Q3	20.9%	29.9%	22.4%	73.1%	20.7%	43.9%	25.6%	90.2%
	Q4	19.4%	22.4%	17.9%	59.7%	25.9%	46.9%	13.6%	86.4%
4 Quarters	Q2	32.2%	30.5%	16.9%	79.7%	19.4%	36.1%	22.2%	77.8%
	Q3	22.0%	28.8%	25.4%	76.3%	19.4%	37.5%	23.6%	80.6%
	Q4	20.3%	25.4%	20.3%	66.1%	26.4%	41.7%	13.9%	81.9%
Average					68%				89%
Min					57%				78%
Max					80%				98%

		Event counts					
		All Measures		Jensen &Omega		Other Measures	
		up	down	up	down	up	down
1 Quarter	Q2	2	3	0	2	2	1
	Q3	0	5	0	2	0	3
	Q4	5	1	2	0	3	1
2 Quarters	Q2	1	5	0	2	1	3
	Q3	3	3	0	2	3	1
	Q4	6	0	2	0	4	0
3 Quarters	Q2	3	3	0	2	3	1
	Q3	2	4	0	2	2	2
	Q4	6	0	2	0	4	0
4 Quarters	Q2	4	2	0	2	4	0
	Q3	1	3	0	2	1	1
	Q4	3	1	2	0	1	1
Average		10	13	0	8	10	5
Min		6	15	0	8	6	7
Max		20	2	8	0	12	2
		36	30	8	16	28	14

Chapter 4: Fund Characteristics

4.1 Introduction

Markowitz introduced mean-variance optimization of a fund. Investment managers organise their funds with the intention of ending with what they believe is the optimal fund based on their view of appropriate risk and return preferences. Considering how differently funds are organised from each other, it would appear that there is not simply one version of an optimal fund. Studies in behavioural finance have provided explanations as to why funds may not be optimized according to Markowitz's principles. Other proposals of theories that explain market equilibrium (and disequilibrium) include those based on varying beliefs and expectations of investors as an alternative to theories based entirely on the assumption of homogeneous rationality among investors. Despite collective theory supporting the existence of a state of equilibrium for the optimal fund, the instrument holdings and performances of funds differ from each other. Studying these differences will help investors understand their consequences and thereby improve investment decision-making.

Since the presentation of Markowitz's mean-variance optimal fund there have been several studies that have considered various fund structures and strategies. These include the differing effects of funds with a value or growth bias and the effects of trading and momentum strategies. Some studies have considered the success of trading strategies over various horizons while the effects of collective fund structures have been considered by analyzing "families" of funds. Other studies have considered the differences in performances between funds that hold large capitalization (large-cap) stocks and those that hold small capitalisation (small-caps) stocks. Identifying the different aspects of fund organisation and the associated fund performance will assist investors in their decisions with respect to choice of funds to invest in.

In an earlier chapter we noted that fund performance is dependent on the selection of attractive investments and the extent of the contributions of the chosen combinations of individual selections (fund organization). This chapter focuses on fund organisation which is dependent on different structures within the fund and which we refer to as fund characteristics. We examine the extent of the differences in characteristics between funds and their association with superior and inferior performing funds.

This chapter is organised as follows:

- The first section discusses fund characteristics with the intention of providing context for it, its distinguishing features and its interaction with other components
- Literature review and a specific recent development
- The methodology used
- The results which are separated into those for the cross-sectional Spearman correlations and those for the contingency table and a summary of the results is provided
- The conclusion
- The Appendix which contains details relating to calculations referred to in the text and an example of the application of the calculations

4.2 Defining fund characteristics

A number of different fund characteristics and their effects on returns have been considered in different studies. Academic literature distinguishes fund characteristics from ergonomical characteristics and manager characteristics. In an earlier chapter we identified stock characteristics as a sub-group of ergonomical characteristics. In the discussion that follows, for the sake of consistency with references made to stock characteristics in other studies, we distinguish stock characteristics from other non-ergonomical characteristics.

Daniel, Grinblatt, Titman and Wermers (1997) focus on stock characteristics and investigate the relationship between funds' returns relative to characteristic-based benchmarks that are based on stock characteristics such as book-to-market, size and momentum. In contrast, Chevalier and Ellison (1999) examined the relationship between manager characteristics and fund returns. Manager characteristics examined included the SAT score of managers, MBA qualification, age of the manager and tenure. In contrast with the studies on stock and manager characteristics, Khorana and Nelling (1998) study the relationship between Morningstar ratings and fund characteristics such as manager tenure, total assets, turnover, expense ratio and front load. Other, more recent studies have considered fund characteristics such as fund maturity, investment objective, turnover, incentive fees, number of shares and loadings (Thomas and Tonks, 2000; Baker, Litov, Wachter and Wurgler, 2004; Jiang, Yao and Yu, 2007). Massa (2004) studies the impact of fund characteristics such as the number of funds within a category, fee levels, degree of informativeness, demand and attitude toward risk on stock characteristics such as returns, volatility, liquidity and cross-stock correlations.

Distinguishing a fund characteristic from a stock or manager characteristic is not always clear-cut. For example, it is not clear whether an investment strategy is a fund characteristic or a manager characteristic. Some investment strategies such as longer security holding periods may result from an initiative by a manager, but may also be explicitly prescribed in an investment mandate and therefore may be considered as a characteristic of a fund.

Another perspective on the link between the different categories of characteristics may be obtained from considering investment performance rewards. Rewards such as returns achieved by an individual stock may be regarded as a stock characteristic while a fund's returns, achieved by a collection of all stock returns in a fund, may be regarded as a fund characteristic. A manager's reward or remuneration for managing a fund may be linked to the fund's returns and regarded as a manager characteristic. So, stock characteristics influence fund characteristics which in turn influence manager characteristics.

The preferences for different securities holdings among funds can be expected to result in differences in performances between the funds. Also, the similarities in securities holdings can be expected to result in similarities in fund organisation between funds. Clearly, while the securities holdings among some funds may be similar, the funds may have different value-weightings for the individual securities in their funds and this is likely to contribute to differences in funds' performances. So, even though some funds' individual holdings may be similar, their organisations and resultant performances are likely to be different.

In practice, as a result of different investment decision making processes, funds are unlikely to hold the same securities with the same weightings between them. For example, some investment managers have investment processes that involve constructing equity funds with a particular emphasis on their position relative to securities and their weightings in a specific equity benchmark. Other investment managers have processes that ignore equity benchmarks and their opportunity set is likely to give equal weighting to "off benchmark" and benchmark securities and the fund security weightings may differ substantially from security weightings in a benchmark. The former investment process is often referred as a benchmark-driven process while the later is referred to as absolute investment process.

So, individual security holdings and the fund weightings of securities, which we individually refer to as fund characteristics and are collectively referred to as fund organisation, will differ between funds and result in a divergence in performances between funds. However, the converse is also true: funds that have similar individual security holdings and weights are likely to experience a convergence of their performances. Identifying characteristics of equity funds such as commonality in funds' holdings fuels expectations for the performance of funds in established and newly spawned firms – a further insight leading to a refinement in the investor's decision making process.

We identify fund characteristics as:

- The portion of a fund's equity holdings (interchangeably referred to as stocks or securities) that is not traded for four quarters and which we call the static portion.
- The portion of a fund's holdings that are traded (i.e. not held for four or more quarters),.
- The funds' respective performances and the extent of a fund's overlap with the JSE's Top 40, mid and small capitalisation indices.

We investigate the association of these characteristics with the performance of the funds. It seems reasonable to expect that substantial index overlaps among funds increases the likelihood of funds having common equity holdings with the consequential performance similarities between these funds.

4.3 Literature review

There is empirical support for the development of performances expectations based on similarities between funds' characteristics, regardless of the size of the investment management firm. Chen, Jegadeesh and Wermers (2000) (CJW) have found that those equity securities that are more widely held among funds, underperform those that are not. Investment industry segmentation and the commonality of security holdings have also been considered. Commonality of holdings between large investment houses and the smaller firms that they spawn has been studied by Faff, Parwada and Yang (2006).

The structures (or organisation) of funds may differ between groups of funds, even though similarities in holdings preferences between the groups may exist. Bathala, Ma and Rao (2005) examine cross-sectional differences in the institutional ownership of a sample of firms. Specifically, they test for relationships between institutional ownership and securities (stocks) with certain characteristics. While they find no evidence supporting institutional preferences for value or glamour securities, they do find an institutional preference for securities that display momentum, financial strength, small market capitalisation and low or no dividend yields.

Mutual fund categories are one facility available to the public and that should assist investors to identify and evaluate funds based on their characteristics. However, there is substantial evidence that highlights the extent to which the categorisations of funds are misleading in investment decision making (diBartolomeo and Witkoski (1997), Kim, Shukla and Thomas (2000), Castellanos and Alonso (2005), Lau and Tze-Haw (2007)). This evidence provides motivation for our investigation into identifying fund characteristics that are not misleading as inputs to investors' decision making processes.

The research interest in this study is closely aligned to the CJW study. Their study examines the performance of individual securities held by funds and the securities traded by funds. They consider the equity securities holdings at the end of each quarter as a percentage of total equity securities outstanding and the "trades" measure is the change in this percentage from the end of one quarter to the next. The buy-and-hold returns for each fund are based on formation periods of one, two, three and four quarters. The stock characteristics (such as large and small capitalisation) of funds' holdings and turnover are examined. They also investigate the performance persistence among funds.

The CJW study finds that actively traded stocks outperform those passively held by funds and that funds with a higher frequency of trades perform better than those that trade less frequently. Also, the stocks passively held by winning funds outperform those held by losing funds. CJW refer to the buy-and-hold portion of a fund as stockholdings passively carried by the fund. Describing the un-traded portion of a fund as passive holdings may lead to confusion since that portion is likely to contain active bets that are not being actively traded. To avoid confusion we refer to the un-traded portion of a fund as the static portion (instead of the passive portion).

Consistent with the findings of CJW, this study finds that:

- funds have a preference for large capitalisation securities. The overlap with the ALSI Top 40 index is consistently higher than that with the mid and small capitalisation indices. One explanation for this may be that the South African equity market has a high concentration of large stocks and funds will inevitably hold higher amounts of large capitalisation securities
- the static portion of the winning funds outperforms the static portion of the losing funds, and

- Winning funds capitalise on their stock selection skills through increased levels of trading with which they experience greater success than the losing funds.

Earlier investigations into the relationship between trading and fund performance are mixed. Grinblatt and Titman (1989) find a direct relationship between turnover and fund performance,while Carhart (1997) finds an inverse relationship and is supported by the Khorana and Nelling (1998) findings that lower rated funds exhibit higher fund turnover which, as the authors point out, is consistent with the notions of herding and window dressing among fund managers.

Our study is similar to the CJW study in that we examine the static and trading portion of funds. However, the CJW study focuses on securities while we focus on the collective holdings of securities. We examine the collective performance of equity securities held by funds and the collective performance of the equity securities traded by funds. Securities held for four consecutive quarters (formation period) form the static portion of the fund and their collective performance is calculated. The static performance is subtracted from the total performance to give an indication of the performance that is attributed to trading. The performance calculation using the Dietz method is described in an earlier chapter.

The size of the static portion (and hence the size of the trading portion) and the overlap of fund holdings with the constituents of various equity indices (such as those representing large and small capitalisation stocks) are examined as fund characteristics and we do not consider the individual stock characteristics. We investigate the persistence in the association of fund characteristics with superior and inferior performing managers. The success of the timing and trading strategies of funds is investigated in the next chapter.

The issue of increased trading needs to be clarified. There are two ways in which a fund may experience an increase in the value of trading: through either increasing the portion of the fund that is traded over a period or increasing the frequency of trades. For example, a fund consisting of ten securities of equal weighting may trade five of its securities once over the period of a year – a trading value representing 50% of the fund. Alternatively, the fund may trade those five securities two or more times over the year – a trading value equal to 100%, or more, of the fund.
Therefore, trading value is affected by the size of trades and the frequency with which they are made.

This study considers the trading portion to be that portion of the fund value for which the individual security holdings differ at two consecutive quarter ends. In other words, we assume that trades do not occur during the quarter if the number of securities is the same from one quarter end to the next. Where the number of security holdings differs, the value of trades is assumed to have taken place in the middle of the quarter (consistent with the Dietz performance calculation mentioned earlier).

4.4 Recent developments in literature

Excluded from our literature review above is the presentation (in a working paper) by Lo (2007) of a fund return decomposition. Since there are close similarities between this study and the Lo (2007) study, we comment on the Lo (2007) study with the view to providing further relevant context for this study.

Lo (2007) proposes a new measure of the value of active management that includes the static and dynamic investment strategies in a fund. The static weighted-average returns of individual securities returns are a measure of the fund's static investments in individual securities. The sum of covariances between returns and weightings of individual securities measures the manager's timing ability through the execution of dynamic investment choices.

The Lo (2007) study defines a fund's returns as

$$R_{pt} = \sum_{i=1}^{n} w_{it} R_{it}$$

where the weights (w_{it}) are security weights at time t and the security returns are for the period $t-1$ to t.

The motivation for using security weights (rather than, say, quantities) is that while a fund's return is determined by the returns in respect of the individual securities and the characteristics of the security weights in the fund, the larger portion of an investors' fees for active management is for the manager's fund weights or fund organisation. This approach emphasises the static portion in the context of the entire fund while our quantities-based static portion is an emphasis on the static individual security holdings in the fund.

The use of weights at time *t* is based on the assumption/restriction that these weights are a function of available information at *t-1*. Therefore, assimilation of information at *t-1* is translated into a security weighting that is maintained for the entire period between *t* and *t-1* including *t*. For example, consider a period of one quarter. The information at the end of the previous quarter (*t-1*) leads to a specific security weighting that is maintained from the day after *t-1* until the end of the quarter (*t*).

A general decomposition of fund returns is presented by Lo (2007) as

$$E[R_{pt}] = \sum_{i=1}^{n} Cov[w_{it} R_{it}] + \sum_{i=1}^{n} E[w_{it}]E[R_{it}] = \delta_p + \upsilon_p$$

where δ_p and υ_p are referred to as the active and passive components respectively.

The active component is a measure of the manager's timing ability while the passive component measures the returns attributable to the manager's buy-and hold strategy.

Our return attribution is consistent with that of Lo (2007), but only in principle. While both studies use "static" as synonymous with "passive" or "buy-and-hold" strategies, timing ability is associated with "trading" in our study and with "dynamic" by Lo (2007). The studies diverge substantially when the detail of the measurement of the components of fund returns are considered. In particular,

- we measure static returns based on minimums of quarter-end quantities held over four quarters whereas Lo (2007) uses the average of end-of-period fund weights over an interval and
- we use a Dietz method for measuring fund returns and treat the trading portion as the difference between the fund returns and the static return, whereas Lo (2007) uses covariances between weights and returns to directly measure the dynamic portion that is summed with the static portion to provide a fund return.

The different return decompositions mentioned above lead to different definitions of active and passive management which, for example, have obvious implications for the fees that investors pay fund managers for the "active" management of assets. As Lo (2007) notes, this is relevant for long-only funds (as considered in our study) and particularly relevant for hedge-funds (not considered in our study).

4.5 Methodology

A particular aspect of our analysis needs to be discussed in order to develop an understanding of the potentially counter-intuitive approach taken.

The approach taken is to identify associations between fund performance measures and individual fund characteristics. The persistence in the associations is anchored in the performance measure ranking at a quarter-end as a predictor of the ranking of each fund characteristic over the subsequent four quarters. It may be perceived that it would be more useful to test for the reverse where fund characteristics are considered as a potential predictor of performance rankings in subsequent quarters.

The benefit of following the former approach is that expectations about fund characteristics can be developed. "Breaks" in associations highlighted in this study will result in expectations disappointments and should trigger further investigation into identifying whether any significant changes in the management of a fund have occurred. Changes in the management of a fund may be the result of changes in manager characteristics such as changes to the individual(s) directly responsible for stock selection or portfolio construction, ergonomical characteristics such as changes in the business cycle, or other fund characteristics that are prescriptive such as a change in the fund mandate.

The important underpin to following the former approach is that we have provided evidence of persistence in fund performance measures in earlier chapters, particularly with respect to superior and inferior performing funds. It follows that persistence in the association between fund characteristics and fund performance is a basis for developing expectations for the management and, hence, organisation of a fund.

The benefit of following the latter approach that involves the investigation into fund characteristics as predictors of fund performance is that once a change in a relationship or association has been identified, expectations about fund performance can be developed. An analysis based on this approach may provide interesting results.

Investors rely on measures of performance and their degree of persistence to formulate expectations for future investment performance. Different fund characteristics and the implementation of different investment strategies will result in performance variation among funds. Understanding the association between performance measures and fund characteristics will improve performance expectation formulation and decision-making by investors.

As noted above, fund performance may be considered as a fund characteristic. For the purposes of this study we distinguish fund performance from other fund characteristics.

We examine the results of the relationships between two fund performance measures and several fund characteristics. The fund performance measures used in the analysis are:

- total raw returns and
- the Omega statistic

The relationships are examined at each quarter and over the subsequent four quarters (with the performance measure fixed for each case). The fund characteristics considered are:

- Raw returns for the static portion
- Raw returns for the trading portion
- Static size
- Overlap with the ALSI Top 40 constituents
- Overlap with the mid-cap constituents
- Overlap with the small-cap constituents

The functional relationship suggested by our investigation is that the performance ranking of a fund (PerfRank) is dependent on the independent variables: Static return (R^s), Trading return (R^{tr}), Static size (S), Large-caps overlap (O^L), mid-caps overlap (O^M) and small-caps overlap (O^s). The suggested relationship may be expressed as:

$$PerfRank = f(R^s, R^{tr}, S, O^L, O^M, O^S)$$

This study uses four non-parametric tests: the z-test, Chi-squared test, the Cross-product ratio test and Spearman's rank correlation test. Non-parametric tests are preferred over parametric tests where small sample sizes have distributional assumptions that are under doubt (Hallahan and Faff, 2001).

The z-test follows that proposed by Malkiel (1995), the Chi-squared test follows that of Kahn and Rudd (1995) and the third follows that used by Malkiel (1995) and Brown and Goetzmann (1995) who use Cross-product ratios to evaluate performance persistence. For the performance-ranked fund methodology, Spearman's rank correlations are used to indicate whether there is a relationship between a fund's performance rankings for the previous quarter and subsequent quarters.

Since our data is exposed to survivorship bias we should consider its impact on our analysis. Carpenter and Lynch (1999) note that survivorship leads to biases in persistence measures. Brown *et al*. (1992) show that survivorship imparts an upward bias to persistence measures while Brown *et al*. (1992), Grinblatt and Titman (1992) and Hendricks, Patel and Zeckhoauser (1993) argue that survivorship imparts reversals in persistence measures. There is support for the view that the negative impact of survivorship bias may be reduced. Carpenter and Lynch (1999) find that while the "…Spearman test is very powerful…", the "…Chi-squared test is the most robust to the presence of survivorship bias."

The Spearman correlations and contingency tables have been used to analyse the persistence in the relationships between performance measures and fund characteristics. The results support each other in certain instances while in other instances the evidence for significant relationships is sparse.

An analysis using contingency tables provides a measure for an entire data set which contrasts with an analysis using Spearman correlation where averages of cross-correlations are obtained. The averages of these averages are then calculated. As an aid to comparing the different outputs we conservatively segmented and summarised the evaluation of the results on the basis of "strongly" positive, "weak" positive, "weak" negative and "strongly" negative (for example, see Table 4.6 in Appendix 4). We attempt to do the same with the results for the contingency tables. Significance of the Pearson statistic and repeat winner and loser z-statistics indicates "strongly" positive, or negative while that for the Pearson statistics alone indicates "weak" positive, or negative.

The calculations of returns for the fund and the static portion are provided in Appendix 4 (with an example) and are based on the Dietz method presented in Chapter 1. Since the static portion of the portfolio is based on the share quantities that are constant for four consecutive quarters, the quantities at t and at $t-1$ will be equal. Substituting equal quantities into the formula used to calculate the fund weighted holdings-based return for each i , we have the return R^{s*} on the static quantity of a security i at t::

$$R_{it}^{s*} = \frac{1}{MVAP_t^s} \times (MV_{it}^s - MV_{i(t-1)}^s)$$

where $MVAP_t^s$ is the adjusted beginning market value at t and MV_{it}^s, $MV_{i(t-1)}^s$ are the market values of security i at t and $t-1$ respectively. The sum of the fund weighted holdings-based returns at t for the static holding of each i is the holdings-based static return for the fund with n securities in its static portion.

4.6 Results

The tables referred to in this section appear in Appendix 4. Table 4.1.2 shows a summary of the quartile averages for performance measures (Total raw return and Omega) and the measures for the fund characteristics.

Section 4.6.1 focuses on the Spearman rank correlations, Section 4.6.2 on the contingency tables and Section 4.6.3 summarizes the discussion.

4.6.1 Cross-sectional Spearman correlations

Tables 4.2.1 – 4.2.6 show the rank correlations between raw returns and a fund characteristic for the same quarter and the subsequent four quarters.

Table 4.2.1 indicates that the 9-year average contemporaneous correlation between raw returns and static returns of 60% is strongly positive. Only once, in 1998, did a negative correlation (-26%) occur.

Except for the first consecutive quarter, the number of positive correlations increased as the horizon decreased from 9 years to 3 years, while all were dominated by "weak positive" over the three different horizons and across all the subsequent quarters. The results suggest that funds that receive higher returns for their static portion are more likely to enjoy high raw returns for their total fund, and conversely. Moreover, using total raw returns to formulate expected rankings for static returns over subsequent quarters is not entirely futile. The results suggest that there is at least a 58% probability that the rankings of static raw returns over the subsequent four quarters will have a similar ranking as the funds with the prior total raw return ranking.

Table 4.2.2 highlights a weaker overall contemporaneous relationship between total raw returns and trading raw returns than that for static raw returns. However, the relative weakness does not persist over subsequent quarters. Considering the percentage positive correlations over the three different horizons and across the subsequent first and fourth quarters, the number of positive correlations between total raw returns and static raw returns is lower than that for trading raw returns. Similar to the results for Table 4.2.1, there is a greater than 50% probability that the rankings of trading raw returns over the subsequent four quarters will have a similar ranking as the funds with the prior total raw return ranking.

The results from Tables 4.2.1 and 4.2.2 must be considered in the context of the management of a fund and the sources of fund performance. Investment managers have different investment horizons and utilize different investment strategies. This results in some managers holding varying proportions of their fund as static while the quality of the static portion will also vary between funds. Other managers that rely on aggressive trading strategies to generate superior returns may hold static portions of "poor quality". The results above suggest that managers who achieve superior raw return rankings display an ability to generate superior returns through their static holding and their trading activities and that they are more likely to continue to do so for the subsequent four quarters into the future. The separate use of these two sources of return, static and trading, is considered as a fund characteristic that can be associated with the total return to the fund.

The relationship between static size and total raw returns is shown in Table 4.2.3. For the 9-year period, almost two-thirds of the contemporaneous correlations were negative (34% were positive). This inverse relationship strengthens for each of the subsequent quarters as the horizons shorten from 9 years to 3 years. This suggests that funds that enjoy higher total raw returns have lower static portions and this situation has become more acute in recent times. The implication of this result is that funds with higher proportional levels of trading are more likely to out-perform funds with lower proportional levels of trading.

The results thus far suggest that managers who maintain lower static holdings that generate higher static returns and have higher levels of trading (as a percentage of the fund) that generate higher returns, will experience higher total fund returns. This implies that superior performing funds have static portions that are smaller but that are of a better quality (better bets) and that the managers of those funds possess superior trading abilities.

The extent to which a fund's instrument weightings are the same as those for the constituents of an index is another distinguishing fund characteristic. Tables 4.2.4 – 4.2.6 indicate the association between a fund's overlap with the Top 40, mid-cap and small-cap indices and the total raw returns.

The results in Table 4.2.4 suggest an inverse relationship between total returns and the extent of a fund's overlap with the Top 40 index - similar (even stronger) to that seen for the static size. The relationship changes to a positive one with the mid-cap and small-cap indices. Over the 9-year period the number of positive contemporaneous correlations with small-caps is marginally stronger (60% for small-caps in Table4.2.6 versus 58% for mid-caps in Table 4.2.5), the 5-year horizon favours the mid-caps with 84% over the small-caps with 68% and the 3-year figure is the same for small-caps and mid-caps at 91%.

The results of Tables 4.2.1 – 4.2.6 suggest that, relative to their peers, equity funds with superior total raw returns have:

- Higher quality holdings in their static portion
- Managers with superior trading abilities
- Lower static portions
- Lower Top 40 overlaps
- Higher mid-cap overlaps
- Higher small-cap overlaps

The characteristics' contemporaneous association with total raw returns persists over the subsequent four quarters.

Tables 4.3.1 – 4.3.6 correspond to Tables 4.2.1 – 4.2.6 with total raw returns being replaced by the Omega statistic.

In Table 4.3.1, only the relationship between the Omega statistic and the subsequent first quarter's raw static returns shows a slightly more positive relationship simultaneously over the three horizons compared to that for total raw returns. The remaining results (over the subsequent two, three and four quarters) in Table 4.3.1 indicate a weaker positive relationship with static raw returns than that for total raw returns. The results at the bottom of Table 4.3.2 show that while the 9 and 5-year contemporaneous positive relationships between the Omega statistic and trading raw returns are slightly weaker than the corresponding figures in Table 4.2.2, the overall persistence in the relationship (across subsequent quarters) is higher for the Omega statistic than for total raw returns.

The results above suggest that the relationship between the unadjusted performance measure, total raw returns and its components, static and trading raw returns, is maintained when substituting the unadjusted measure for the risk-adjusted fund performance measure, Omega.

The results in Table 4.3.3 for static size show a lower number of positive correlations than those for Table 4.2.3 over the 9-year period and across the subsequent quarters for that period. This indicates a higher inverse relationship between the Omega statistic and static size. The 5 and 3-year contemporaneous Omega statistic relationships and those for the subsequent quarters in the 5-year period, show lower negative persistence than the results for raw total returns (Table 4.2.3).

The stronger inverse relationship between the Omega statistic and the Top 40 index overlap compared to that between total raw returns and the Top 40 index is shown in Table 4.3.4. Only the relationships across the subsequent quarters over the 5-year horizon show a higher number of positive correlations for the Omega statistic – a weaker, persistent inverse relationship. The results for a positive Omega and mid-cap relationship (Table 4.3.5) are largely weaker than those for the raw returns and mid-cap relationship shown in Table 4.2.5. All the correlations are "weak" and lie between –50% and +50%. The positive Omega and small-cap relationships (Table 4.3.6) are mostly weaker than those indicated in Table 4.2.6 for the 9 and 5-year periods and across the quarters in those periods. The 3-year results indicate a stronger relationship between the Omega and the small-cap index. However, as with the mid-caps, there are no correlations greater than +50% or less than –50%.

Tables 4.3.1 – 4.3.6 indicate that the signs (positive or negative) of the relationships between the Omega statistic and the fund characteristics are the same as those for the total raw returns and the fund characteristics. The sign of the relationship in both sets of relationships also persists over the subsequent quarters.

The results in earlier chapters suggest that performance evaluations based on the ranking of raw returns will be similar to those based on the Sharpe, Treynor and Sortino ratios but different to those based on the rankings of the Omega statistic and Jensen's alpha. However, the persistence in the rankings for the latter two performance measures indicates a higher level of determinism when formulating future performance expectations based on those measures.

In this analysis we observe that the rankings of total raw returns and the Omega statistics bear similar relationships with the fund characteristics. However, the Omega statistic appears to have been a better predictor of:

- future trading raw returns, static size and Top 40 overlaps over the 9-year period,
- future trading raw returns over the 5-year period and
- future trading raw returns and Top 40 overlaps over the 3-year period.

4.6.2 Contingency tables

Tables 4.4.1 – 4.4.6 in Appendix 4 show the results based on the analysis using contingency tables for raw returns and a fund characteristic for the same quarter and the subsequent four quarters. Tables 4.5.1 – 4.5.6 show results of the same analysis except that the Omega statistic is used in place of total raw returns.

The results for total raw returns and static raw returns are shown in Table 4.4.1. Over the 9-year period, the contemporaneous relationship is positive (z-value for the CPR is positive) and significant at the 1% level (p-value for Pearson statistic < 0.01). 72% of those that have total raw returns above the median also have static returns that are above the static returns' median. The z-statistic with p-value < 0.01 indicates that this relationship is significant at the 1% level. Similarly, for those below the median, the relationship is also significant at the 1% level. These relationships are maintained over the 3 and 5-year periods and across 1 quarter for all periods (albeit at a higher level of significance for the 3-year period), while evidence of persistence in the relationship dissipates rapidly across an increasing number of quarters subsequent to the first quarter.

Almost all of the contemporaneous and one quarter's relationships between total raw returns and the remaining fund characteristics are significant at the 5% level. Those that are not significant are the inverse relationship (z-value of CPR is negative) with the static size over the 9 and 5-year periods and the repeat winners and losers for the mid and small-caps over the 9-year period.

The greater amount of evidence of persistence in relationships over the three periods and across quarters is for trading raw returns, Top 40 overlap and small-caps.

Tables 4.5.1 – 4.5.6 correspond with Tables 4.4.1 – 4.4.6 but replace total raw returns with the Omega statistic. Contemporaneous relationships between the static raw returns, trading raw returns and the Top 40 overlap and the Omega statistic are significant at the 5% level with two exceptions. There is no significant relationship between the above median Omega statistics and the above median static and trading raw returns over the 3-year period. The relationship with the most support for the existence of persistence is the Top 40 overlap – after four quarters the significance of the relationship for repeat winners and losers begin to fade.

When compared with the results for total raw returns in Tables 4.4.1 – 4.4.6, the results for the Omega statistic show less evidence of persistence over the three periods and across the four quarters. However, both performance measures show significant inverse relationships that persist for 3 quarters, with the Top 40 overlap.

As mentioned in an earlier chapter, contingency tables are only valid asymptotically and are therefore subject to small sample bias. In order to avoid repetition we refer the reader to that earlier note.

4.6.3 Summary

The outputs for the parametric and non-parametric tests for total raw returns and the Omega statistic shown in Table 4.6 provide complementary evidence for the relationships between total raw returns, Omega statistics and fund characteristics. The results provide evidence that rankings of total raw returns and the Omega statistics have the following relationships with the rankings of fund characteristics:

- Positively associated with static raw returns
- Positively associated with trading raw returns

- Negatively associated with static size
- Negatively associated with an ALSI Top 40 overlap
- Positively associated with a small-cap overlap

The relationship between total raw returns and a mid-cap overlap was mostly positive but the results of the analysis using the Omega statistic were mixed and inconclusive.

The strongest relationship was the negative association between the two performance measures (total raw returns and Omega) and the Top 40 overlap. Both tests only show signs of a weakening in this relationship after a lag of four quarters.

4.7 Conclusion

Superior performing managers maintain lower static holdings that generate higher static returns, and have higher levels of trading (as a percentage of the fund). Therefore, the static portions of superior performing funds are of a better quality (better bets) and the managers of those funds possess superior trading abilities. The CJW study attributes the sustained higher performance of the static portion for winning funds to the momentum effect presented by Jegadeesh and Titmann (1993). While our findings of higher trading levels of superior funds is consistent with those of the CJW study, our results are in contrast with the findings of Khorana and Nelling (1998) who find that lower rated funds have higher turnover.

Consistent with the CJW study, we find that funds have a preference for large stocks. However, we find that superior performing funds hold a lower percentage in large stocks than inferior funds.

Equity fund performance, unadjusted or risk-adjusted, can be used to develop expectations about fund characteristics. The purpose of developing expectations for fund characteristics is so that unrealised expectations will provide a signal to investors that changes in manager or ergonomical characteristics have occurred. This in turn can be expected to alter expectations for fund performance.

4.8 References

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4.9 Appendix 4

4.9.1 Calculation of the fund return, static portion and the static return

The three sections below outline the calculations used for the total equity fund returns and the static returns for the static portion. The first section is a repeat of that found in Appendix 1 and presents the formulae used in the calculation of fund returns. The second section presents formulae used in the calculation of the static portion and its associated return. The third section uses a fictitious fund and shows examples of the calculations using data from the fund. The repetition of material in each of the sections is to allow the sections to be read in isolation.

4.9.1.1 The application of the Dietz method to performance evaluation

Let

Q_{it} = Quantity of security *i* held in the portfolio at time *t*

P_{it} = Price of security *i* held in the portfolio at time *t*

Then the Modified Dietz formula for the return for each security is:

$$R_{it} = \frac{MV_{it} - MV_{i(t-1)} - CF}{MV_{i(t-1)} + \sum (CF_i \times w_i)}$$

where

$MV_{it} = Q_{it} \times P_{it}$ = Market Value for a security,

CF is the net cash flow during the period *t* and *t-1* and

w_i is the proportion of the period for which each cash flow (CF_i) is held in the account.

The Dietz method assumes that a single cash flow occurs in the middle of the period and its value is the average of the prices at the beginning and at the end of the period, then:

$$CF = (\frac{P_{it} + P_{i(t-1)}}{2}) \times (Q_{it} - Q_{i(t-1)})$$

and the w_i in the second term in the denominator is 0.5 since the cash flow will have been in the account for half of the period.

We now have

$$R_{it} = \frac{MV_{it} - MV_{i(t-1)} - (\frac{P_{it} + P_{i(t-1)}}{2}) \times (Q_{it} - Q_{i(t-1)})}{MV_{i(t-1)} + 0.5 \times (\frac{P_{it} + P_{i(t-1)}}{2}) \times (Q_{it} - Q_{i(t-1)})}$$

Simplify the denominator in the above formula by letting the adjusted beginning market value for each security be:

$$MVA_{it} = MV_{i(t-1)} + 0.5 \times (\frac{P_{it} + P_{i(t-1)}}{2}) \times (Q_{it} - Q_{i(t-1)})$$

and the adjusted beginning market value for the fund with n securities at t :

$$MVAP_t = \sum MVA_{it}$$

The fund weighting for each security is then

$$\frac{MVA_{it}}{MVAP_t}$$

Substituting into the Dietz formula and assuming a single, mid-period cash flow gives the fund weighted holdings-based return for each i as

$$R_{it}^* = \frac{MVA_{it}}{MVAP_t} \times \frac{(MV_{it} - MV_{i(t-1)} - (\frac{P_{it} + P_{i(t-1)}}{2}) \times (Q_{it} - Q_{i(t-1)}))}{(MV_{i(t-1)} + 0.5 \times (\frac{P_{it} + P_{i(t-1)}}{2}) \times (Q_{it} - Q_{i(t-1)}))}$$

$$= \frac{1}{MVAP_t} \times (MV_{it} - MV_{i(t-1)} - (\frac{P_{it} + P_{i(t-1)}}{2}) \times (Q_{it} - Q_{i(t-1)}))$$

or

$$R_{it}^{*} = \frac{MVA_{it}}{MVAP_{t}} \times R_{it}$$

The sum of the fund weighted holdings-based returns at t for each i is the holdings-based return for the fund with n securities, i.e.

$$R_{t} = \sum R_{it}^{*} \ .$$

4.9.1.2 Static portion and static returns

We follow our earlier presentation of the Deitz method, which was applied to the calculation of total fund return, to show how it is applied to the calculation of the static portion of a fund and its associated static returns.

Let

Q_{it} = Quantity of security i held in the portfolio at time t

P_{it} = Price of security i held in the portfolio at time t

Let the static quantity for a security be:

$$Q_{it}^{s} = \min(Q_{i(t-3)}, Q_{i(t-2)}, Q_{i(t-1)}, Q_{it})$$

Since $Q_{i(t-1)}^{s} = Q_{it}^{s}$ we have:

$$MV_{it}^{s} = Q_{it}^{s} \times P_{it} \quad \text{and} \quad MV_{i(t-1)}^{s} = Q_{it}^{s} \times P_{i(t-1)}$$

and, therefore, the return on the static quantity of a security is

$$R_{it}^{s} = \frac{MV_{it}^{s} - MV_{i(t-1)}^{s} - (\frac{P_{it} + P_{i(t-1)}}{2}) \times (Q_{it}^{s} - Q_{i(t-1)}^{s})}{MV_{i(t-1)}^{s} + 0.5 \times (\frac{P_{it} + P_{i(t-1)}}{2}) \times (Q_{it}^{s} - Q_{i(t-1)}^{s})} = \frac{P_{it}}{P_{i(t-1)}} - 1$$

The adjusted beginning market value for a security is:

$$MVA_{it}^{s} = MV_{i(t-1)}^{s} + 0.5 \times (\frac{P_{it} + P_{i(t-1)}}{2}) \times (Q_{it}^{s} - Q_{i(t-1)}^{s}) = MV_{i(t-1)}^{s}$$

The fund weighted static portion (*SP*) for each security is

$$SP_{it} = \frac{MV_{i(t-1)}^{s}}{MVAP_{t}}$$

and the static portion of the fund is

$$SP_{t} = \sum SP_{it}$$

Substituting into the Dietz formula, the fund weighted static holdings-based return for each security is

$$R_{it}^{s*} = SP_{it} \times R_{it}^{s}$$

The sum of the fund weighted, static holdings-based return at *t* for each *i* is the holdings-based return for the static portion of the fund with *n* securities, i.e.

$$R_{t}^{s} = \sum R_{it}^{s*}$$

4.9.1.3 Example

Table 4.1.1 below is an extension of that found in Appendix 1 and is used to demonstrate steps taken in the calculation process for determining the static portion, the static portion returns and the total fund returns.

Suppose a fund holds three shares over the quarter ends starting in July 2005 and ending in December 2006.

The top of the table shows the quarterly quantities for the three JSE listed ordinary shares: BHP Billiton (BIL), Impala Platinum Holdings (IMP) and Remgro (REM). The second section of the table shows the share prices at each quarter-end.

The market values for each of the share holdings are shown in the third section. For example, the market value for BIL at the end of September 2005 is the number of shares held in the fund multiplied by the price of each share:

211 400 shares x 10 380 cents = 2 194 332 000 cents

The total market value for the fund at the quarter-end is 13 881 622 900 cents.

The fourth section shows the adjusted beginning market value for BIL (value in cents)

$$1829859500 = 1862952000 + 0.5 \times (\frac{10380 + 8530}{2}) \times (211400 - 218400)$$

The sum of the adjusted beginning market values for each share at the end of September 2005 is 12 245 023 525 cents.

Assuming a single, mid-period cash flow gives the holdings-based return for BIL at the end of September 2005 as:

$$21.7\% = \frac{2194332000 - 1862952000 - (\frac{10380 + 8530}{2}) \times (211400 - 218400)}{1862952000 + 0.5 \times (\frac{10380 + 8530}{2}) \times (211400 - 218400)}$$

The fund weighting of BIL is

$$14.9\% = \frac{1829859500}{12245023525}$$

and the fund weighted return for BIL is

3.2% = 14.9% x 21.7%

Table 4.1.1: Example of performance and static portion calculation

Number of shares held							
	06/2005	09/2005	12/2005	03/2006	06/2006	09/2006	12/2006
BIL	218,400	211,400	208,700	410,000	379,900	628,500	625,100
IMP	2,545,700	2,545,700	2,832,200	2,988,700	793,900	753,700	843,500
REM	682,000	805,500	860,050	951,450	635,550	438,550	338,850
Prices							
	06/2005	09/2005	12/2005	03/2006	06/2006	09/2006	12/2006
BIL	8530	10380	10390	11249	13875	13366	12895
IMP	1012	1112	1185	1415	1180	1225	1500
REM	10520	10995	12200	13500	13501	15400	17801
End of period Quantities Holding Value							
Col Totals	11,613,840,400	13,881,622,900	16,017,160,000	21,685,675,500	14,788,475,050	16,077,483,500	15,357,783,350
	06/2005	09/2005	12/2005	03/2006	06/2006	09/2006	12/2006
BIL	1,862,952,000	2,194,332,000	2,168,393,000	4,612,090,000	5,271,112,500	8,400,531,000	8,060,664,500
IMP	2,576,248,400	2,830,818,400	3,356,157,000	4,229,010,500	936,802,000	923,282,500	1,265,250,000
REM	7,174,640,000	8,856,472,500	10,492,610,000	12,844,575,000	8,580,560,550	6,753,670,000	6,031,868,850
Adjusted Beginning Market Value							
Col Totals		12,245,023,525	14,348,447,588	17,795,112,675	17,940,336,925	15,033,958,700	15,288,802,975
		09/2005	12/2005	03/2006	06/2006	09/2006	12/2006
BIL		1,829,859,500	2,180,312,250	3,257,375,675	4,423,031,900	6,964,140,650	8,378,209,150
IMP		2,576,248,400	2,995,341,025	3,457,882,000	2,805,134,000	912,631,750	984,458,750
REM		7,838,915,625	9,172,794,313	11,079,855,000	10,712,171,025	7,157,186,300	5,926,135,075
Holdings Based Returns for Total Portfolio							
Col Totals		8.2%	8.4%	11.9%	3.3%	5.3%	5.6%
		09/2005	12/2005	03/2006	06/2006	09/2006	12/2006
BIL		3.2%	0.0%	1.5%	5.8%	-1.7%	-1.9%
IMP		2.1%	1.4%	3.8%	-2.5%	0.2%	1.4%
REM		2.9%	7.0%	6.6%	0.0%	6.8%	6.1%
Static portion							
Col Totals				75.9%	67.2%	64.6%	73.4%
				03/2006	06/2006	09/2006	12/2006
BIL				12.2%	13.1%	19.3%	33.2%
IMP				17.0%	6.3%	5.9%	6.0%
REM				46.8%	47.8%	39.4%	34.1%
Static Holdings Returns							
Col Totals				9.3%	2.0%	5.1%	5.5%
				03/2006	06/2006	09/2006	12/2006
BIL				1.0%	3.1%	-0.7%	-1.2%
IMP				3.3%	-1.0%	0.2%	1.4%
REM				5.0%	0.0%	5.5%	5.3%

The sum of the fund weighted returns for the three shares is 8.2%, the return for the fund over the quarter ending in September 2005.

The static quantity for BIL is the quantity of BIL shares that were unchanged over four quarter ends. Therefore, the minimum of the quantities for the four quarters to the end of March 2006 (a different valuation date to that used in the previous example) is

min (218 400, 211 400, 208700, 410 000) = 208 700

and the fund weighted static portion for BIL is

12.2% = (208 700 x 10 390) / 17 795 112 675

(Note that the formula in the immediately prior section prescribes the use of 10390 as the relevant price and not end of period price)

The static portion of the fund is the sum of the static portions for each of the securities:

75.9% = 12.2% + 17.0% + 46.8%

Substituting into the Dietz formula, the fund weighted static holdings-based return for BIL is

1.0% = 12.2% x ((11249 / 10390) - 1)

The holdings-based return for the static portion of the fund for the quarter ending in March 2006 is the sum of the weighted holdings-based returns for each security:

9.3% = 1.0% + 3.3% + 5.0%

4.9.2 Figures and tables

Table 4.1.2: Fund performance and fund characteristics

Averages for quartiles across the three horizons

	Quartile	Performance Measures: Total return	Performance Measures: Omega Statistic	Fund Characteristics: Static Return	Trading Return	Static Size	Top 40 Overlap	Mid Cap Overlap	Small Cap Overlap
9 Years		**(Number of Funds = 18)**							
	1	3.6%	1.128	2.3%	1.3%	58.9%	32.5%	14.5%	5.4%
	2	3.0%	0.882	2.0%	1.1%	65.7%	38.4%	14.1%	4.8%
	3	2.5%	0.967	1.8%	0.8%	71.0%	49.8%	14.8%	4.6%
	4	1.7%	0.653	0.9%	0.9%	57.8%	37.9%	16.6%	7.1%
5 Years		**(Number of Funds = 35)**							
	1	5.0%	1.445	2.8%	2.2%	52.5%	25.8%	15.8%	6.9%
	2	3.1%	1.016	2.2%	0.9%	66.2%	41.5%	16.9%	5.9%
	3	2.5%	0.855	1.2%	1.2%	58.8%	51.1%	15.1%	6.0%
	4	1.6%	0.801	0.8%	0.8%	62.6%	45.6%	15.9%	5.0%
3 Years		**(Number of Funds = 43)**							
	1	6.5%	1.585	3.5%	2.9%	53.8%	27.4%	20.7%	7.7%
	2	5.1%	0.994	2.8%	2.3%	55.7%	35.3%	19.5%	8.5%
	3	4.0%	0.993	2.2%	1.8%	62.6%	46.7%	19.7%	5.6%
	4	2.7%	0.803	1.4%	1.3%	67.2%	63.2%	15.1%	3.1%

Table 4.2.1: Fund returns and static returns

Spearman's rank correlations and p-values for each quarter and the subsequent 4 quarters										
	Coinciding Quarter		1 Quarter		2 Quarters		3 Quarters		4 Quarters	
Starting date	Spearmans	p-values	Spearmans	p-values	Spearmans	p-values	Spearmans	p-values	Spearmans	p-values
03/96	48%	0.045	19%	0.454	-13%	0.615	-11%	0.674	1%	0.964
06/96	86%	0.000	18%	0.459	42%	0.085	-16%	0.536	-22%	0.370
09/96	91%	0.000	44%	0.064	21%	0.391	22%	0.352	32%	0.179
12/96	71%	0.001	-1%	0.974	1%	0.971	41%	0.081	-34%	0.154
03/97	56%	0.011	61%	0.005	-30%	0.204	39%	0.090	55%	0.014
06/97	78%	0.000	1%	0.959	13%	0.575	14%	0.566	10%	0.679
09/97	78%	0.000	4%	0.879	44%	0.052	34%	0.138	-38%	0.099
12/97	28%	0.223	74%	0.000	45%	0.040	-47%	0.031	12%	0.603
03/98	1%	0.951	-19%	0.380	19%	0.374	-15%	0.481	-36%	0.087
06/98	90%	0.000	-55%	0.006	9%	0.666	52%	0.010	-56%	0.005
09/98	-26%	0.210	17%	0.427	50%	0.013	4%	0.857	0%	1.000
12/98	35%	0.079	-1%	0.968	11%	0.577	-14%	0.492	50%	0.010
03/99	13%	0.496	0%	0.999	3%	0.896	24%	0.226	31%	0.114
06/99	83%	0.000	66%	0.000	-12%	0.538	-8%	0.683	48%	0.009
09/99	73%	0.000	-66%	0.000	-33%	0.053	42%	0.013	20%	0.249
12/99	78%	0.000	36%	0.032	-11%	0.505	7%	0.702	-9%	0.594
03/00	53%	0.001	-21%	0.225	-31%	0.066	-23%	0.182	-16%	0.350
06/00	68%	0.000	25%	0.124	54%	0.000	38%	0.019	1%	0.928
09/00	83%	0.000	46%	0.003	14%	0.365	6%	0.720	-9%	0.578
12/00	90%	0.000	47%	0.002	2%	0.908	21%	0.166	31%	0.046
03/01	87%	0.000	42%	0.006	54%	0.000	12%	0.447	15%	0.347
06/01	17%	0.272	2%	0.891	44%	0.003	25%	0.105	-36%	0.018
09/01	76%	0.000	-37%	0.015	-8%	0.626	59%	0.000	67%	0.000
12/01	72%	0.000	42%	0.005	-51%	0.000	-46%	0.002	-64%	0.000
03/02	88%	0.000	-39%	0.010	-8%	0.608	-13%	0.414	-26%	0.085
06/02	90%	0.000	56%	0.000	64%	0.000	53%	0.000	40%	0.007
09/02	90%	0.000	77%	0.000	51%	0.000	14%	0.331	57%	0.000
12/02	87%	0.000	60%	0.000	31%	0.037	56%	0.000	27%	0.071
03/03	62%	0.000	27%	0.061	48%	0.001	48%	0.001	40%	0.005
06/03	52%	0.000	-32%	0.026	23%	0.116	-14%	0.325	14%	0.337
09/03	44%	0.002	-14%	0.328	10%	0.477	-2%	0.872	-16%	0.269
12/03	32%	0.019	-30%	0.035	-3%	0.864	4%	0.790	-3%	0.846
03/04	29%	0.041	27%	0.058	-9%	0.540	16%	0.284		
06/04	77%	0.000	1%	0.940	61%	0.000				
09/04	16%	0.279	-28%	0.050						
12/04	47%	0.001								
Average	60%	0.075	13%	0.268	15%	0.328	13%	0.321	6%	0.282
9 Years										
% positive correlations	97%		62%		70%		69%		58%	
Strongly positive	24		6		5		4		3	
Weak positive	10		16		19		19		16	
Weak negative	1		11		9		10		11	
Strongly negative	0		2		1		0		2	
5 Years										
% positive correlations	100%		67%		71%		75%		60%	
Strongly positive	13		3		5		3		2	
Weak positive	6		10		8		10		8	
Weak negative	0		6		4		4		5	
Strongly negative	0		0		1		0		1	
3 Years										
% positive correlations	100%		60%		78%		75%		71%	
Strongly positive	6		3		3		2		1	
Weak positive	5		4		5		5		5	
Weak negative	0		4		2		2		2	
Strongly negative	0		0		0		0		0	

Table 4.2.2: Fund returns and trading returns

Spearman's rank correlations and p-values for each quarter and the subsequent 4 quarters										
	Coinciding Quarter		1 Quarter		2 Quarters		3 Quarters		4 Quarters	
Starting date	Spearmans	p-values	Spearmans	p-values	Spearmans	p-values	Spearmans	p-values	Spearmans	p-values
03/96	59%	0.011	-15%	0.541	19%	0.439	32%	0.192	-21%	0.407
06/96	23%	0.350	9%	0.733	6%	0.802	27%	0.277	11%	0.665
09/96	67%	0.002	32%	0.186	49%	0.033	45%	0.056	56%	0.013
12/96	53%	0.020	24%	0.311	13%	0.588	21%	0.383	24%	0.318
03/97	56%	0.011	28%	0.225	27%	0.246	-1%	0.962	0%	0.990
06/97	70%	0.001	20%	0.384	8%	0.746	58%	0.008	29%	0.208
09/97	25%	0.295	-49%	0.029	-58%	0.008	-25%	0.287	1%	0.980
12/97	72%	0.000	-34%	0.136	-34%	0.128	36%	0.110	-33%	0.149
03/98	67%	0.001	74%	0.000	-56%	0.005	19%	0.368	51%	0.013
06/98	77%	0.000	-34%	0.101	5%	0.798	46%	0.025	-45%	0.030
09/98	77%	0.000	-50%	0.012	-66%	0.000	27%	0.185	45%	0.026
12/98	84%	0.000	32%	0.116	-2%	0.925	-28%	0.164	4%	0.845
03/99	44%	0.019	-19%	0.319	-28%	0.147	-17%	0.396	-10%	0.607
06/99	65%	0.000	50%	0.006	-34%	0.068	-41%	0.028	17%	0.362
09/99	70%	0.000	-5%	0.755	-14%	0.427	58%	0.000	60%	0.000
12/99	-4%	0.805	5%	0.786	-25%	0.139	-50%	0.002	-23%	0.183
03/00	55%	0.001	-6%	0.749	29%	0.084	-7%	0.697	-23%	0.177
06/00	68%	0.000	50%	0.001	59%	0.000	37%	0.020	-2%	0.884
09/00	63%	0.000	12%	0.454	36%	0.021	29%	0.063	22%	0.163
12/00	70%	0.000	38%	0.011	18%	0.247	12%	0.460	34%	0.026
03/01	76%	0.000	29%	0.057	37%	0.016	20%	0.199	46%	0.002
06/01	36%	0.017	31%	0.041	-41%	0.006	-26%	0.094	48%	0.001
09/01	49%	0.001	26%	0.089	8%	0.619	6%	0.698	4%	0.800
12/01	45%	0.003	28%	0.070	-9%	0.555	-17%	0.279	2%	0.901
03/02	63%	0.000	-33%	0.028	-17%	0.276	-25%	0.106	-36%	0.018
06/02	76%	0.000	59%	0.000	60%	0.000	57%	0.000	33%	0.028
09/02	26%	0.076	12%	0.419	-8%	0.581	-22%	0.143	9%	0.544
12/02	77%	0.000	39%	0.008	28%	0.058	51%	0.000	34%	0.019
03/03	-24%	0.101	-13%	0.382	-40%	0.005	-35%	0.016	-36%	0.013
06/03	60%	0.000	34%	0.018	36%	0.012	25%	0.087	16%	0.280
09/03	68%	0.000	45%	0.001	28%	0.048	8%	0.600	-14%	0.338
12/03	27%	0.049	40%	0.003	13%	0.371	-9%	0.544	26%	0.076
03/04	68%	0.000	28%	0.053	-16%	0.285	41%	0.004		
06/04	74%	0.000	-45%	0.001	57%	0.000				
09/04	30%	0.035	10%	0.510						
12/04	53%	0.000								
Average	55%	0.051	13%	0.215	3%	0.255	11%	0.226	10%	0.315
9 Years										
% positive correlations	94%		71%		55%		59%		71%	
Strongly positive	24		2		3		4		3	
Weak positive	9		23		16		16		20	
Weak negative	2		10		12		12		9	
Strongly negative	0		0		3		1		0	
5 Years										
% positive correlations	95%		83%		65%		63%		73%	
Strongly positive	12		1		3		2		0	
Weak positive	6		15		9		9		12	
Weak negative	1		3		6		6		4	
Strongly negative	0		0		0		0		0	
3 Years										
% positive correlations	91%		80%		67%		63%		71%	
Strongly positive	7		1		2		2		0	
Weak positive	3		8		5		4		6	
Weak negative	1		2		3		3		2	
Strongly negative	0		0		0		0		0	

Table 4.2.3: Fund returns and static size

Spearman's rank correlations and p-values for each quarter and the subsequent 4 quarters										
	Coinciding Quarter		1 Quarter		2 Quarters		3 Quarters		4 Quarters	
Starting date	Spearmans	p-values	Spearmans	p-values	Spearmans	p-values	Spearmans	p-values	Spearmans	p-values
03/96	-16%	0.525	46%	0.056	7%	0.789	-6%	0.811	15%	0.538
06/96	37%	0.125	-1%	0.961	-9%	0.717	17%	0.501	9%	0.720
09/96	-7%	0.787	-21%	0.393	-10%	0.694	5%	0.840	-56%	0.015
12/96	-24%	0.313	-15%	0.531	11%	0.649	-47%	0.044	16%	0.510
03/97	-23%	0.318	14%	0.566	-38%	0.099	9%	0.693	-7%	0.758
06/97	-8%	0.733	-36%	0.120	17%	0.482	-43%	0.061	-49%	0.031
09/97	-29%	0.219	-13%	0.572	-69%	0.001	-70%	0.001	53%	0.018
12/97	8%	0.743	-60%	0.004	-44%	0.046	34%	0.126	-2%	0.948
03/98	-52%	0.010	-61%	0.002	55%	0.006	-21%	0.320	-46%	0.024
06/98	-53%	0.009	59%	0.003	-25%	0.229	-55%	0.006	22%	0.303
09/98	54%	0.006	-23%	0.272	-63%	0.001	26%	0.209	32%	0.117
12/98	-37%	0.063	-51%	0.008	33%	0.103	42%	0.034	11%	0.591
03/99	-30%	0.115	16%	0.425	26%	0.176	23%	0.228	18%	0.347
06/99	9%	0.634	26%	0.166	20%	0.299	19%	0.321	49%	0.007
09/99	0%	0.979	49%	0.003	23%	0.189	4%	0.820	42%	0.013
12/99	45%	0.006	10%	0.551	-3%	0.869	26%	0.118	-4%	0.826
03/00	21%	0.221	15%	0.395	41%	0.014	9%	0.585	-22%	0.189
06/00	32%	0.047	38%	0.017	23%	0.158	11%	0.500	-15%	0.368
09/00	27%	0.085	17%	0.275	11%	0.500	-14%	0.389	-12%	0.438
12/00	22%	0.163	2%	0.906	-23%	0.142	-21%	0.182	20%	0.199
03/01	11%	0.463	-15%	0.328	-18%	0.234	31%	0.042	21%	0.170
06/01	-16%	0.290	-21%	0.181	29%	0.058	22%	0.156	-37%	0.014
09/01	-21%	0.169	34%	0.027	25%	0.101	-35%	0.021	-27%	0.081
12/01	36%	0.017	8%	0.601	-30%	0.045	-37%	0.015	-44%	0.003
03/02	21%	0.175	-43%	0.004	-36%	0.015	-34%	0.022	-24%	0.124
06/02	-51%	0.000	-52%	0.000	-49%	0.001	-36%	0.015	-39%	0.009
09/02	-38%	0.009	-40%	0.006	-28%	0.056	-28%	0.058	-18%	0.222
12/02	-55%	0.000	-36%	0.014	-26%	0.082	-35%	0.016	-35%	0.015
03/03	-45%	0.002	-22%	0.126	-47%	0.001	-41%	0.004	-35%	0.016
06/03	-26%	0.073	-44%	0.002	-26%	0.066	-28%	0.051	-15%	0.309
09/03	-45%	0.001	-26%	0.073	-21%	0.140	-6%	0.686	12%	0.407
12/03	-2%	0.905	-35%	0.012	-7%	0.618	1%	0.948	-18%	0.225
03/04	-24%	0.091	3%	0.855	-12%	0.400	-11%	0.452		
06/04	-3%	0.818	-11%	0.466	-10%	0.495				
09/04	-8%	0.585	-17%	0.240						
12/04	-22%	0.130								
Average	-9%	0.277	-9%	0.262	-8%	0.249	-9%	0.281	-6%	0.267
9 Years										
% positive correlations	34%		38%		36%		47%		39%	
Strongly positive	1		1		1		0		1	
Weak positive	11		12		11		15		11	
Weak negative	19		18		20		16		19	
Strongly negative	4		4		2		2		1	
5 Years										
% positive correlations	32%		33%		24%		25%		20%	
Strongly positive	0		0		0		0		0	
Weak positive	6		6		4		4		3	
Weak negative	11		12		14		13		13	
Strongly negative	2		1		0		0		0	
3 Years										
% positive correlations	0%		10%		0%		13%		14%	
Strongly positive	0		0		0		0		0	
Weak positive	0		1		0		1		1	
Weak negative	9		9		10		8		7	
Strongly negative	2		1		0		0		0	

Table 4.2.4: Fund returns and ALSI Top 40 overlap

Spearman's rank correlations and p-values for each quarter and the subsequent 4 quarters										
	Coinciding Quarter		1 Quarter		2 Quarters		3 Quarters		4 Quarters	
Starting date	Spearmans	p-values	Spearmans	p-values	Spearmans	p-values	Spearmans	p-values	Spearmans	p-values
03/96	18%	0.469	24%	0.337	-19%	0.441	-31%	0.206	-40%	0.106
06/96	31%	0.211	-18%	0.482	-25%	0.310	-37%	0.135	-25%	0.318
09/96	-26%	0.282	-32%	0.180	-44%	0.060	-36%	0.129	-51%	0.029
12/96	-36%	0.135	-39%	0.099	-34%	0.150	-60%	0.008	10%	0.691
03/97	-34%	0.139	-17%	0.476	-50%	0.027	2%	0.919	-32%	0.168
06/97	-22%	0.358	-42%	0.064	1%	0.970	-34%	0.137	-43%	0.060
09/97	-57%	0.009	-9%	0.714	-41%	0.071	-49%	0.029	45%	0.046
12/97	-12%	0.593	-36%	0.106	-42%	0.059	45%	0.042	18%	0.420
03/98	-34%	0.104	-50%	0.015	50%	0.013	8%	0.714	-27%	0.210
06/98	-46%	0.026	54%	0.007	4%	0.848	-23%	0.285	55%	0.006
09/98	43%	0.034	2%	0.941	-21%	0.312	56%	0.004	37%	0.071
12/98	-20%	0.324	-25%	0.225	39%	0.050	21%	0.292	23%	0.261
03/99	-30%	0.117	49%	0.009	34%	0.076	19%	0.344	11%	0.592
06/99	52%	0.004	36%	0.054	25%	0.197	4%	0.816	36%	0.055
09/99	25%	0.143	34%	0.047	-3%	0.876	30%	0.077	28%	0.110
12/99	31%	0.068	-7%	0.666	36%	0.034	29%	0.085	36%	0.032
03/00	-1%	0.936	33%	0.053	32%	0.061	37%	0.029	-31%	0.064
06/00	33%	0.044	30%	0.065	36%	0.024	-27%	0.102	-21%	0.201
09/00	36%	0.021	34%	0.032	-21%	0.177	-21%	0.177	-45%	0.004
12/00	41%	0.007	-13%	0.402	-26%	0.094	-41%	0.007	69%	0.000
03/01	-14%	0.378	-25%	0.106	-45%	0.003	68%	0.000	32%	0.036
06/01	-27%	0.077	-59%	0.000	70%	0.000	40%	0.008	-79%	0.000
09/01	-65%	0.000	71%	0.000	41%	0.007	-80%	0.000	-79%	0.000
12/01	72%	0.000	47%	0.001	-82%	0.000	-80%	0.000	-80%	0.000
03/02	44%	0.003	-80%	0.000	-80%	0.000	-80%	0.000	-55%	0.000
06/02	-85%	0.000	-83%	0.000	-87%	0.000	-61%	0.000	-31%	0.038
09/02	-86%	0.000	-89%	0.000	-57%	0.000	-25%	0.088	-66%	0.000
12/02	-90%	0.000	-62%	0.000	-30%	0.040	-60%	0.000	-28%	0.058
03/03	-71%	0.000	-33%	0.023	-66%	0.000	-30%	0.038	-37%	0.010
06/03	-31%	0.028	-56%	0.000	-27%	0.063	-32%	0.024	-41%	0.003
09/03	-55%	0.000	-25%	0.090	-35%	0.015	-36%	0.012	26%	0.072
12/03	-9%	0.540	-43%	0.002	-51%	0.000	37%	0.009	-55%	0.000
03/04	-46%	0.001	-54%	0.000	45%	0.001	-64%	0.000		
06/04	-56%	0.000	47%	0.001	-67%	0.000				
09/04	49%	0.000	-64%	0.000						
12/04	-65%	0.000								
Average	-15%	0.144	-14%	0.148	-16%	0.146	-15%	0.143	-14%	0.114
9 Years										
% positive correlations	31%		32%		36%		41%		42%	
Strongly positive	2		2		2		2		2	
Weak positive	9		9		10		11		11	
Weak negative	15		16		15		13		12	
Strongly negative	9		8		7		7		7	
5 Years										
% positive correlations	32%		28%		24%		19%		20%	
Strongly positive	1		1		1		1		1	
Weak positive	5		4		3		2		2	
Weak negative	5		6		7		8		7	
Strongly negative	8		8		7		6		6	
3 Years										
% positive correlations	9%		10%		11%		13%		14%	
Strongly positive	0		0		0		0		0	
Weak positive	1		1		1		1		1	
Weak negative	3		4		4		5		5	
Strongly negative	7		6		5		3		2	

Table 4.2.5: Fund returns and mid-cap overlap

Spearman's rank correlations and p-values for each quarter and the subsequent 4 quarters										
	Coinciding Quarter		1 Quarter		2 Quarters		3 Quarters		4 Quarters	
Starting date	Spearmans	p-values	Spearmans	p-values	Spearmans	p-values	Spearmans	p-values	Spearmans	p-values
03/96	27%	0.277	-15%	0.563	3%	0.899	-12%	0.621	-18%	0.462
06/96	-12%	0.633	-22%	0.370	-37%	0.133	-35%	0.155	-32%	0.197
09/96	-9%	0.710	-20%	0.418	-28%	0.243	-19%	0.440	-5%	0.854
12/96	-17%	0.489	-31%	0.198	-25%	0.292	2%	0.925	-14%	0.556
03/97	-44%	0.053	-42%	0.065	-13%	0.590	-26%	0.264	-3%	0.911
06/97	-38%	0.097	-49%	0.029	-20%	0.389	-34%	0.147	-43%	0.061
09/97	-55%	0.013	-13%	0.581	-41%	0.075	-49%	0.028	20%	0.405
12/97	-7%	0.776	-53%	0.015	-62%	0.004	19%	0.397	19%	0.404
03/98	-10%	0.653	-26%	0.219	17%	0.425	17%	0.430	-9%	0.661
06/98	-18%	0.391	12%	0.560	22%	0.307	-6%	0.787	34%	0.103
09/98	15%	0.464	1%	0.953	-23%	0.271	12%	0.580	-3%	0.884
12/98	5%	0.790	-10%	0.613	37%	0.064	34%	0.091	-9%	0.656
03/99	16%	0.424	21%	0.272	15%	0.447	1%	0.971	-18%	0.371
06/99	-6%	0.764	-14%	0.477	10%	0.586	-4%	0.839	-13%	0.496
09/99	-15%	0.378	46%	0.006	15%	0.372	-24%	0.170	-15%	0.388
12/99	62%	0.000	23%	0.176	-38%	0.023	-21%	0.228	-21%	0.216
03/00	-20%	0.245	-19%	0.258	1%	0.962	-11%	0.529	-9%	0.598
06/00	-9%	0.606	-9%	0.570	-2%	0.889	-17%	0.311	-16%	0.322
09/00	5%	0.768	-8%	0.636	-22%	0.174	-4%	0.789	-15%	0.338
12/00	9%	0.581	-16%	0.304	-19%	0.226	-33%	0.030	-4%	0.781
03/01	11%	0.475	-2%	0.882	-8%	0.629	-10%	0.523	-6%	0.707
06/01	7%	0.640	4%	0.775	-3%	0.824	4%	0.788	4%	0.778
09/01	23%	0.126	-16%	0.285	18%	0.245	23%	0.141	46%	0.002
12/01	-25%	0.100	2%	0.893	29%	0.061	42%	0.005	28%	0.063
03/02	3%	0.871	25%	0.107	50%	0.001	35%	0.021	25%	0.106
06/02	44%	0.003	62%	0.000	53%	0.000	45%	0.002	24%	0.105
09/02	58%	0.000	52%	0.000	33%	0.024	20%	0.176	39%	0.007
12/02	47%	0.001	33%	0.026	30%	0.042	28%	0.055	28%	0.061
03/03	31%	0.030	26%	0.079	28%	0.052	30%	0.042	9%	0.528
06/03	31%	0.033	34%	0.017	49%	0.000	20%	0.169	25%	0.084
09/03	15%	0.299	31%	0.029	15%	0.298	14%	0.319	11%	0.435
12/03	39%	0.004	23%	0.109	25%	0.078	-1%	0.961	43%	0.002
03/04	8%	0.555	32%	0.025	-3%	0.828	48%	0.001		
06/04	42%	0.003	-12%	0.428	59%	0.000				
09/04	-20%	0.164	58%	0.000						
12/04	43%	0.002								
Average	7%	0.355	3%	0.313	5%	0.307	3%	0.362	3%	0.392
9 Years										
% positive correlations	57%		50%		55%		53%		45%	
Strongly positive	2		3		3		0		0	
Weak positive	18		15		16		18		15	
Weak negative	14		16		14		15		17	
Strongly negative	1		1		1		0		0	
5 Years										
% positive correlations	84%		67%		65%		69%		73%	
Strongly positive	1		3		3		0		0	
Weak positive	15		10		9		12		12	
Weak negative	3		6		6		5		4	
Strongly negative	0		0		0		0		0	
3 Years										
% positive correlations	91%		90%		89%		88%		100%	
Strongly positive	1		3		2		0		0	
Weak positive	9		7		7		8		8	
Weak negative	1		1		1		1		0	
Strongly negative	0		0		0		0		0	

Table 4.2.6: Fund returns and small-cap overlap

Spearman's rank correlations and p-values for each quarter and the subsequent 4 quarters										
	Coinciding Quarter		1 Quarter		2 Quarters		3 Quarters		4 Quarters	
Starting date	Spearmans	p-values	Spearmans	p-values	Spearmans	p-values	Spearmans	p-values	Spearmans	p-values
03/96	-35%	0.150	-49%	0.042	-31%	0.209	-28%	0.253	24%	0.333
06/96	-61%	0.009	-31%	0.212	-27%	0.275	14%	0.583	33%	0.178
09/96	-35%	0.147	-33%	0.163	8%	0.729	13%	0.588	6%	0.795
12/96	-21%	0.381	1%	0.960	7%	0.784	24%	0.322	-19%	0.427
03/97	0%	0.990	6%	0.789	29%	0.205	-31%	0.186	1%	0.980
06/97	13%	0.579	42%	0.067	-43%	0.061	12%	0.601	51%	0.023
09/97	25%	0.295	-41%	0.073	7%	0.780	41%	0.075	-24%	0.309
12/97	-26%	0.250	-6%	0.810	21%	0.354	-19%	0.415	1%	0.964
03/98	-9%	0.679	7%	0.757	-12%	0.561	7%	0.751	36%	0.082
06/98	11%	0.622	-16%	0.458	1%	0.958	30%	0.147	-7%	0.746
09/98	-18%	0.379	9%	0.664	32%	0.122	-18%	0.388	-23%	0.274
12/98	8%	0.697	33%	0.105	9%	0.662	12%	0.550	-20%	0.333
03/99	9%	0.652	23%	0.233	24%	0.219	-32%	0.098	-37%	0.055
06/99	11%	0.568	11%	0.551	-36%	0.056	-44%	0.017	-2%	0.916
09/99	18%	0.290	-52%	0.002	-46%	0.006	12%	0.480	-14%	0.420
12/99	-43%	0.009	-32%	0.060	-5%	0.764	-15%	0.388	-2%	0.892
03/00	-36%	0.032	-19%	0.274	-20%	0.246	-15%	0.393	26%	0.121
06/00	-25%	0.117	-13%	0.439	-14%	0.398	27%	0.100	29%	0.075
09/00	-21%	0.177	-35%	0.026	-4%	0.814	12%	0.444	1%	0.949
12/00	-25%	0.107	17%	0.285	13%	0.424	10%	0.513	-33%	0.036
03/01	29%	0.057	9%	0.545	25%	0.110	-26%	0.098	3%	0.826
06/01	10%	0.500	33%	0.031	-46%	0.002	-34%	0.022	41%	0.006
09/01	39%	0.010	-29%	0.061	-31%	0.045	33%	0.033	45%	0.003
12/01	-50%	0.001	-39%	0.009	42%	0.005	56%	0.000	40%	0.008
03/02	-26%	0.087	37%	0.014	55%	0.000	39%	0.010	33%	0.030
06/02	48%	0.001	68%	0.000	65%	0.000	33%	0.028	7%	0.652
09/02	66%	0.000	64%	0.000	28%	0.053	0%	0.980	45%	0.001
12/02	68%	0.000	38%	0.008	13%	0.377	52%	0.000	8%	0.577
03/03	41%	0.004	13%	0.371	54%	0.000	18%	0.217	19%	0.194
06/03	15%	0.319	51%	0.000	32%	0.025	16%	0.273	36%	0.012
09/03	42%	0.003	20%	0.168	24%	0.107	34%	0.020	1%	0.927
12/03	29%	0.033	36%	0.009	50%	0.000	-25%	0.081	64%	0.000
03/04	41%	0.003	50%	0.000	-30%	0.037	66%	0.000		
06/04	42%	0.003	-35%	0.013	64%	0.000				
09/04	-32%	0.025	65%	0.000						
12/04	62%	0.000								
Average	5%	0.234	6%	0.234	8%	0.276	8%	0.274	12%	0.379
9 Years										
% positive correlations	60%		62%		64%		66%		68%	
Strongly positive	3		4		5		3		2	
Weak positive	18		18		17		19		20	
Weak negative	13		12		12		11		10	
Strongly negative	1		1		0		0		0	
5 Years										
% positive correlations	68%		72%		71%		75%		93%	
Strongly positive	3		4		5		3		1	
Weak positive	10		10		8		10		14	
Weak negative	6		5		5		4		1	
Strongly negative	0		0		0		0		0	
3 Years										
% positive correlations	91%		90%		89%		75%		100%	
Strongly positive	3		4		4		2		1	
Weak positive	7		6		5		5		7	
Weak negative	1		1		1		2		0	
Strongly negative	0		0		0		0		0	

Table 4.3.1: Omega and static returns

Spearman's rank correlations and p-values for each quarter and the subsequent 4 quarters										
	Coinciding Quarter		1 Quarter		2 Quarters		3 Quarters		4 Quarters	
Starting date	Spearmans	p-values	Spearmans	p-values	Spearmans	p-values	Spearmans	p-values	Spearmans	p-values
03/96	-14%	0.617	21%	0.420	65%	0.008	20%	0.453	31%	0.232
06/96	15%	0.561	24%	0.337	-6%	0.818	25%	0.308	9%	0.708
09/96	25%	0.312	36%	0.139	18%	0.464	-6%	0.818	9%	0.726
12/96	51%	0.029	-1%	0.986	-7%	0.787	11%	0.644	-12%	0.621
03/97	40%	0.089	31%	0.191	8%	0.735	22%	0.363	27%	0.257
06/97	56%	0.014	34%	0.160	16%	0.519	32%	0.181	9%	0.702
09/97	12%	0.606	39%	0.091	51%	0.022	26%	0.268	-36%	0.120
12/97	32%	0.169	47%	0.039	24%	0.301	-31%	0.181	12%	0.615
03/98	68%	0.001	45%	0.041	-45%	0.044	8%	0.730	24%	0.297
06/98	67%	0.000	-68%	0.000	23%	0.267	35%	0.095	-60%	0.002
09/98	-44%	0.034	1%	0.971	24%	0.258	-71%	0.000	-58%	0.004
12/98	30%	0.143	20%	0.326	-53%	0.007	-60%	0.002	58%	0.003
03/99	43%	0.032	-56%	0.004	-59%	0.002	45%	0.026	27%	0.187
06/99	-34%	0.088	-41%	0.039	41%	0.040	18%	0.383	-15%	0.458
09/99	-18%	0.336	9%	0.649	0%	0.989	-4%	0.843	-38%	0.041
12/99	3%	0.845	7%	0.700	18%	0.311	-26%	0.124	24%	0.164
03/00	18%	0.285	5%	0.774	-32%	0.054	12%	0.475	8%	0.641
06/00	16%	0.335	-22%	0.200	22%	0.189	9%	0.613	-11%	0.506
09/00	6%	0.732	30%	0.060	16%	0.330	0%	0.981	-2%	0.922
12/00	47%	0.002	5%	0.771	-2%	0.920	-12%	0.446	24%	0.126
03/01	49%	0.001	13%	0.396	31%	0.041	3%	0.827	30%	0.048
06/01	27%	0.082	43%	0.005	30%	0.050	32%	0.038	-7%	0.665
09/01	48%	0.001	13%	0.406	26%	0.092	16%	0.308	21%	0.171
12/01	39%	0.009	34%	0.023	2%	0.919	5%	0.768	0%	0.982
03/02	48%	0.001	-9%	0.580	0%	1.000	-7%	0.641	-20%	0.195
06/02	10%	0.529	16%	0.309	9%	0.571	-8%	0.618	-22%	0.156
09/02	40%	0.007	34%	0.021	10%	0.517	-6%	0.705	28%	0.064
12/02	30%	0.043	10%	0.515	-18%	0.232	29%	0.048	-2%	0.876
03/03	17%	0.266	-9%	0.568	28%	0.061	-4%	0.771	19%	0.202
06/03	17%	0.261	35%	0.015	11%	0.445	19%	0.194	31%	0.031
09/03	42%	0.003	15%	0.309	21%	0.142	35%	0.016	-40%	0.006
12/03	19%	0.186	28%	0.051	41%	0.004	-36%	0.013	43%	0.002
03/04	20%	0.166	42%	0.003	-27%	0.063	42%	0.003		
06/04	51%	0.000	-30%	0.039	50%	0.000				
09/04	-16%	0.259	46%	0.001						
12/04	59%	0.000								
Average	25%	0.201	13%	0.290	10%	0.329	5%	0.391	4%	0.335
9 Years										
% positive correlations	89%		76%		67%		59%		55%	
Strongly positive	6		0		2		0		1	
Weak positive	25		27		21		20		17	
Weak negative	4		6		9		11		12	
Strongly negative	0		2		2		2		2	
5 Years										
% positive correlations	95%		78%		76%		56%		47%	
Strongly positive	2		0		1		0		0	
Weak positive	16		15		13		10		8	
Weak negative	1		4		4		7		8	
Strongly negative	0		0		0		0		0	
3 Years										
% positive correlations	91%		80%		78%		50%		57%	
Strongly positive	2		0		1		0		0	
Weak positive	8		9		7		5		5	
Weak negative	1		2		2		4		3	
Strongly negative	0		0		0		0		0	

Table 4.3.2: Omega and trading returns

Spearman's rank correlations and p-values for each quarter and the subsequent 4 quarters										
	Coinciding Quarter		1 Quarter		2 Quarters		3 Quarters		4 Quarters	
Starting date	Spearmans	p-values	Spearmans	p-values	Spearmans	p-values	Spearmans	p-values	Spearmans	p-values
03/96	36%	0.171	37%	0.130	62%	0.007	74%	0.001	34%	0.161
06/96	34%	0.164	42%	0.083	34%	0.169	53%	0.026	54%	0.021
09/96	9%	0.708	1%	0.966	28%	0.248	59%	0.009	55%	0.015
12/96	21%	0.375	31%	0.191	3%	0.897	31%	0.189	53%	0.021
03/97	13%	0.588	35%	0.138	38%	0.101	17%	0.462	26%	0.257
06/97	58%	0.011	68%	0.001	43%	0.060	62%	0.004	57%	0.010
09/97	-40%	0.084	-46%	0.043	-59%	0.007	-58%	0.008	-55%	0.014
12/97	0%	0.992	-8%	0.737	-10%	0.657	-2%	0.926	-21%	0.367
03/98	43%	0.051	67%	0.000	47%	0.021	67%	0.000	72%	0.000
06/98	24%	0.250	33%	0.120	29%	0.174	25%	0.239	11%	0.613
09/98	-37%	0.073	-36%	0.081	-55%	0.005	-50%	0.012	-39%	0.057
12/98	21%	0.308	30%	0.151	29%	0.155	32%	0.108	30%	0.133
03/99	6%	0.777	6%	0.760	13%	0.492	8%	0.698	12%	0.526
06/99	-9%	0.647	20%	0.288	15%	0.430	13%	0.510	14%	0.464
09/99	-9%	0.630	-3%	0.872	-8%	0.630	0%	0.985	14%	0.407
12/99	43%	0.011	47%	0.004	36%	0.032	27%	0.118	-7%	0.704
03/00	-18%	0.306	-10%	0.566	0%	0.981	16%	0.351	-13%	0.454
06/00	-5%	0.790	18%	0.266	41%	0.009	31%	0.059	32%	0.045
09/00	9%	0.592	-13%	0.419	6%	0.718	30%	0.059	16%	0.310
12/00	31%	0.052	25%	0.106	49%	0.001	39%	0.010	55%	0.000
03/01	43%	0.004	45%	0.003	51%	0.001	56%	0.000	54%	0.000
06/01	-20%	0.187	-7%	0.658	-15%	0.333	-17%	0.277	-8%	0.601
09/01	47%	0.001	58%	0.000	57%	0.000	60%	0.000	53%	0.000
12/01	16%	0.290	16%	0.292	14%	0.352	12%	0.452	19%	0.207
03/02	39%	0.009	29%	0.053	24%	0.119	19%	0.210	19%	0.212
06/02	6%	0.717	24%	0.116	15%	0.336	20%	0.184	36%	0.016
09/02	42%	0.004	33%	0.026	33%	0.024	29%	0.047	30%	0.042
12/02	27%	0.072	23%	0.116	34%	0.021	41%	0.004	57%	0.000
03/03	-5%	0.723	-14%	0.343	-16%	0.277	-29%	0.050	-39%	0.006
06/03	13%	0.389	17%	0.245	31%	0.034	44%	0.002	45%	0.001
09/03	19%	0.192	25%	0.082	44%	0.002	41%	0.003	43%	0.002
12/03	19%	0.193	24%	0.092	29%	0.042	32%	0.024	40%	0.006
03/04	6%	0.680	15%	0.302	10%	0.479	20%	0.175		
06/04	34%	0.016	26%	0.072	26%	0.077				
09/04	11%	0.447	22%	0.140						
12/04	37%	0.010								
Average	16%	0.329	19%	0.242	20%	0.232	24%	0.188	24%	0.177
9 Years										
% positive correlations	74%		76%		82%		84%		77%	
Strongly positive	1		3		2		6		9	
Weak positive	25		24		26		22		16	
Weak negative	9		8		4		4		6	
Strongly negative	0		0		2		1		1	
5 Years										
% positive correlations	84%		83%		88%		88%		87%	
Strongly positive	0		1		2		2		4	
Weak positive	16		15		14		13		10	
Weak negative	3		3		2		2		2	
Strongly negative	0		0		0		0		0	
3 Years										
% positive correlations	91%		90%		89%		88%		86%	
Strongly positive	0		0		0		0		1	
Weak positive	10		10		9		8		6	
Weak negative	1		1		1		1		1	
Strongly negative	0		0		0		0		0	

Table 4.3.3: Omega and static size

Spearman's rank correlations and p-values for each quarter and the subsequent 4 quarters										
	Coinciding Quarter		1 Quarter		2 Quarters		3 Quarters		4 Quarters	
Starting date	Spearmans	p-values	Spearmans	p-values	Spearmans	p-values	Spearmans	p-values	Spearmans	p-values
03/96	-28%	0.288	-26%	0.302	-48%	0.047	-55%	0.020	-28%	0.267
06/96	-23%	0.357	-46%	0.056	-52%	0.028	-23%	0.348	-29%	0.242
09/96	-44%	0.066	-24%	0.317	-14%	0.580	-44%	0.060	-21%	0.389
12/96	-24%	0.331	-25%	0.302	-46%	0.047	-33%	0.170	-6%	0.804
03/97	-19%	0.431	-28%	0.250	-25%	0.290	5%	0.844	-19%	0.411
06/97	-22%	0.365	-30%	0.195	-8%	0.738	-31%	0.181	-37%	0.105
09/97	-38%	0.103	-17%	0.468	-54%	0.016	-61%	0.005	-50%	0.027
12/97	-10%	0.667	-41%	0.070	-40%	0.072	-25%	0.269	-45%	0.043
03/98	-33%	0.148	-57%	0.004	-31%	0.135	-54%	0.007	-60%	0.002
06/98	-55%	0.007	-31%	0.139	-47%	0.022	-54%	0.007	-56%	0.005
09/98	-28%	0.178	-22%	0.282	-41%	0.043	-38%	0.065	-28%	0.182
12/98	-22%	0.286	-38%	0.059	-31%	0.133	-28%	0.166	-24%	0.244
03/99	-3%	0.899	-4%	0.833	-16%	0.408	-11%	0.591	-13%	0.513
06/99	-8%	0.703	-20%	0.297	-21%	0.271	-22%	0.252	-13%	0.505
09/99	-33%	0.078	-43%	0.010	-32%	0.058	-18%	0.294	-3%	0.862
12/99	-46%	0.006	-42%	0.012	-34%	0.046	-22%	0.187	10%	0.579
03/00	-45%	0.006	-36%	0.033	-23%	0.185	10%	0.558	-22%	0.190
06/00	-11%	0.525	10%	0.562	34%	0.037	27%	0.093	14%	0.400
09/00	25%	0.128	43%	0.005	40%	0.010	25%	0.122	36%	0.023
12/00	46%	0.003	36%	0.018	15%	0.321	30%	0.048	18%	0.254
03/01	35%	0.020	33%	0.029	28%	0.066	28%	0.066	25%	0.109
06/01	25%	0.110	20%	0.193	19%	0.204	19%	0.213	11%	0.475
09/01	11%	0.458	20%	0.199	22%	0.160	14%	0.378	4%	0.771
12/01	16%	0.305	17%	0.262	12%	0.456	-5%	0.761	6%	0.678
03/02	8%	0.611	2%	0.896	-14%	0.367	3%	0.837	-1%	0.943
06/02	0%	0.999	-14%	0.348	-1%	0.928	-5%	0.757	-23%	0.136
09/02	0%	0.982	2%	0.879	6%	0.697	-4%	0.775	-8%	0.593
12/02	-13%	0.374	-9%	0.549	-17%	0.252	-21%	0.151	-37%	0.012
03/03	1%	0.970	-11%	0.465	-16%	0.277	-28%	0.050	-41%	0.004
06/03	-20%	0.174	-23%	0.110	-35%	0.015	-50%	0.000	-47%	0.001
09/03	-16%	0.265	-21%	0.161	-37%	0.010	-33%	0.020	-32%	0.025
12/03	-18%	0.225	-23%	0.106	-26%	0.070	-25%	0.088	-35%	0.015
03/04	-13%	0.369	-13%	0.358	-17%	0.244	-25%	0.090		
06/04	-13%	0.374	-13%	0.390	-22%	0.126				
09/04	-18%	0.225	-27%	0.060						
12/04	-30%	0.040								
Average	-13%	0.344	-14%	0.263	-17%	0.217	-17%	0.257	-17%	0.307
9 Years										
% positive correlations	26%		26%		24%		28%		26%	
Strongly positive	0		0		0		0		0	
Weak positive	9		9		8		9		8	
Weak negative	25		25		24		20		22	
Strongly negative	1		1		2		4		2	
5 Years										
% positive correlations	47%		50%		47%		44%		47%	
Strongly positive	0		0		0		0		0	
Weak positive	9		9		8		7		7	
Weak negative	10		10		10		9		9	
Strongly negative	0		0		0		1		0	
3 Years										
% positive correlations	18%		10%		11%		0%		0%	
Strongly positive	0		0		0		0		0	
Weak positive	2		1		1		0		0	
Weak negative	9		10		9		8		8	
Strongly negative	0		0		0		1		0	

Table 4.3.4: Omega and ALSI Top 40 overlap

Spearman's rank correlations and p-values for each quarter and the subsequent 4 quarters

	Coinciding Quarter		1 Quarter		2 Quarters		3 Quarters		4 Quarters	
Starting date	Spearmans	p-values	Spearmans	p-values	Spearmans	p-values	Spearmans	p-values	Spearmans	p-values
03/96	10%	0.717	29%	0.237	-20%	0.422	-35%	0.158	-40%	0.100
06/96	28%	0.266	-18%	0.462	-33%	0.176	-38%	0.116	-17%	0.503
09/96	-15%	0.541	-23%	0.350	-33%	0.163	-24%	0.331	-39%	0.100
12/96	-22%	0.362	-30%	0.209	-24%	0.327	-35%	0.137	-47%	0.045
03/97	-10%	0.673	-5%	0.843	-22%	0.344	-19%	0.414	-38%	0.103
06/97	-5%	0.837	-22%	0.344	-25%	0.281	-40%	0.085	-48%	0.035
09/97	-22%	0.347	-18%	0.453	-42%	0.064	-49%	0.031	-36%	0.120
12/97	-22%	0.354	-41%	0.069	-51%	0.018	-43%	0.055	-37%	0.096
03/98	-36%	0.104	-55%	0.006	-33%	0.113	-39%	0.058	-46%	0.026
06/98	-49%	0.015	-32%	0.133	-34%	0.100	-40%	0.053	-30%	0.150
09/98	-45%	0.027	-25%	0.233	-41%	0.043	-27%	0.191	-10%	0.620
12/98	-18%	0.381	-40%	0.050	-31%	0.129	-24%	0.243	-22%	0.287
03/99	-45%	0.025	-33%	0.103	-18%	0.347	-14%	0.475	-5%	0.816
06/99	-25%	0.226	-13%	0.490	-15%	0.421	-8%	0.682	2%	0.913
09/99	-6%	0.739	-8%	0.656	0%	0.980	14%	0.436	26%	0.124
12/99	-13%	0.452	-4%	0.798	9%	0.601	22%	0.206	57%	0.000
03/00	-3%	0.851	12%	0.479	26%	0.125	62%	0.000	15%	0.395
06/00	10%	0.560	20%	0.226	58%	0.000	14%	0.404	15%	0.360
09/00	14%	0.410	39%	0.012	2%	0.877	14%	0.380	2%	0.891
12/00	37%	0.017	2%	0.921	21%	0.167	3%	0.853	22%	0.163
03/01	-1%	0.972	17%	0.262	1%	0.932	18%	0.245	25%	0.111
06/01	14%	0.377	-17%	0.281	0%	0.988	7%	0.673	-10%	0.503
09/01	-24%	0.110	-8%	0.622	0%	0.987	-16%	0.313	-36%	0.017
12/01	-7%	0.672	2%	0.891	-15%	0.339	-33%	0.030	-25%	0.106
03/02	2%	0.919	-15%	0.321	-35%	0.019	-26%	0.082	-28%	0.070
06/02	-17%	0.283	-43%	0.003	-32%	0.034	-34%	0.022	-51%	0.000
09/02	-36%	0.016	-30%	0.044	-26%	0.081	-41%	0.005	-50%	0.000
12/02	-31%	0.034	-28%	0.060	-42%	0.003	-51%	0.000	-66%	0.000
03/03	-33%	0.024	-49%	0.000	-56%	0.000	-63%	0.000	-74%	0.000
06/03	-49%	0.001	-55%	0.000	-63%	0.000	-72%	0.000	-68%	0.000
09/03	-47%	0.001	-55%	0.000	-63%	0.000	-59%	0.000	-60%	0.000
12/03	-56%	0.000	-68%	0.000	-65%	0.000	-63%	0.000	-68%	0.000
03/04	-71%	0.000	-71%	0.000	-67%	0.000	-76%	0.000		
06/04	-70%	0.000	-67%	0.000	-75%	0.000				
09/04	-57%	0.000	-66%	0.000						
12/04	-72%	0.000								
Average	-22%	0.323	-23%	0.273	-25%	0.267	-25%	0.202	-25%	0.208
9 Years										
% positive correlations	17%		18%		21%		25%		26%	
Strongly positive	0		0		1		1		1	
Weak positive	6		6		6		7		7	
Weak negative	24		22		20		19		17	
Strongly negative	5		7		7		6		7	
5 Years										
% positive correlations	26%		28%		29%		31%		27%	
Strongly positive	0		0		1		0		0	
Weak positive	5		5		4		5		4	
Weak negative	9		8		7		6		5	
Strongly negative	5		6		6		6		7	
3 Years										
% positive correlations	0%		0%		0%		0%		0%	
Strongly positive	0		0		0		0		0	
Weak positive	0		0		0		0		0	
Weak negative	6		5		4		3		1	
Strongly negative	5		6		6		6		7	

Table 4.3.5: Omega and mid-cap overlap

Spearman's rank correlations and p-values for each quarter and the subsequent 4 quarters										
	Coinciding Quarter		1 Quarter		2 Quarters		3 Quarters		4 Quarters	
Starting date	Spearmans	p-values	Spearmans	p-values	Spearmans	p-values	Spearmans	p-values	Spearmans	p-values
03/96	55%	0.029	58%	0.013	26%	0.288	21%	0.395	3%	0.892
06/96	30%	0.230	-7%	0.799	-15%	0.552	-20%	0.431	1%	0.984
09/96	-6%	0.818	-1%	0.986	-6%	0.820	7%	0.762	-6%	0.815
12/96	11%	0.639	6%	0.806	7%	0.762	-10%	0.673	-15%	0.541
03/97	-1%	0.968	-9%	0.699	-24%	0.315	-30%	0.202	-32%	0.171
06/97	-8%	0.737	-21%	0.382	-28%	0.224	-42%	0.064	-46%	0.041
09/97	-14%	0.542	-11%	0.658	-38%	0.100	-42%	0.064	-34%	0.139
12/97	-28%	0.231	-36%	0.111	-51%	0.020	-48%	0.029	-43%	0.055
03/98	-46%	0.037	-44%	0.033	-28%	0.185	-26%	0.216	-26%	0.225
06/98	-35%	0.099	-23%	0.283	-18%	0.405	-15%	0.489	-4%	0.863
09/98	-20%	0.358	-4%	0.858	-21%	0.314	-15%	0.472	-10%	0.633
12/98	-31%	0.137	-43%	0.034	-34%	0.098	-26%	0.193	-31%	0.117
03/99	-12%	0.579	-15%	0.469	-18%	0.353	-24%	0.216	-22%	0.249
06/99	10%	0.641	3%	0.888	-8%	0.676	-8%	0.691	-1%	0.970
09/99	-25%	0.185	-21%	0.219	-15%	0.400	-8%	0.634	-4%	0.825
12/99	-7%	0.691	10%	0.546	15%	0.388	17%	0.318	30%	0.072
03/00	-12%	0.483	-5%	0.768	2%	0.896	25%	0.140	-11%	0.512
06/00	8%	0.642	18%	0.283	40%	0.012	6%	0.724	-5%	0.770
09/00	21%	0.195	20%	0.204	-8%	0.617	-5%	0.768	-14%	0.395
12/00	15%	0.337	-12%	0.456	-4%	0.788	-25%	0.107	-20%	0.195
03/01	-11%	0.481	-4%	0.784	-19%	0.211	-11%	0.495	-5%	0.729
06/01	4%	0.811	1%	0.955	3%	0.868	5%	0.750	7%	0.639
09/01	19%	0.215	12%	0.452	12%	0.452	17%	0.278	24%	0.114
12/01	-5%	0.728	-8%	0.601	-1%	0.963	6%	0.675	-2%	0.907
03/02	-8%	0.617	2%	0.904	12%	0.450	5%	0.766	5%	0.749
06/02	-1%	0.924	17%	0.274	9%	0.572	10%	0.521	23%	0.126
09/02	5%	0.766	-1%	0.969	-5%	0.740	9%	0.536	18%	0.214
12/02	6%	0.699	3%	0.863	17%	0.248	25%	0.096	39%	0.007
03/03	-4%	0.779	10%	0.486	17%	0.253	25%	0.083	25%	0.087
06/03	11%	0.474	17%	0.244	25%	0.092	21%	0.140	19%	0.189
09/03	-10%	0.500	-2%	0.889	-5%	0.751	-6%	0.660	7%	0.622
12/03	-5%	0.730	-2%	0.891	-2%	0.918	9%	0.518	25%	0.088
03/04	-2%	0.907	-4%	0.781	4%	0.783	14%	0.325		
06/04	-3%	0.812	-1%	0.967	22%	0.138				
09/04	12%	0.403	19%	0.191						
12/04	17%	0.251								
Average	-2%	0.526	-2%	0.564	-4%	0.460	-4%	0.407	-3%	0.435
9 Years										
% positive correlations	37%		38%		39%		47%		39%	
Strongly positive	0		0		0		0		0	
Weak positive	13		13		13		15		12	
Weak negative	22		22		20		18		20	
Strongly negative	0		0		1		0		0	
5 Years										
% positive correlations	53%		56%		59%		75%		67%	
Strongly positive	0		0		0		0		0	
Weak positive	10		10		10		12		10	
Weak negative	9		9		8		5		6	
Strongly negative	0		0		0		0		0	
3 Years										
% positive correlations	45%		50%		67%		88%		100%	
Strongly positive	0		0		0		0		0	
Weak positive	5		5		6		7		7	
Weak negative	6		6		4		2		1	
Strongly negative	0		0		0		0		0	

Table 4.3.6: Omega and small-cap overlap

Spearman's rank correlations and p-values for each quarter and the subsequent 4 quarters										
	Coinciding Quarter		1 Quarter		2 Quarters		3 Quarters		4 Quarters	
Starting date	Spearmans	p-values	Spearmans	p-values	Spearmans	p-values	Spearmans	p-values	Spearmans	p-values
03/96	-8%	0.780	-10%	0.705	7%	0.770	3%	0.899	10%	0.689
06/96	-11%	0.650	0%	0.993	1%	0.970	-2%	0.948	-2%	0.934
09/96	10%	0.696	1%	0.960	0%	0.997	-2%	0.951	3%	0.897
12/96	-4%	0.888	-6%	0.820	0%	1.000	4%	0.868	-4%	0.865
03/97	-6%	0.815	4%	0.857	5%	0.844	-11%	0.658	-9%	0.695
06/97	19%	0.433	4%	0.874	-7%	0.782	-6%	0.811	0%	0.985
09/97	-5%	0.851	-25%	0.290	-14%	0.555	-9%	0.705	-12%	0.621
12/97	-34%	0.148	-17%	0.452	-15%	0.517	-18%	0.445	-14%	0.550
03/98	-32%	0.156	-17%	0.415	-14%	0.505	-19%	0.382	-11%	0.612
06/98	-21%	0.334	-25%	0.240	-24%	0.250	-15%	0.471	-19%	0.369
09/98	-4%	0.844	1%	0.965	-2%	0.908	-12%	0.579	-18%	0.390
12/98	-9%	0.681	0%	0.988	4%	0.857	1%	0.956	-3%	0.867
03/99	-1%	0.963	2%	0.929	10%	0.604	4%	0.824	-4%	0.833
06/99	3%	0.879	7%	0.706	1%	0.942	-7%	0.710	-6%	0.769
09/99	7%	0.730	22%	0.195	10%	0.584	4%	0.805	-1%	0.969
12/99	12%	0.488	13%	0.463	10%	0.545	6%	0.742	-9%	0.581
03/00	10%	0.579	5%	0.790	2%	0.919	-9%	0.582	2%	0.897
06/00	-8%	0.648	-13%	0.419	-20%	0.222	-10%	0.559	-4%	0.800
09/00	-19%	0.252	-25%	0.113	-27%	0.086	-29%	0.065	-30%	0.060
12/00	-14%	0.384	-9%	0.567	-18%	0.260	-14%	0.381	-18%	0.245
03/01	3%	0.825	-6%	0.715	-5%	0.747	-10%	0.504	-4%	0.803
06/01	1%	0.924	-2%	0.905	-5%	0.749	-5%	0.757	9%	0.577
09/01	5%	0.740	4%	0.823	3%	0.826	14%	0.368	14%	0.383
12/01	-2%	0.916	-5%	0.765	8%	0.588	9%	0.557	16%	0.303
03/02	7%	0.657	19%	0.215	21%	0.180	27%	0.077	26%	0.094
06/02	8%	0.598	23%	0.135	21%	0.161	18%	0.240	28%	0.067
09/02	24%	0.111	24%	0.111	19%	0.200	26%	0.075	34%	0.021
12/02	19%	0.189	18%	0.236	26%	0.080	33%	0.025	44%	0.002
03/03	0%	0.977	11%	0.454	19%	0.206	25%	0.081	41%	0.004
06/03	22%	0.125	31%	0.031	34%	0.018	37%	0.008	35%	0.014
09/03	16%	0.274	25%	0.085	30%	0.037	29%	0.046	35%	0.015
12/03	22%	0.131	30%	0.036	30%	0.039	32%	0.028	37%	0.011
03/04	32%	0.022	33%	0.020	36%	0.011	41%	0.004		
06/04	23%	0.116	26%	0.068	33%	0.024				
09/04	32%	0.028	41%	0.004						
12/04	39%	0.006								
Average	4%	0.538	5%	0.496	5%	0.500	4%	0.488	5%	0.498
9 Years										
% positive correlations	57%		65%		61%		50%		45%	
Strongly positive	0		0		0		0		0	
Weak positive	20		23		21		17		15	
Weak negative	15		12		12		16		17	
Strongly negative	0		0		0		0		0	
5 Years										
% positive correlations	74%		67%		71%		69%		73%	
Strongly positive	0		0		0		0		0	
Weak positive	14		13		13		12		12	
Weak negative	5		6		5		5		4	
Strongly negative	0		0		0		0		0	
3 Years										
% positive correlations	91%		100%		100%		100%		100%	
Strongly positive	0		0		0		0		0	
Weak positive	10		11		10		9		8	
Weak negative	1		0		0		0		0	
Strongly negative	0		0		0		0		0	

	Table 4.4.1: Fund returns & static returns					**Table 4.4.2: Fund returns & trading returns**				
9 years	Coinciding	1 Quarter	2 Quarters	3 Quarters	4 Quarters	Coinciding	1 Quarter	2 Quarters	3 Quarters	4 Quarters
No of WW	460	344	306	306	285	438	330	310	299	280
No of LL	478	361	320	321	299	456	350	329	311	291
No of WL	180	269	282	258	255	202	283	278	265	260
No of LW	180	269	283	257	254	202	280	274	267	262
N	1298	1243	1191	1142	1093	1298	1243	1191	1142	1093
Stdev	12%	11%	12%	12%	12%	12%	11%	12%	12%	12%
CPR	6.79	1.72	1.23	1.48	1.32	4.89	1.46	1.34	1.31	1.20
z	15.44	4.72	1.76	3.30	2.26	13.25	3.31	2.51	2.30	1.48
p-value for z	0.00	0.00	0.08	0.00	0.02	0.00	0.00	0.01	0.02	0.14
% WW	35%	28%	26%	27%	26%	34%	27%	26%	26%	26%
%LL	37%	29%	27%	28%	27%	35%	28%	28%	27%	27%
Pearson Statistic	257.26	22.38	3.11	10.95	5.12	184.86	10.96	6.32	5.31	2.19
p-value for Pearson	0.00	0.00	0.08	0.00	0.02	0.00	0.00	0.01	0.02	0.14
Yates adjustment	174.32	19.00	2.74	9.48	4.48	131.26	9.50	5.51	4.68	1.91
p-value for Yates	0.00	0.00	0.10	0.00	0.03	0.00	0.00	0.02	0.03	0.17
Repeat Winner z	11.07	3.03	0.99	2.02	1.29	9.33	1.90	1.32	1.43	0.86
p-value for RW	0.00	0.00	0.32	0.04	0.20	0.00	0.06	0.19	0.15	0.39
RW	72%	56%	52%	54%	53%	68%	54%	53%	53%	52%
Repeat Loser z	11.62	3.67	1.51	2.66	1.91	9.90	2.79	2.24	1.83	1.23
p-value for RL	0.00	0.00	0.13	0.01	0.06	0.00	0.01	0.03	0.07	0.22
RL	73%	57%	53%	56%	54%	69%	56%	55%	54%	53%
5 years	Coinciding	1 Quarter	2 Quarters	3 Quarters	4 Quarters	Coinciding	1 Quarter	2 Quarters	3 Quarters	4 Quarters
No of WW	330	242	217	198	187	303	241	228	213	188
No of LL	342	253	223	203	190	315	251	237	218	188
No of WL	122	183	183	178	165	149	184	172	163	164
No of LW	122	183	186	181	169	149	185	172	166	171
N	916	861	809	760	711	916	861	809	760	711
Stdev	15%	14%	14%	15%	15%	14%	14%	14%	15%	15%
CPR	7.58	1.83	1.42	1.25	1.27	4.30	1.78	1.83	1.72	1.26
z	13.55	4.38	2.49	1.52	1.61	10.34	4.17	4.24	3.69	1.54
p-value for z	0.00	0.00	0.01	0.13	0.11	0.00	0.00	0.00	0.00	0.12
% WW	36%	28%	27%	26%	26%	33%	28%	28%	28%	26%
%LL	37%	29%	28%	27%	27%	34%	29%	29%	29%	26%
Pearson Statistic	199.90	19.29	6.23	2.32	2.60	111.72	17.54	18.07	13.69	2.37
p-value for Pearson	0.00	0.00	0.01	0.13	0.11	0.00	0.00	0.00	0.00	0.12
Yates adjustment	133.21	16.05	5.39	1.99	2.23	80.69	14.70	15.04	11.57	2.05
p-value for Yates	0.00	0.00	0.02	0.16	0.14	0.00	0.00	0.00	0.00	0.15
Repeat Winner z	9.78	2.86	1.70	1.03	1.17	7.24	2.76	2.80	2.58	1.28
p-value for RW	0.00	0.00	0.09	0.30	0.24	0.00	0.01	0.01	0.01	0.20
RW	73%	57%	54%	53%	53%	67%	57%	57%	57%	53%
Repeat Loser z	10.21	3.35	1.83	1.12	1.11	7.71	3.16	3.21	2.65	0.90
p-value for RL	0.00	0.00	0.07	0.26	0.27	0.00	0.00	0.00	0.01	0.37
RL	74%	58%	55%	53%	53%	68%	58%	58%	57%	52%
3 years	Coinciding	1 Quarter	2 Quarters	3 Quarters	4 Quarters	Coinciding	1 Quarter	2 Quarters	3 Quarters	4 Quarters
No of WW	207	147	125	111	101	188	146	143	116	109
No of LL	215	153	129	114	102	196	152	147	119	111
No of WL	80	113	110	100	86	99	114	92	95	78
No of LW	80	114	111	101	88	99	115	93	96	79
N	582	527	475	426	377	582	527	475	426	377
Stdev	19%	18%	18%	19%	21%	17%	18%	19%	19%	21%
CPR	6.95	1.75	1.32	1.25	1.36	3.76	1.69	2.46	1.51	1.96
z	10.44	3.17	1.51	1.16	1.49	7.57	2.99	4.78	2.13	3.23
p-value for z	0.00	0.00	0.13	0.25	0.14	0.00	0.00	0.00	0.03	0.00
% WW	36%	28%	26%	26%	27%	32%	28%	30%	27%	29%
%LL	37%	29%	27%	27%	27%	34%	29%	31%	28%	29%
Pearson Statistic	117.89	10.10	2.29	1.35	2.23	59.40	9.02	23.20	4.54	10.53
p-value for Pearson	0.00	0.00	0.13	0.25	0.14	0.00	0.00	0.00	0.03	0.00
Yates adjustment	78.96	8.31	1.88	1.07	1.80	43.44	7.45	18.17	3.73	8.43
p-value for Yates	0.00	0.00	0.17	0.30	0.18	0.00	0.01	0.00	0.05	0.00
Repeat Winner z	7.50	2.11	0.98	0.76	1.10	5.25	1.98	3.33	1.45	2.27
p-value for RW	0.00	0.03	0.33	0.45	0.27	0.00	0.05	0.00	0.15	0.02
RW	72%	57%	53%	53%	54%	66%	56%	61%	55%	58%
Repeat Loser z	7.86	2.39	1.16	0.89	1.02	5.65	2.26	3.49	1.57	2.32
p-value for RL	0.00	0.02	0.25	0.38	0.31	0.00	0.02	0.00	0.12	0.02
RL	73%	57%	54%	53%	54%	66%	57%	61%	55%	58%

	Table 4.4.3: Fund returns & static size					Table 4.4.4: Fund returns & ALSI Top 40 overlap				
9 years	Coinciding	1 Quarter	2 Quarters	3 Quarters	4 Quarters	Coinciding	1 Quarter	2 Quarters	3 Quarters	4 Quarters
No of WW	300	283	278	280	270	273	267	253	251	248
No of LL	318	290	275	270	256	291	281	261	257	253
No of WL	340	330	310	284	270	367	346	335	313	292
No of LW	340	340	328	308	297	367	349	342	321	300
N	1298	1243	1191	1142	1093	1298	1243	1191	1142	1093
Stdev	11%	11%	12%	12%	12%	11%	11%	12%	12%	12%
CPR	0.83	0.73	0.75	0.86	0.86	0.59	0.62	0.58	0.64	0.72
z	-1.73	-2.75	-2.45	-1.23	-1.23	-4.71	-4.16	-4.71	-3.72	-2.75
p-value for z	0.08	0.01	0.01	0.22	0.22	0.00	0.00	0.00	0.00	0.01
% WW	23%	23%	23%	25%	25%	21%	21%	21%	22%	23%
%LL	24%	23%	23%	24%	23%	22%	23%	22%	23%	23%
Pearson Statistic	2.99	7.56	6.03	1.52	1.50	22.34	17.42	22.32	13.90	7.57
p-value for Pearson	0.08	0.01	0.01	0.22	0.22	0.00	0.00	0.00	0.00	0.01
Yates adjustment	2.90	7.89	6.30	1.47	1.47	24.76	19.06	25.20	15.16	7.92
p-value for Yates	0.09	0.00	0.01	0.23	0.23	0.00	0.00	0.00	0.00	0.00
Repeat Winner z	-1.58	-1.90	-1.32	-0.17	0.00	-3.72	-3.19	-3.38	-2.61	-1.89
p-value for RW	0.11	0.06	0.19	0.87	1.00	0.00	0.00	0.00	0.01	0.06
RW	47%	46%	47%	50%	50%	43%	44%	43%	45%	46%
Repeat Loser z	-0.86	-1.99	-2.16	-1.58	-1.74	-2.96	-2.71	-3.30	-2.66	-2.00
p-value for RL	0.39	0.05	0.03	0.11	0.08	0.00	0.01	0.00	0.01	0.05
RL	48%	46%	46%	47%	46%	44%	45%	43%	44%	46%
5 years	Coinciding	1 Quarter	2 Quarters	3 Quarters	4 Quarters	Coinciding	1 Quarter	2 Quarters	3 Quarters	4 Quarters
No of WW	213	194	181	175	167	186	177	160	157	151
No of LL	225	203	188	184	177	198	189	170	167	161
No of WL	239	231	219	201	185	266	248	240	219	201
No of LW	239	233	221	200	182	266	247	239	217	198
N	916	861	809	760	711	916	861	809	760	711
Stdev	13%	14%	14%	15%	15%	13%	14%	14%	15%	15%
CPR	0.84	0.73	0.70	0.80	0.88	0.52	0.55	0.47	0.55	0.61
z	-1.33	-2.28	-2.50	-1.53	-0.87	-4.87	-4.39	-5.21	-4.05	-3.26
p-value for z	0.18	0.02	0.01	0.13	0.39	0.00	0.00	0.00	0.00	0.00
% WW	23%	23%	22%	23%	23%	20%	21%	20%	21%	21%
%LL	25%	24%	23%	24%	25%	22%	22%	21%	22%	23%
Pearson Statistic	1.76	5.23	6.24	2.33	0.75	23.97	19.38	27.50	16.55	10.68
p-value for Pearson	0.18	0.02	0.01	0.13	0.39	0.00	0.00	0.00	0.00	0.00
Yates adjustment	1.64	5.29	6.42	2.21	0.64	27.46	21.77	32.36	18.43	11.41
p-value for Yates	0.20	0.02	0.01	0.14	0.42	0.00	0.00	0.00	0.00	0.00
Repeat Winner z	-1.22	-1.79	-1.90	-1.34	-0.96	-3.76	-3.44	-4.00	-3.20	-2.67
p-value for RW	0.22	0.07	0.06	0.18	0.34	0.00	0.00	0.00	0.00	0.01
RW	47%	46%	45%	47%	47%	41%	42%	40%	42%	43%
Repeat Loser z	-0.65	-1.44	-1.63	-0.82	-0.26	-3.16	-2.78	-3.41	-2.55	-1.95
p-value for RL	0.52	0.15	0.10	0.41	0.79	0.00	0.01	0.00	0.01	0.05
RL	48%	47%	46%	48%	49%	43%	43%	42%	43%	45%
3 years	Coinciding	1 Quarter	2 Quarters	3 Quarters	4 Quarters	Coinciding	1 Quarter	2 Quarters	3 Quarters	4 Quarters
No of WW	120	104	91	84	78	98	90	75	70	67
No of LL	128	112	99	91	83	106	98	80	74	70
No of WL	167	156	144	127	109	189	170	160	141	120
No of LW	167	155	141	124	107	189	169	160	141	120
N	582	527	475	426	377	582	527	475	426	377
Stdev	17%	18%	19%	20%	21%	17%	18%	20%	20%	21%
CPR	0.55	0.48	0.44	0.49	0.56	0.29	0.31	0.23	0.26	0.33
z	-3.56	-4.12	-4.34	-3.67	-2.83	-7.10	-6.49	-7.41	-6.56	-5.24
p-value for z	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
% WW	21%	20%	19%	20%	21%	17%	17%	16%	16%	18%
%LL	22%	21%	21%	21%	22%	18%	19%	17%	17%	19%
Pearson Statistic	12.75	17.18	19.06	13.60	8.04	52.11	43.35	57.37	44.74	28.16
p-value for Pearson	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Yates adjustment	14.07	19.74	22.30	15.33	8.58	71.63	58.16	84.88	63.67	36.96
p-value for Yates	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Repeat Winner z	-2.77	-3.22	-3.46	-2.96	-2.27	-5.37	-4.96	-5.54	-4.89	-3.88
p-value for RW	0.01	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00
RW	42%	40%	39%	40%	42%	34%	35%	32%	33%	36%
Repeat Loser z	-2.27	-2.63	-2.71	-2.25	-1.74	-4.83	-4.35	-5.16	-4.57	-3.63
p-value for RL	0.02	0.01	0.01	0.02	0.08	0.00	0.00	0.00	0.00	0.00
RL	43%	42%	41%	42%	44%	36%	37%	33%	34%	37%

Table 4.4.5: Fund returns & mid-caps overlap

9 years	Coinciding	1 Quarter	2 Quarters	3 Quarters	4 Quarters
No of WW	336	324	327	296	272
No of LL	354	337	335	298	271
No of WL	304	289	261	268	268
No of LW	304	293	268	280	282
N	1298	1243	1191	1142	1093
Stdev	11%	11%	12%	12%	12%
CPR	1.29	1.29	1.57	1.18	0.98
z	2.27	2.24	3.85	1.36	-0.21
p-value for z	0.02	0.03	0.00	0.17	0.84
% WW	26%	26%	27%	26%	25%
%LL	27%	27%	28%	26%	25%
Pearson Statistic	5.15	5.01	14.85	1.86	0.04
p-value for Pearson	0.02	0.03	0.00	0.17	0.84
Yates adjustment	4.55	4.44	12.95	1.65	0.02
p-value for Yates	0.03	0.04	0.00	0.20	0.88
Repeat Winner z	1.26	1.41	2.72	1.18	0.17
p-value for RW	0.21	0.16	0.01	0.24	0.86
RW	53%	53%	56%	52%	50%
Repeat Loser z	1.95	1.75	2.73	0.75	-0.47
p-value for RL	0.05	0.08	0.01	0.45	0.64
RL	54%	53%	56%	52%	49%
5 years	**Coinciding**	**1 Quarter**	**2 Quarters**	**3 Quarters**	**4 Quarters**
No of WW	248	237	233	202	182
No of LL	260	247	242	208	187
No of WL	204	188	167	174	170
No of LW	204	189	167	176	172
N	916	861	809	760	711
Stdev	13%	14%	14%	15%	15%
CPR	1.55	1.65	2.02	1.37	1.16
z	3.29	3.63	4.93	2.17	1.01
p-value for z	0.00	0.00	0.00	0.03	0.31
% WW	27%	28%	29%	27%	26%
%LL	28%	29%	30%	27%	26%
Pearson Statistic	10.89	13.27	24.55	4.73	1.02
p-value for Pearson	0.00	0.00	0.00	0.03	0.31
Yates adjustment	9.30	11.25	20.09	4.08	0.84
p-value for Yates	0.00	0.00	0.00	0.04	0.36
Repeat Winner z	2.07	2.38	3.30	1.44	0.64
p-value for RW	0.04	0.02	0.00	0.15	0.52
RW	55%	56%	58%	54%	52%
Repeat Loser z	2.60	2.78	3.71	1.63	0.79
p-value for RL	0.01	0.01	0.00	0.10	0.43
RL	56%	57%	59%	54%	52%
3 years	**Coinciding**	**1 Quarter**	**2 Quarters**	**3 Quarters**	**4 Quarters**
No of WW	166	158	146	118	102
No of LL	174	163	150	121	104
No of WL	121	102	89	93	85
No of LW	121	104	90	94	86
N	582	527	475	426	377
Stdev	17%	18%	19%	20%	21%
CPR	1.97	2.43	2.73	1.63	1.45
z	4.04	4.97	5.31	2.51	1.80
p-value for z	0.00	0.00	0.00	0.01	0.07
% WW	29%	30%	31%	28%	27%
%LL	30%	31%	32%	28%	28%
Pearson Statistic	16.47	25.08	28.81	6.34	3.25
p-value for Pearson	0.00	0.00	0.00	0.01	0.07
Yates adjustment	13.34	19.77	22.19	5.20	2.64
p-value for Yates	0.00	0.00	0.00	0.02	0.10
Repeat Winner z	2.66	3.47	3.72	1.72	1.24
p-value for RW	0.01	0.00	0.00	0.09	0.21
RW	58%	61%	62%	56%	55%
Repeat Loser z	3.09	3.61	3.87	1.84	1.31
p-value for RL	0.00	0.00	0.00	0.07	0.19
RL	59%	61%	63%	56%	55%

Table 4.4.6: Fund returns & small-caps overlap

9 years	Coinciding	1 Quarter	2 Quarters	3 Quarters	4 Quarters
No of WW	338	331	316	305	287
No of LL	357	352	334	318	295
No of WL	299	280	271	258	253
No of LW	301	278	268	259	256
N	1295	1241	1189	1140	1091
Stdev	11%	11%	12%	12%	12%
CPR	1.34	1.50	1.45	1.45	1.31
z	2.63	3.53	3.21	3.13	2.21
p-value for z	0.01	0.00	0.00	0.00	0.03
% WW	26%	27%	27%	27%	26%
%LL	28%	28%	28%	28%	27%
Pearson Statistic	6.93	12.53	10.32	9.83	4.88
p-value for Pearson	0.01	0.00	0.00	0.00	0.03
Yates adjustment	6.11	10.81	8.94	8.57	4.31
p-value for Yates	0.01	0.00	0.00	0.00	0.04
Repeat Winner z	1.55	2.06	1.86	1.98	1.46
p-value for RW	0.12	0.04	0.06	0.05	0.14
RW	53%	54%	54%	54%	53%
Repeat Loser z	2.18	2.95	2.69	2.46	1.66
p-value for RL	0.03	0.00	0.01	0.01	0.10
RL	54%	56%	55%	55%	54%
5 years	**Coinciding**	**1 Quarter**	**2 Quarters**	**3 Quarters**	**4 Quarters**
No of WW	251	246	234	221	207
No of LL	264	257	241	223	205
No of WL	198	177	165	154	145
No of LW	200	179	167	160	152
N	913	859	807	758	709
Stdev	13%	14%	14%	15%	15%
CPR	1.67	2.00	2.05	2.00	1.93
z	3.86	4.99	5.01	4.70	4.30
p-value for z	0.00	0.00	0.00	0.00	0.00
% WW	27%	29%	29%	29%	29%
%LL	29%	30%	30%	29%	29%
Pearson Statistic	14.95	25.12	25.32	22.31	18.68
p-value for Pearson	0.00	0.00	0.00	0.00	0.00
Yates adjustment	12.65	20.65	20.78	18.56	15.71
p-value for Yates	0.00	0.00	0.00	0.00	0.00
Repeat Winner z	2.50	3.35	3.45	3.46	3.30
p-value for RW	0.01	0.00	0.00	0.00	0.00
RW	56%	58%	59%	59%	59%
Repeat Loser z	2.97	3.74	3.66	3.22	2.81
p-value for RL	0.00	0.00	0.00	0.00	0.01
RL	57%	59%	59%	58%	57%
3 years	**Coinciding**	**1 Quarter**	**2 Quarters**	**3 Quarters**	**4 Quarters**
No of WW	178	164	155	139	121
No of LL	186	170	157	138	118
No of WL	108	95	80	72	66
No of LW	109	97	82	76	71
N	581	526	474	425	376
Stdev	17%	18%	19%	20%	21%
CPR	2.81	3.03	3.71	3.51	3.05
z	6.03	6.11	6.77	6.16	5.20
p-value for z	0.00	0.00	0.00	0.00	0.00
% WW	31%	31%	33%	33%	32%
%LL	32%	32%	33%	32%	31%
Pearson Statistic	37.15	38.31	47.47	39.18	27.71
p-value for Pearson	0.00	0.00	0.00	0.00	0.00
Yates adjustment	28.50	29.10	35.11	29.48	21.39
p-value for Yates	0.00	0.00	0.00	0.00	0.00
Repeat Winner z	4.14	4.29	4.89	4.61	4.02
p-value for RW	0.00	0.00	0.00	0.00	0.00
RW	62%	63%	66%	66%	65%
Repeat Loser z	4.48	4.47	4.85	4.24	3.42
p-value for RL	0.00	0.00	0.00	0.00	0.00
RL	63%	64%	66%	64%	62%

	Table 4.5.1: Omega & static returns					**Table 4.5.2: Omega & trading returns**				
9 years	Coinciding	1 Quarter	2 Quarters	3 Quarters	4 Quarters	Coinciding	1 Quarter	2 Quarters	3 Quarters	4 Quarters
No of WW	348	325	303	278	262	328	299	280	266	248
No of LL	364	340	318	294	275	352	318	292	278	258
No of WL	268	267	265	266	258	288	293	288	278	272
No of LW	270	269	266	265	259	282	291	292	281	276
N	1250	1201	1152	1103	1054	1250	1201	1152	1103	1054
Stdev	11%	12%	12%	12%	12%	11%	12%	12%	12%	12%
CPR	1.75	1.54	1.37	1.16	1.08	1.42	1.12	0.97	0.95	0.85
z	4.90	3.71	2.64	1.23	0.61	3.10	0.94	-0.24	-0.46	-1.30
p-value for z	0.00	0.00	0.01	0.22	0.54	0.00	0.35	0.81	0.65	0.19
% WW	28%	27%	26%	25%	25%	26%	25%	24%	24%	24%
%LL	29%	28%	28%	27%	26%	28%	26%	25%	25%	24%
Pearson Statistic	24.17	13.82	7.00	1.51	0.37	9.61	0.89	0.06	0.21	1.68
p-value for Pearson	0.00	0.00	0.01	0.22	0.54	0.00	0.35	0.81	0.65	0.19
Yates adjustment	20.50	11.96	6.13	1.29	0.29	8.31	0.75	0.03	0.16	1.58
p-value for Yates	0.00	0.00	0.01	0.26	0.59	0.00	0.39	0.86	0.69	0.21
Repeat Winner z	3.22	2.38	1.59	0.51	0.18	1.61	0.25	-0.34	-0.51	-1.05
p-value for RW	0.00	0.02	0.11	0.61	0.86	0.11	0.81	0.74	0.61	0.29
RW	56%	55%	53%	51%	50%	53%	51%	49%	49%	48%
Repeat Loser z	3.73	2.88	2.15	1.23	0.69	2.78	1.09	0.00	-0.13	-0.78
p-value for RL	0.00	0.00	0.03	0.22	0.49	0.01	0.27	1.00	0.90	0.44
RL	57%	56%	54%	53%	51%	56%	52%	50%	50%	48%
5 years	Coinciding	1 Quarter	2 Quarters	3 Quarters	4 Quarters	Coinciding	1 Quarter	2 Quarters	3 Quarters	4 Quarters
No of WW	252	228	209	197	184	243	218	202	190	171
No of LL	261	235	213	199	183	253	226	208	191	172
No of WL	189	189	184	172	161	198	199	191	179	174
No of LW	190	191	188	177	168	198	200	193	185	179
N	892	843	794	745	696	892	843	794	745	696
Stdev	14%	14%	14%	15%	15%	13%	14%	14%	15%	15%
CPR	1.83	1.48	1.29	1.29	1.24	1.57	1.24	1.14	1.10	0.94
z	4.47	2.85	1.77	1.72	1.44	3.34	1.55	0.92	0.62	-0.38
p-value for z	0.00	0.00	0.08	0.09	0.15	0.00	0.12	0.36	0.53	0.71
% WW	28%	27%	26%	26%	26%	27%	26%	25%	26%	25%
%LL	29%	28%	27%	27%	26%	28%	27%	26%	26%	25%
Pearson Statistic	20.11	8.16	3.15	2.97	2.08	11.19	2.39	0.85	0.39	0.14
p-value for Pearson	0.00	0.00	0.08	0.08	0.15	0.00	0.12	0.36	0.53	0.71
Yates adjustment	16.81	7.04	2.73	2.57	1.79	9.55	2.06	0.70	0.30	0.09
p-value for Yates	0.00	0.01	0.10	0.11	0.18	0.00	0.15	0.40	0.58	0.76
Repeat Winner z	3.00	1.91	1.26	1.30	1.24	2.14	0.93	0.55	0.57	-0.16
p-value for RW	0.00	0.06	0.21	0.19	0.22	0.03	0.35	0.58	0.57	0.87
RW	57%	55%	53%	53%	53%	55%	52%	51%	51%	50%
Repeat Loser z	3.34	2.13	1.25	1.13	0.80	2.59	1.26	0.75	0.31	-0.37
p-value for RL	0.00	0.03	0.21	0.26	0.42	0.01	0.21	0.45	0.76	0.71
RL	58%	55%	53%	53%	52%	56%	53%	52%	51%	49%
3 years	Coinciding	1 Quarter	2 Quarters	3 Quarters	4 Quarters	Coinciding	1 Quarter	2 Quarters	3 Quarters	4 Quarters
No of WW	156	141	125	108	98	155	134	118	105	92
No of LL	160	144	127	108	97	161	138	120	107	93
No of WL	124	115	107	100	86	125	122	114	103	92
No of LW	126	117	109	103	89	125	123	116	104	93
N	566	517	468	419	370	566	517	468	419	370
Stdev	17%	18%	19%	20%	21%	17%	18%	18%	20%	21%
CPR	1.60	1.51	1.36	1.13	1.24	1.60	1.23	1.07	1.05	1.00
z	2.77	2.33	1.66	0.64	1.04	2.77	1.19	0.37	0.24	0.00
p-value for z	0.01	0.02	0.10	0.52	0.30	0.01	0.24	0.71	0.81	1.00
% WW	28%	27%	27%	26%	26%	27%	26%	25%	25%	25%
%LL	28%	28%	27%	26%	26%	28%	27%	26%	26%	25%
Pearson Statistic	7.69	5.43	2.77	0.40	1.08	7.68	1.41	0.14	0.06	0.00
p-value for Pearson	0.01	0.02	0.10	0.52	0.30	0.01	0.24	0.71	0.81	1.00
Yates adjustment	6.45	4.55	2.29	0.28	0.84	6.40	1.14	0.08	0.02	0.01
p-value for Yates	0.01	0.03	0.13	0.59	0.36	0.01	0.29	0.78	0.88	0.92
Repeat Winner z	1.91	1.63	1.18	0.55	0.88	1.79	0.75	0.26	0.14	0.00
p-value for RW	0.06	0.10	0.24	0.58	0.38	0.07	0.45	0.79	0.89	1.00
RW	56%	55%	54%	52%	53%	55%	52%	51%	50%	50%
Repeat Loser z	2.01	1.67	1.17	0.34	0.59	2.13	0.93	0.26	0.21	0.00
p-value for RL	0.04	0.09	0.24	0.73	0.56	0.03	0.35	0.79	0.84	1.00
RL	56%	55%	54%	51%	52%	56%	53%	51%	51%	50%

Table 4.5.3: Omega & static size						Table 4.5.4: Omega & ALSI TOP 40 overlap				
9 years	Coinciding	1 Quarter	2 Quarters	3 Quarters	4 Quarters	Coinciding	1 Quarter	2 Quarters	3 Quarters	4 Quarters
No of WW	300	298	295	287	279	255	255	248	243	243
No of LL	305	293	282	270	261	267	263	254	247	244
No of WL	316	294	273	257	241	361	337	320	301	277
No of LW	329	316	302	289	273	367	346	330	312	290
N	1250	1201	1152	1103	1054	1250	1201	1152	1103	1054
Stdev	11%	12%	12%	12%	12%	11%	12%	12%	12%	12%
CPR	0.88	0.94	1.01	1.04	1.11	0.51	0.58	0.60	0.64	0.74
z	-1.13	-0.54	0.08	0.35	0.82	-5.80	-4.75	-4.35	-3.69	-2.46
p-value for z	0.26	0.59	0.94	0.73	0.41	0.00	0.00	0.00	0.00	0.01
% WW	24%	25%	26%	26%	26%	20%	21%	22%	22%	23%
%LL	24%	24%	24%	24%	25%	21%	22%	22%	22%	23%
Pearson Statistic	1.27	0.29	0.01	0.12	0.68	33.99	22.67	19.00	13.70	6.05
p-value for Pearson	0.26	0.59	0.94	0.73	0.41	0.00	0.00	0.00	0.00	0.01
Yates adjustment	1.19	0.24	0.00	0.09	0.59	39.71	25.67	21.29	15.01	6.29
p-value for Yates	0.27	0.62	0.99	0.77	0.44	0.00	0.00	0.00	0.00	0.01
Repeat Winner z	-0.64	0.16	0.92	1.29	1.67	-4.27	-3.37	-3.02	-2.49	-1.49
p-value for RW	0.52	0.87	0.36	0.20	0.10	0.00	0.00	0.00	0.01	0.14
RW	49%	50%	52%	53%	54%	41%	43%	44%	45%	47%
Repeat Loser z	-0.95	-0.93	-0.83	-0.80	-0.52	-3.97	-3.36	-3.14	-2.75	-1.99
p-value for RL	0.34	0.35	0.41	0.42	0.60	0.00	0.00	0.00	0.01	0.05
RL	48%	48%	48%	48%	49%	42%	43%	43%	44%	46%
5 years	Coinciding	1 Quarter	2 Quarters	3 Quarters	4 Quarters	Coinciding	1 Quarter	2 Quarters	3 Quarters	4 Quarters
No of WW	220	214	200	189	179	180	174	162	157	153
No of LL	228	219	206	196	188	189	183	172	167	162
No of WL	221	203	193	180	166	261	243	231	212	192
No of LW	223	207	195	180	163	262	243	229	209	189
N	892	843	794	745	696	892	843	794	745	696
Stdev	13%	14%	14%	15%	15%	14%	14%	14%	15%	15%
CPR	1.02	1.12	1.09	1.14	1.24	0.50	0.54	0.53	0.59	0.68
z	0.13	0.79	0.64	0.91	1.44	-5.13	-4.43	-4.46	-3.55	-2.50
p-value for z	0.90	0.43	0.52	0.36	0.15	0.00	0.00	0.00	0.00	0.01
% WW	25%	25%	25%	25%	26%	20%	21%	20%	21%	22%
%LL	26%	26%	26%	26%	27%	21%	22%	22%	22%	23%
Pearson Statistic	0.02	0.63	0.41	0.83	2.06	26.62	19.77	20.04	12.67	6.28
p-value for Pearson	0.90	0.43	0.52	0.36	0.15	0.00	0.00	0.00	0.00	0.01
Yates adjustment	0.00	0.51	0.31	0.68	1.73	31.07	22.39	22.72	13.73	6.41
p-value for Yates	0.95	0.48	0.58	0.41	0.19	0.00	0.00	0.00	0.00	0.01
Repeat Winner z	-0.05	0.54	0.35	0.47	0.70	-3.86	-3.38	-3.48	-2.86	-2.10
p-value for RW	0.96	0.59	0.72	0.64	0.48	0.00	0.00	0.00	0.00	0.04
RW	50%	51%	51%	51%	52%	41%	42%	41%	43%	44%
Repeat Loser z	0.24	0.58	0.55	0.83	1.33	-3.44	-2.91	-2.85	-2.17	-1.44
p-value for RL	0.81	0.56	0.58	0.41	0.18	0.00	0.00	0.00	0.03	0.15
RL	51%	51%	51%	52%	54%	42%	43%	43%	44%	46%
3 years	Coinciding	1 Quarter	2 Quarters	3 Quarters	4 Quarters	Coinciding	1 Quarter	2 Quarters	3 Quarters	4 Quarters
No of WW	126	119	109	99	93	96	92	84	78	76
No of LL	133	126	116	104	97	101	97	88	81	77
No of WL	154	137	123	109	91	184	164	148	130	108
No of LW	153	135	120	107	89	185	164	148	130	109
N	566	517	468	419	370	566	517	468	419	370
Stdev	17%	18%	19%	20%	21%	18%	18%	19%	20%	21%
CPR	0.71	0.81	0.86	0.88	1.11	0.28	0.33	0.34	0.37	0.50
z	-2.02	-1.19	-0.84	-0.64	0.52	-7.11	-6.04	-5.66	-4.89	-3.31
p-value for z	0.04	0.23	0.40	0.52	0.60	0.00	0.00	0.00	0.00	0.00
% WW	22%	23%	23%	24%	25%	17%	18%	18%	19%	21%
%LL	23%	24%	25%	25%	26%	18%	19%	19%	19%	21%
Pearson Statistic	4.09	1.42	0.70	0.41	0.27	52.30	37.40	32.88	24.36	11.07
p-value for Pearson	0.04	0.23	0.40	0.52	0.60	0.00	0.00	0.00	0.00	0.00
Yates adjustment	4.04	1.26	0.56	0.30	0.16	72.88	49.22	42.93	30.62	12.56
p-value for Yates	0.04	0.26	0.45	0.59	0.69	0.00	0.00	0.00	0.00	0.00
Repeat Winner z	-1.67	-1.13	-0.92	-0.69	0.15	-5.26	-4.50	-4.20	-3.61	-2.36
p-value for RW	0.09	0.26	0.36	0.49	0.88	0.00	0.00	0.00	0.00	0.02
RW	45%	46%	47%	48%	51%	34%	36%	36%	38%	41%
Repeat Loser z	-1.18	-0.56	-0.26	-0.21	0.59	-4.97	-4.15	-3.91	-3.37	-2.35
p-value for RL	0.24	0.58	0.79	0.84	0.56	0.00	0.00	0.00	0.00	0.02
RL	47%	48%	49%	49%	52%	35%	37%	37%	38%	41%

Table 4.5.5: Omega & mid-caps overlap						Table 4.5.6: Omega & small-caps overlap				
9 years	Coinciding	1 Quarter	2 Quarters	3 Quarters	4 Quarters	Coinciding	1 Quarter	2 Quarters	3 Quarters	4 Quarters
No of WW	290	284	275	264	259	314	291	273	256	242
No of LL	303	291	276	262	251	334	307	286	266	249
No of WL	326	308	293	280	261	301	301	295	287	278
No of LW	331	318	308	297	283	299	301	296	292	283
N	1250	1201	1152	1103	1054	1248	1200	1150	1101	1052
Stdev	11%	12%	12%	12%	12%	11%	12%	12%	12%	12%
CPR	0.81	0.84	0.84	0.83	0.88	1.17	0.99	0.89	0.81	0.77
z	-1.81	-1.47	-1.47	-1.53	-1.04	1.35	-0.12	-0.95	-1.72	-2.16
p-value for z	0.07	0.14	0.14	0.13	0.30	0.18	0.90	0.34	0.09	0.03
% WW	23%	24%	24%	24%	25%	25%	24%	24%	23%	23%
%LL	24%	24%	24%	24%	24%	27%	26%	25%	24%	24%
Pearson Statistic	3.29	2.16	2.15	2.34	1.07	1.82	0.01	0.90	2.96	4.66
p-value for Pearson	0.07	0.14	0.14	0.13	0.30	0.18	0.90	0.34	0.09	0.03
Yates adjustment	3.23	2.09	2.10	2.30	1.01	1.58	0.00	0.80	2.89	4.70
p-value for Yates	0.07	0.15	0.15	0.13	0.32	0.21	0.95	0.37	0.09	0.03
Repeat Winner z	-1.45	-0.99	-0.76	-0.69	-0.09	0.52	-0.41	-0.92	-1.33	-1.58
p-value for RW	0.15	0.32	0.45	0.49	0.93	0.60	0.68	0.36	0.18	0.11
RW	47%	48%	48%	49%	50%	51%	49%	48%	47%	47%
Repeat Loser z	-1.11	-1.09	-1.32	-1.48	-1.38	1.39	0.24	-0.41	-1.10	-1.47
p-value for RL	0.27	0.27	0.19	0.14	0.17	0.16	0.81	0.68	0.27	0.14
RL	48%	48%	47%	47%	47%	53%	50%	49%	48%	47%
5 years	Coinciding	1 Quarter	2 Quarters	3 Quarters	4 Quarters	Coinciding	1 Quarter	2 Quarters	3 Quarters	4 Quarters
No of WW	223	208	191	179	169	239	219	204	188	175
No of LL	232	216	197	183	170	248	224	205	185	170
No of WL	218	209	202	190	176	201	198	189	180	170
No of LW	219	210	204	193	181	202	201	194	190	179
N	892	843	794	745	696	890	842	792	743	694
Stdev	13%	14%	14%	15%	15%	13%	14%	14%	15%	15%
CPR	1.08	1.02	0.91	0.89	0.90	1.46	1.23	1.14	1.02	0.98
z	0.60	0.17	-0.64	-0.77	-0.68	2.81	1.52	0.92	0.11	-0.15
p-value for z	0.55	0.87	0.52	0.44	0.50	0.00	0.13	0.36	0.91	0.88
% WW	25%	25%	24%	24%	24%	27%	26%	26%	25%	25%
%LL	26%	26%	25%	25%	24%	28%	27%	26%	25%	24%
Pearson Statistic	0.36	0.03	0.41	0.59	0.46	7.91	2.30	0.86	0.01	0.02
p-value for Pearson	0.55	0.87	0.52	0.44	0.50	0.00	0.13	0.35	0.91	0.88
Yates adjustment	0.28	0.01	0.33	0.50	0.38	6.83	1.98	0.71	0.00	0.01
p-value for Yates	0.60	0.92	0.57	0.48	0.54	0.01	0.16	0.40	0.97	0.94
Repeat Winner z	0.24	-0.05	-0.55	-0.57	-0.38	1.81	1.03	0.76	0.42	0.27
p-value for RW	0.81	0.96	0.58	0.57	0.71	0.07	0.30	0.45	0.68	0.79
RW	51%	50%	49%	49%	49%	54%	53%	52%	51%	51%
Repeat Loser z	0.61	0.29	-0.35	-0.52	-0.59	2.17	1.12	0.55	-0.26	-0.48
p-value for RL	0.54	0.77	0.73	0.61	0.56	0.03	0.26	0.58	0.80	0.63
RL	51%	51%	49%	49%	48%	55%	53%	51%	49%	49%
3 years	Coinciding	1 Quarter	2 Quarters	3 Quarters	4 Quarters	Coinciding	1 Quarter	2 Quarters	3 Quarters	4 Quarters
No of WW	138	124	110	100	91	161	148	131	114	99
No of LL	142	127	112	102	90	165	149	129	109	92
No of WL	142	132	122	108	93	119	108	101	94	85
No of LW	144	134	124	109	96	120	111	106	101	93
N	566	517	468	419	370	565	516	467	418	369
Stdev	17%	18%	19%	20%	21%	17%	18%	19%	20%	21%
CPR	0.96	0.89	0.81	0.87	0.92	1.86	1.84	1.58	1.31	1.15
z	-0.25	-0.66	-1.11	-0.73	-0.41	3.64	3.42	2.45	1.37	0.68
p-value for z	0.80	0.51	0.27	0.46	0.68	0.00	0.00	0.01	0.17	0.50
% WW	24%	24%	24%	24%	25%	28%	29%	28%	27%	27%
%LL	25%	25%	24%	24%	24%	29%	29%	28%	26%	25%
Pearson Statistic	0.06	0.44	1.23	0.54	0.17	13.39	11.80	6.03	1.88	0.46
p-value for Pearson	0.80	0.51	0.27	0.46	0.68	0.00	0.00	0.01	0.17	0.50
Yates adjustment	0.03	0.34	1.09	0.42	0.10	11.02	9.77	5.09	1.57	0.33
p-value for Yates	0.87	0.56	0.30	0.52	0.75	0.00	0.00	0.02	0.21	0.56
Repeat Winner z	-0.24	-0.50	-0.79	-0.55	-0.15	2.51	2.50	1.97	1.39	1.03
p-value for RW	0.81	0.62	0.43	0.58	0.88	0.01	0.01	0.05	0.17	0.30
RW	49%	48%	47%	48%	49%	58%	58%	56%	55%	54%
Repeat Loser z	-0.12	-0.43	-0.78	-0.48	-0.44	2.67	2.36	1.50	0.55	-0.07
p-value for RL	0.91	0.66	0.43	0.63	0.66	0.01	0.02	0.13	0.58	0.94
RL	50%	49%	47%	48%	48%	58%	57%	55%	52%	50%

Table 4.6: Performance measures and fund characteristics: Summary of Spearman and CPR results
(s & CP represent Spearman and Cross-Product respectively)

Fund returns - Combination	Static returns					Trading returns					Static size					Large-cap overlap					Mid-cap overlap					Small-cap overlap				
	0Q	1Q	2Q	3Q	4Q	0Q	1Q	2Q	3Q	4Q	0Q	1Q	2Q	3Q	4Q	0Q	1Q	2Q	3Q	4Q	0Q	1Q	2Q	3Q	4Q	0Q	1Q	2Q	3Q	4Q
9 Years																														
Strongly positive	sCP	CP		CP		sCP																	CP				CP		CP	
Weak positive		s	s	s	sCP		sCP	sCP	sCP	s											sCP	CP	s	s		sCP	s	sCP	s	sCP
Weak negative											s	sCP	sCP	s	s	s	s	s	s	sCP		s			s					
Strongly negative																CP	CP	CP	CP											
5 Years																														
Strongly positive	sCP	CP				sCP	CP	CP	CP												CP	CP	CP			CP	CP	CP	CP	CP
Weak positive		s	sCP	s	s		s	s	s	s											s	s	s	sCP	s	s	s	s	s	s
Weak negative											s	sCP	sCP	s	s				s	sCP										
Strongly negative																sCP	sCP	sCP	CP											
3 Years																														
Strongly positive	sCP	CP				sCP	CP	CP		CP											CP	CP	CP			CP	CP	CP	CP	CP
Weak positive		s	s	s	s		s	s	sCP	s											s	s	s	sCP	s	s	s	s	s	s
Weak negative											s	s	s	s	sCP				s	s										
Strongly negative											CP	CP	CP	CP		sCP	sCP	sCP	CP	CP										

Omega - Combination	Static returns					Trading returns					Static size					Large-cap overlap					Mid-cap overlap					Small-cap overlap				
	0Q	1Q	2Q	3Q	4Q	0Q	1Q	2Q	3Q	4Q	0Q	1Q	2Q	3Q	4Q	0Q	1Q	2Q	3Q	4Q	0Q	1Q	2Q	3Q	4Q	0Q	1Q	2Q	3Q	4Q
9 Years																														
Strongly positive	CP	CP																												
Weak positive	s	s	sCP	s	s	sCP	s	s	s	s																s	s	s	s	CP
Weak negative											s	s	s	s	s	s	s	s	s	sCP	s	s	s	s	s					s
Strongly negative																CP	CP	CP	CP											
5 Years																														
Strongly positive	CP					CP																								
Weak positive	s	sCP	s	s		s	s	s	s	s											s	s	s	s	s	sCP	s	s	s	s
Weak negative					s						s	s	s	s	s	s	s	s	s	CP										
Strongly negative																CP	CP	CP	CP	s										
3 Years																														
Strongly positive																										CP	CP			
Weak positive	sCP	sCP	s	s	s	sCP	s	s	s	s													s	s	s	s	s	sCP	s	s
Weak negative											sCP	s	s	s	s						s	s								
Strongly negative																sCP	sCP	sCP	sCP	sCP										

Chapter 5: Fund Trades and Investment Timing

5.1 Introduction

In the previous chapter, we decomposed equity fund performance into static returns and trading returns. Our results showed that static returns are the dominant driver of fund returns and that the returns in respect of the funds' trades are a weaker determinant of fund returns. Also, the results relating to the size of the static portion suggest that funds with high turnover achieve higher returns in respect of their turnover portion than lower turnover funds do.

There are a number of reasons why a manager may want to trade. A manager may wish to alter specific market exposure by altering allocations to different asset classes or to individual securities within asset classes. Since performance expectations for asset classes and their individual securities and the investment horizons for those expectations differ between investment managers, managers may purchase or sell different securities at different times in order to position their funds according to their expectations. Therefore, trading may be viewed as a necessary part of an investment strategy for maintaining an optimal fund based on a manager's risk and return preferences.

Grinold (2007) says that trading is used to close the "backlog" – the gap between what is held in a fund and what the manager would prefer to be holding. Risk aversion and trading costs should determine an optimal level of trading. Higher costs should lead to lower trading and a high rate of information loss – old information becomes stale and new information arrives – should lead to lower trading frequency (rebalancing interval). Grinold (2007) says that all these parameters should be used in analysing the fund as a moving object.

Ang, Chen and Lin (1998) have studied the behaviour of mutual fund managers according to their past performance. Under-performing managers might exert effort in stock selection and trading to improve performance. In an effort to participate in an increased number of higher performing opportunities, managers trade more frequently. A more active investment approach requires increased information flow and analysis of that information. Increased trading, use of research staff for analysis and use of technology in information processing will result in an increase in the expense ratio.

It is apparent that trading is an important part of the management of a fund and therefore should be an important consideration in investors' decision making processes. Investigating trading ability among equity fund managers is related to investigating share selection ability since a decision to trade involves a decision about which share to trade.

As noted in Chapter 1, investment strategies that are implemented are determined by the intersection of managers' preferences (and abilities) and fund mandate prescriptions and it is extremely difficult to defease their influences on investment performance. Therefore, the focus of this chapter can viewed as an extension of our research into fund characteristics or it may be considered as research into manager characteristics. However, the decision as to which characteristics are the main focus of this chapter is less important than identifying whether trading is a successful strategy for adding value to investors' funds.

In our study we examine the trades that are implemented by managers in their South African equity funds and determine whether managers possess the ability to trade successfully.

5.2 Expected consequences of trades

Implementing the appropriate strategy when managing a "balanced" fund, involves the evaluation of expected payoffs in respect of various asset classes. The strategy will result in a shift between asset classes in an attempt to "time the market". Market timing strategies may also be implemented within an asset class. When equity-only fund managers wish to reduce the systematic risk of their fund (lower the fund beta), they will switch into stocks with lower individual stock betas or increase the fund's cash holding. Within the context of the equity asset class and the focus of this study, this investment strategy is also referred to as market timing and is expected to enhance fund performance.

More generally, the trading of securities - whether for speculative reasons, timing gains/losses for individual securities or for altering specific fund exposure - is expected to add value to the fund. Fund managers are expected to possess the ability to trade successfully, thereby enhancing the performance of clients' assets through trading activities.

Evidence suggests that successful trading is not easy to achieve. Firer and Gray (1996) note that prior studies indicate that a predictive accuracy of between 75% and 90% is required for a market timing strategy to beat a buy-and-hold strategy and that this is probably beyond the capabilities of the normal investor.

So while it may be the manager's intention to add value to clients' assets through the trading of securities, it is the identification of their ability to do so that is more meaningful to the development of investors' expectations for the performances of their assets.

5.3 The aim of this chapter

Our objective is to provide and evaluate evidence, by examining fund trades, which will indicate whether managers have the ability to add value to investors' assets through their trading activities. Evidence that managers add value to clients' assets via market timing and/or trading would contradict finance theory.

The Efficient Market Hypothesis (EMH) says that all prices fully reflect all available information. In other words, any profit opportunities are immediately "competed" away by investors. As noted by Firer, Gray, Sandler and Ward (1996) and Lo (2007), the implication of the EMH is that abnormal profits cannot be garnered from market timing or information-based trading strategies. The unveiling of evidence that supports the achievement of abnormal profits through market timing or trading would lead to a rejection of the null hypothesis (EMH).

In an earlier chapter we showed that some equity funds achieve superior abnormal profits and that the success of these funds persists. This chapter is a continuation of our investigation (with a focus on trading) into the sources of performance persistence among equity funds.

We study the market timing abilities of managers by using traditional market timing measures for the returns of the equity portfolios and test the validity of these results. In an effort to seek corroboration for these results, we evaluate the success of trades in individual stocks in the equity portfolios.

5.4 Structure of the remainder of this chapter

Firstly, we provide further context to this chapter by revisiting the extended version of The Fundamental Law of Active Management and by discussing aspects of performance attribution and the measurement of trades.

Secondly, we review international and South African literature that deals with developments and results in the research into the timing and trading success of fund managers and we position this study relative to the literature review.

Thirdly, we discuss the methodology and data used and provide an additional discussion on trade measurement used in other studies with the intention of further contextualizing the position of this study.

Finally, the results are discussed, followed by the conclusion.

5.5 Trades and active management

In an earlier chapter the extended version of The Fundamental Law of Active Management was presented as:

$$IR = ICx\sqrt{N}\,xTC$$

An increase in the information ratio (*IR*) implies an increase in valued added by the investment manager. The Information Coefficient (*IC*) and the Breadth (*N*), together, capture the aspect of active management that deals with the successful forecasts for selected securities over a period. While success in this context is based on security performance relative to a benchmark, our study is based on absolute returns and not on benchmark relative returns.

IC is based on correlations between a manager's expected performance in respect of a number of securities and the realised performance for those securities. It is considered a measure of manager skill where a higher correlation (close to 1.0) between expected and realised outcomes indicates a higher degree of success/skill. A manager with no security forecasting ability will have an IC of zero. In our study we consider a successful security purchase as one that enjoys a price increase after the purchase and a successful sale is followed by a price decline. More specifically, a fund for which all trades are successful will have a hit rate of 100% whereas the hit rate is 50% if the trades are successful. In other words, *IC* focuses on success based on price as a vector with magnitude and direction. Our study focuses on success based on the direction of price changes (to the exclusion of magnitude).

N is the number of independent forecasts for shares per annum. If there are 8 shares and forecasts are made twice a year then $N = 16$. In our study we consider the success of trades over different horizons. For a period of four quarters we examine the success of trades over a horizon of:

- one quarter, i.e. a frequency of 4,
- two quarters, i.e. a frequency of 3 (quarter one and two is the first period, quarter two and three is the next period, etc.),
- three quarters, i.e. a frequency of 2 and
- four quarters, i.e. a frequency of 1.

Therefore, the total assumed frequency for our analysis is 10. We do not count the number of shares for which forecasts are made since the exact breadth is not needed to complete our analysis.

Managers do not always enjoy the privilege of conducting their trades without constraints. Limitations to the universe of instruments that may be traded, the size of the trades, the direction of the trades (long or short) and the frequency of individual trades are factors affecting the success of a manager's trades. This is a typical feature of the pension fund market. Larger pension funds employ a multi-fund strategy to ensure the assets of the pension fund are managed appropriately. Managers selected as part of the multi-fund strategy are often given investment management mandates that are restrictive. For example, an equity mandate may specify that the manager maintain a minimum of 98% of the assets in equity securities. The manager may decrease/increase the portfolio beta by switching into lower/higher beta stocks. Suppose that a manager decides that altering the fund's beta would be more appropriately done through an increase in cash holdings rather than switching between securities, then compliance with mandate requirements (in this example) will restrict the manager from implementing his/her best investment view and, therefore, the success of his/her trading strategy.

There are a growing number of similar fund management restrictions being placed on fund managers, partly as a result of the recent trend in decomposing fund management according to alpha and beta components of fund performance. Portfolio construction based on principles of portable alpha requires different parts of a large fund to be managed according to the prescriptions of the portfolio construction methodology. Fund management prescriptions that prevent managers from implementing their best investment view are contrary to the recent support for the lifting of constraints on fund managers so that the Transfer Coefficient (TC) in the Generalized Fundamental Law of Active Management (Clarke, de Silva and Thorley (2002)) can be increased.

Since it is not necessary for the completion of our study, we do not isolate the impact of mandate restrictions on the implementation of share trades, i.e. we assume $TC = 1$ for equity fund trades.

5.6 Performance attribution and the measurement of trades

A number of different methods have been used in the literature to measure trades, some of which we discuss in the literature review. In the following three subsections we briefly discuss some of the broader issues relating to these approaches with the intention of providing the reader with a basic framework within which to further position our analysis.

5.6.1 Returns, holdings and transactions based methods

Fund analysis and/or performance attribution can be implemented using data with varying levels of resolution. Fund returns are the easiest to obtain and analyse but improved information and insight can be obtained from an analysis of a fund's holdings and the actual transactions for a fund.

Returns based analysis involves using the actual returns for various funds that include holdings in different asset classes. The measures of Treynor and Mazuy (1966) and Henriksson and Merton (1981) are popular (regression based) measures of the market timing ability of funds. These measures may be conditional, such as depending on economic factors, or unconditional. A result, from the application of such measures, which indicates the existence of evidence in support of market timing ability, is sometimes used to conclude that managers have security selection ability. This may be true but the loss of information associated with returns based analysis requires a substantial leap of faith to have conviction in such a conclusion.

An increasingly popular approach to improving analysis and results is to use the security holdings of funds. Holdings based analysis involves considering the individual securities that are held in a fund at the end of each period e.g. the end of each month or quarter. Inevitably, assumptions are made about the within-period fund activity. Changes in the holdings from one period to the next can be viewed as trades and the performance of those trades may be used to evaluate security selection ability among managers. Usually approximations as to the timing of cash flows and the execution of trades are made, e.g. all occur mid-period. An important question with respect to holdings based analysis of trading is whether a change in fund-value weights or actual quantities held are used in the measure of trades – the implications for using each are different. The former focuses on the entire fund, while the latter focuses on the fund's individual holdings.

Transactions based analysis requires the records of all fund holdings and trading transactions at each point in time. This means trades are measured according to the exact price, quantity and timing of each trade. Usually, the transactions data for funds is not readily available and publicly available research using transactions based analysis is very scarce.

In our holdings based analysis, we use quarterly data and assume that this level of data resolution will be sufficient for identifying managers' trades. The reality is that securities are bought and sold between quarter ends and that this information will be lost when considering only quarter-end holdings data. It seems likely that using higher resolution data such as monthly holdings may yield more convincing results when examining trades in funds.

5.6.2 Asset allocation versus security selection

The nature of the information about a fund will depend on the approach to attributing the fund performance. The dominant sources of fund performance continue to be a contentious issue.

Brinson, Hood and Beebower (BHB) (1986) concluded that: "Data from 91 large US pension plans indicate that investment policy dominates investment strategy (market timing and security selection), explaining on average 93.6% of the variation in total plan return." Practitioners have interpreted this to mean that asset allocation is responsible for more than 90% of fund performance and therefore advocate that fund managers should weight a fund's individual securities according to their asset classes before selecting the security weights within their asset class. Jahnke (1997) and Kritzman and Page (2002) downplay the importance of the BHB study and emphasize the importance of security selection as a determinant of fund performance. This debate highlights the need for distinguishing between different approaches to measuring performance. In particular, using different approaches is necessary for achieving coherency in the investigation and evaluation of fund performance based on stock selection and trades.

For example, in his analysis of 16 Australian pooled superannuation funds, Gallagher (2001) follows the geometric approach presented by Burnie, Knowles and Teder (1998) to decompose active return into security and market timing components. The decomposition facilitates the distinction between managers' investment strategies according to a bottom-up or top-down approach.

In the bottom-up approach the security selection is taken prior to the asset allocation decision ,while in the top-down approach the asset allocation approach is taken prior to the security selection decision. A fund's total return is the sum of the returns from asset allocation and security selection. Different formulae are used to calculate the separate returns due to asset allocation and security selection for each of the bottom-up and top-down approaches. Both sets of formula are based on the average weights of the individual holdings, except that the top-down approach considers security weights with respect to the asset class weights to which those securities belong and the bottom-up approach considers security weights with respect to their corresponding strategic asset allocation.

Gallagher's (2001) results indicate that the majority of funds do not possess market timing or security selection skills. However, the most successful security selection return contribution was from Australian equities. The lack of market timing and security selection ability confirms Gallagher's (2001) results using the returns-based, unconditional timing measures of Treynor and Mazuy (1966) and Henriksson and Merton (1981). Similar to Gallagher, we use more than one approach to our investigation into trading activities of funds.

Whether an investment strategy is adjusted through focusing on a shift in asset allocation or switching between securities, it is widely accepted that, over time, all managers must change their fund’s individual security holdings in order to alter the fund’s exposure. Our study focuses on funds with holdings of South African equities only. With this focus, the top-down and bottom-up approaches to performance attribution may be adjusted to consider equity sector allocations instead of asset class allocations. However, our study does not consider the distinction between the top-down and bottom-up strategies in the same sense as what Gallagher (2001) does. Although we use unconditional timing measures within our analysis, we do not use them to measure market timing through asset or sector allocations.

A distinction in our analysis is that it departs from the traditional performance attribution methodology. We attribute fund equity returns to a static portion and a trading portion. The static portion is that portion of the fund in respect of which the quantities of a security did not experience any change over a period of four quarters. The returns due to the static portion are then subtracted from the fund returns to provide a residual that we refer to as the returns to the trading. The trading portion, therefore, is the portion of the fund that is not static.

Trading is traditionally used with reference to the buying of securities that will be added to the fun’s' existing holdings (if any) of that security and the selling of securities that the fund may have held. However, in our fund return decomposition into static and trading returns, we require trading to refer to more than that for the traditional reference. We require trading to include everything else that is not static. Therefore trading will include the effects of the following on individual security holdings:

- Splits
- Consolidations
- Buy-backs
- New listings
- De-listings
- Suspensions
- Net cash flows to the fund
- New purchase
- New sales

Perhaps, "trading activity" would have been a more general and descriptive reference for the trading portion in our study. However, we have used "trading".

5.6.3 Measuring timing and trades in equity funds

There is wide scope for variation among the different investigations into timing and trades in equity funds. We highlight some of the dimensions along which the differences may occur and position our study along those dimensions.

1. The opportunity set. Equity exposure may be achieved via securities that are not classified as ordinary shares e.g. futures, options, debentures, equity linked notes, shares with reduced voting rights (nil paid letters), etc. Our study considers only ordinary shares.
2. The size of the data set. The number of funds used in studies of developed markets (US and UK) is far greater than the number used in smaller markets such as Australia and South Africa. The actual historical time period, and its length, from which the funds will be examined will differ between studies.
3. Fund profile. Some analysts have made use of actual fund performance while others have used hypothetical funds. We construct equity funds that consist of ordinary shares only and therefore our analysis is based on hypothetical funds.
4. Conditional and unconditional measures. The returns based measures may be unconditional or conditional where the latter will be mapped to an economically-linked variable (such as bull and bear markets or GDP growth) as an independent variable. We use unconditional timing measures.
5. Investors' time horizon. Holding period or the investment horizon can vary substantially and will sometimes depend on the definitions of short, medium and long-term. We consider 12 months and less as short-term and examine trades over various horizons within the 12-month period. The market timing measures are based on quarterly returns data and therefore market timing is assessed over 3-month periods.
6. Costs and expenses. It is easier to include fund performances that are net of costs and expenses when conducting returns based analysis. However, information regarding the actual costs that relate to individual security trades is extremely scarce but can be approximated when conducting holdings based analysis. We exclude costs in our analysis.
7. Definition of holdings. Some studies use fund-value weightings (and/or their changes) of security holdings. These weightings may be based on period-end, average or beginning-period prices and/or quantities. The variations of points at which prices and quantities are taken will lead to calculation of different holdings values, but these differences usually decrease in size as the number of the data observations increases. Also, some variations will increase the risk of including the effect of passive price movements in the assessment of trades. In contrast, we use changes in the quantities of security holdings to identify trades and use subsequent directions of price changes to evaluate whether each trade was a success.

At opportune points in our study we will highlight the position of this investigation along each of these dimensions relative to at least one other investigation.

5.6.4 This study and performance attribution

We use equity-only portfolios and, therefore, do not consider market timing through altering weights to different asset classes or through the selection of instruments within an asset class other than equity. In this sense, our analysis is in sympathy with the emphasis that Jahnke (1997) and Kritzman and Page (2002) place on security selection as a determinant of fund performance. However, this chapter will focus on the return attributable to fund trades, a subset of security selection.

While studies of market timing among South African funds have been conducted using measures for returns-based analysis (as is also used in our study), to the best of our knowledge, this study is the first to use fund holdings to examine the timing success of individual share trades by managers of South African funds.

5.7 Literature review

Due to the large amount of research into external markets, the international review distinguishes between research highlights using returns-based, market timing measures and fund holdings. The South African literature review summarizes the research that has been published over the eleven years to 2007. We discuss these two focus areas separately below.

5.7.1 International literature

There are a number studies scattered across academic literature that attempt to evaluate the timing abilities of managers. The focus area of returns based analysis has included the use of unconditional and conditional models, while holdings and transactions-based analysis has focused on the success of individual security trades across portfolios.

5.7.1.1 Market timing

The traditional measures of Treynor and Mazuy (1966) and Henriksson and Merton (1981) are used in returns-based analysis. While the earlier applications of these measures were done on an unconditional basis, later applications followed the Ferson and Schadt (1996) use of conditional expected returns. Most of these studies find no evidence of market timing ability among managers, with the exception of Kon (1983), who finds significant timing ability among some managers and Bollen and Busse (2001), who find evidence of timing ability using higher frequency, daily data.

A study by Jagannathan and Korajczyk (1986) shows that the application of traditional measures of market-timing models may indicate market-timing ability when no real ability exists. They demonstrate that holding options or option-like securities in a fund will indicate artificial timing ability. Funds with a beta less than unity will have downward biased market timing, but may have upward biased security selectivity. Conversely, funds with higher systematic risk may have downward biased security selection. This results in an inverse relationship between timing ability and security selection. The authors propose a test for misspecification of market-timing models which we use in our analysis.

Artificial timing is not the only issue affecting the reliability of results from studies of market-timing ability. Market-timing ability may be evaluated using an index that is representative of the market portfolio. Timing ability can also be evaluated using various other indices. However, the use of published indices in analysis has been met with growing criticism.

Southard and Bond (2003) note that conventional market indices were created to measure price movements of the markets and were never intended to be used as investments. Three primary limitations on the use of indices as part of an investment strategy have been highlighted:

- Market-cap or float-weighted indices lack diversification and carry embedded security-specific risk.
- Indices lack a valuation component and therefore carry embedded valuation risk when used as investible portfolios.
- They exhibit unpredictable representation such as style-drift due to rebalancing and weighting systems.

Indices only recently attracted attention as investments when investors noticed that indices outperformed most investment managers. However, the aforementioned limitations suggest that investment managers who rely largely on conventional indices as benchmarks for their security selection and the determination of security weightings will probably not be delivering performance as responsibly and proficiently as possible. They are less likely to be applying proper portfolio construction techniques, using an objective valuation process and delivering cost- and tax-efficient performance.

Despite the reservations around the use of published indices as benchmarks, Sensoy and Kaplan (2005) study the benchmark-timing abilities of mutual funds as opposed to their market-timing abilities. They use two methodologies to test for timing ability.

The first method considers the changes to cash weightings in the funds and the results suggest that mutual funds do not have benchmark-timing ability. The authors offer two reasons for this result: Firstly, cash holdings are not entirely under the control of the investment manager since inflows and outflows cause variations in cash and secondly, many investors prescribe limitations for cash holdings within funds in an effort to ensure that investment managers obtain performance through equity investments and not cash.

The second test considers the changes in the benchmark beta of the equity portion of the funds and the results suggest that mutual funds do time benchmarks by varying fund betas. The results show that for horizons of 1, 3, 6, and 12 months, the 1-month horizon is the weakest. When distinguishing between benchmarks, funds with value/growth or growth-oriented benchmarks possess timing ability while those with value-oriented benchmarks do not.

Our study is akin to the second part of the Sensoy and Kaplan (2005) study. We also use the equity-only holdings of funds but firstly utilize returns-based measures of timing ability for the performance of the equity-only portion and then consider the percentage of successful individual trades. Further, we do not consider timing relative to an equity index benchmark – we use equity portfolio returns in excess of the risk free rate as our dependent variable. Therefore, using the principle of Keynes' liquidity preference theory, we examine whether managers are able to time the equity market, relative to risk-free assets, while being constrained by implementing strategies within their listed equity holdings. This principle is consistent, for example with the investment decision-making exercised at Foord Asset Management and contrasts with that at Futuregrowth Asset Management where the equity index benchmark is pivotal to their benchmarking process.

5.7.1.2 Security trading

In a study of the trading activities of mutual fund managers, Wermers (2000) finds that high-turnover funds hold securities with higher average returns than low-turnover funds and that a portion of the higher level returns is due to the better security-picking skills of the managers of those funds. Our study does not consider the portfolio-weighted value of the trades for each fund; rather we determine the success of purchases and sales for each security by considering the changes in quantity held. Thereafter, for each trade, we consider the direction of subsequent price movements but not the magnitude of those movements as part of our evaluation of the success of managers' trades.

Chen, Jegadeesh and Wermers (2000) (CJW) examine security holdings and trades of mutual funds. Their results show that the more commonly held securities among funds do not outperform other securities, that high-turnover funds have better security-picking skills than low-turnover funds and that funds with the best past performance have superior security-picking skills to those with the worst past performance. They find that securities purchased by funds significantly outperform the securities that they sell. Consistent with findings by CJW, we find that high-turnover funds have better security-picking skills and that securities purchased by funds outperform the securities sold.

Baker, Litov, Wachter and Wurgler (2004) examine the returns of securities that managers hold and trade subsequent to earnings announcements. Consistent with the CJW study, they find that securities purchased by managers subsequent to earnings announcements earn significantly higher returns than securities sold. Our study does not focus on trades around specific economic events such as earnings announcements but rather on trades across calendar quarters. It may be the case that certain events will create trades under our assumptions, e.g. a share split would automatically change the number of shares held and imply a trade in that share.

Kosowski, Timmermann, Wermers and White (2006) present evidence that some fund managers possess superior security-picking skills and that the strength of that evidence depends on fund objectives. They find strong evidence of superior performance and performance persistence among growth-oriented funds, but no evidence of ability among managers of income-oriented funds. We do not distinguish between abilities of managers who manage equity funds with different objectives. While our data includes funds that are linked to the three unit trust categories of general equity, value and growth, we assume that these funds compete directly with each other for performance. Therefore, we assume that equity funds with links to different unit trust categorisations do not fundamentally distinguish themselves from each other according to their categorisations. The debate as to whether style differentiation can be used to distinguish South African equity funds from each other in the same way (or to the same extent) as it is used in developed markets, such as the US and UK, is inconclusive.

Commenting on the Wermers (2000) analysis, Moskowitz (2000) highlights important issues with respect to the analysis of hypothetical (or reconstructed) equity funds (as used in our analysis).

- Hypothetical funds may differ from the true equity funds. These differences may be the result of window dressing prior to the reporting of fund holdings or it may be the year-end pursuit of active tax trading strategies. Another reason for differences between (particularly, net and gross) fund returns for hypothetical portfolios could be selection bias that results from matching data from different databases. For example (and as is the case in our study), using holdings data from one database (JPMorgan) and prices from another database (PeregrineQuant) could lead to selection bias. The maintenance levels of historical data such as discontinued funds and de-listed shares and their prices may lead to the exclusion of some shares and hence selection bias. We address the issue of survivorship bias in an earlier chapter that deals with the data used.
- Not all funds are in a position to make active decisions and some may be purely passive funds. The inclusion of index or passive funds in the data may add noise to the analysis. We do not distinguish between index funds and non-index funds in our data.
- Raw or risk-adjusted return performance is one aspect of the value added (or subtracted) to clients' assets. Consideration should be given to after-tax returns on funds. Our analysis of trades considers raw returns and not adjusted returns.
- The volatility of hypothetical funds, with their higher equity exposure, may be higher than the actual net fund returns, which would have lower equity exposure. We do not provide a comparison between the volatilities of the actual funds' returns and the returns in respect of our hypothetical equity funds.
- Examining unconditional performance may understate abilities of funds to deliver returns to investors in certain periods. Fund performance during periods of recession may add more relative value that during non-recessionary periods. As mentioned earlier, we do not isolate our analysis around any specific economic events.

5.7.2.1 SA literature

We review South African literature, relating to market timing, published in the South African Journal of Business Management and Investment Analysts Journal for the eleven years to 2007.

Oldfield and Page (1996) use published monthly returns for 8 general equity funds and 9 specialist funds that were continuously available from September 1987 to September 1994. They find no evidence of superior timing (switching between 5 equity sectors and cash) and selectivity (switching securities within equity sectors and cash) skills.

Dumont de Chassart and Firer (2001), using monthly data of market indices for equities, bonds and cash, for the period 1925 to 2000, analyse how accurately investors can predict the future returns in respect of these asset classes. Trigger points are used to determine bull and bear markets and different asset allocations strategies are assigned to these different market conditions. Their study presents a market timing strategy that investors may use to enhance returns above the JSE equity market portfolio under certain market conditions.

In a later study that updates the data to the end of 2001, Firer, Peagam and Brunyee (2003) show that a fund's proportion of exposure to equities is a more important determinant of fund performance than the choice of rebalancing periods – monthly, quarterly or annually. The implication is that using the strategy of rebalancing asset class exposure (over the three periods) as a timing strategy for equity markets will detract from a fund's potential equity returns.

Akinjolire and Smit (2003) use monthly price data to calculate the returns for 7 general equity unit trusts for the period 1989 to 2002. Using the ALSI, the dividend yield for the ALSI and the difference between the yield of the 3-month NCD and 10-Year bond as independent variables in the Ferson and Schadt (1996) conditional model for measuring market timing, they find no evidence of market timing using the conditional approach.

Mutooni and Muller (2007) use monthly prices and dividends of all the listed JSE industrial shares for the period 1986 to 2006. They construct hypothetical funds based on style factors and calculate their monthly returns. Using an econometric model based on macroeconomic variables to determine a trading trigger, they implement a style rotation strategy. They find that timing style spreads can be more profitable than buying and holding the index.

Muller and Ward (2006), updating databases from earlier studies, use returns for the ALSI Index and cash for the period 1925-2005. Testing various combinations of inputs to a put option hedging strategy for switching effective exposure between equities and cash, they develop a trading rule that, by exploiting seasonality in the JSE total return index, can outperform buying and holding the index.

5.7.2.2 Summary of SA literature

Most of the approaches to market timing follow the top-down approach where asset allocation is emphasized. There are trading methods that result in an out-performance of passive indices and there are strategies that lead to underperformance. While earlier literature emphasized the high degree of accuracy required to successfully time the market, the review above suggests that the evidence for timing success is mixed and inconclusive. The results are dependent on the specific measure used, the timing strategy followed and whether asset allocation or security switching is used to implement a timing strategy.

5.7.3 The literature and this study

Since cash holdings are not entirely under the control of the manager due to varying fund cash flows and since fund objectives may restrict the size of a fund’s cash holdings, this study of reconstructed equity portfolios should provide a clearer identification of managers’ abilities to time markets through equity holdings. This view is consistent with that suggested by Sensoy and Kaplan (2005). This study considers the case where market timing is restricted to the strategy where managers utilize equity securities and precludes the alternative of increasing cash weightings within funds.

It is important that the reader be reminded that while our study focuses on individual securities, manager skill does not only involve selecting attractive investments. The manager must decide on the optimal combination of the individual securities in the fund that will ensure superior fund performance. We do not specifically analyse the success of managers' trades in "baskets" (combinations) of securities.

5.8 Methodology and data

In this section we discuss the three different approaches that we use to examine investment timing and trades of funds. Then we discuss alternative trade measurements that have been used in other studies with the intention of providing further context to our three approaches.

5.8.1 Trading return

Individual security holdings for each quarter and for each reconstructed equity fund were examined. If a quantity of a security had been held for four consecutive quarters, the security formed part of the "static portion" of a fund at the end of the four consecutive quarters. The return for this static portion is calculated in the same manner as indicated earlier for the entire reconstructed equity fund. The trading return is equal to the total equity return minus the return for the static portion:

$$R_t^{tr} = R_t - R_t^s$$

While our study considers the trading returns as a residual after static returns are deducted, the trading portion of the return is not entirely a result of buying and selling activities. As mentioned earlier, the trading returns incorporate the effects of corporate actions such as share splits, consolidations, buy-backs, etc. Therefore, we assume that those managers who achieve higher static portion returns and higher trading returns than poorer performing managers have superior fund management abilities across a broad range of fund management activities.

Using fund returns, we rank funds according to quartiles over 9-year, 5-year and 3-year horizons to the end of 2004 and plot the trading returns associated with those quartiles.

5.8.2 Market timing

Managers may use an investment strategy that includes timing the market. The equity risk premium changes as the equity market fluctuates. In order to benefit from these fluctuations, a skilled manager will increase the beta of the fund before or during a market rise and reduce the beta for a declining market. Treynor and Mazuy (1966) explained that managers only show market timing ability if they can increase fund returns by adjusting the systematic risk of the fund so that the characteristic line is upwardly concave. No timing ability among managers will result in a linear characteristic line. As discussed in work by Treynor (1965), the characteristic line is represented by a plot of the manager's return against the return of a suitable market index. To test the timing abilities of managers, Treynor and Mazuy (1966) added a quadratic term to the CAPM-based Jensen's model:

$$r_p - r_f = \alpha_p + \beta_p(r_m - r_f) + \gamma_p(r_m - r_f)^2 + \varepsilon_p$$

A significantly positive gamma indicates positive market timing ability. Treynor and Mazuy (1966) found no evidence of timing ability among managers.

Henriksson and Merton (1981) developed a model similar to the Treynor-Mazuy model, except that in their model market timing ability has an option like payoff.

$$r_p - r_f = \alpha_p + \beta_p(r_m - r_f) + \gamma_p \max\{0, -r_m + r_f\} + \varepsilon_p$$

When the market is rising, timing ability is indicated by a significantly positive gamma. When markets decline, a skilled manager will switch funds into risk-free assets. Henriksson and Merton (1981) find the average fund does not exhibit timing ability.

One disadvantage of using the above traditional timing measures is that their application to funds' returns does not reveal a distinction between market timing through switches between asset classes and switches between individual securities within an asset class. However, our equity-only portfolios allow for a focused application of the measures that will isolate managers' abilities to time the market using equity switches, since we do not allow for the maintenance of cash positions in the funds.

A further disadvantage of using the above quadratic measures for our equity-only portfolios is that the securities held in these portfolios may have option-like return profiles. To address the potential for the resulting artificial timing bias and model misspecification, Jagannathan and Korajczyk (1986) suggest an additional term be inserted into the above Treynor-Mazuy and Henriksson-Merton models respectively:

TM: $$r_p - r_f = \alpha_p + \beta_p(r_m - r_f) + \gamma_p(r_m - r_f)^2 + \psi_p(r_m - r_f)^3 + \varepsilon_p$$

HM: $r_p - r_f = \alpha_p + \beta_p(r_m - r_f) + \gamma_p \max\{0, -r_m + r_f\} + \psi_p(r_m - r_f)^2 + \varepsilon_p$

If psi (ψ) is significantly different from zero, then the results of the tests are considered spurious.

There is some strain on the results of our analysis. A manager may believe that holding a cash exposure may yield a better return than holding a share or group of shares and will thus hold money market instruments. However, in our hypothetical funds the choice is between shares and not between shares and cash. Therefore, since we use a measurement that is based on the choice between cash and shares – a choice we specifically exclude, our analysis may attract criticism for being too onerous an approach for evaluating market timing abilities among managers.

5.8.3 Security trading

Strategies for market timing include changing weightings between cash and securities holdings, changing the weightings in respect of securities held in the fund (e.g. increasing relative weightings to low beta securities) and changing the securities held in the fund. Each of the strategies involve the purchase and/or sale of individual securities. The timing of trades in individual securities is important for the implementation of market timing strategies. In addition, the superior timing of trades in securities can be a contributor to fund performance.

We investigate the abilities of fund managers to successfully time the purchases and sales of securities over one, two, three, and four quarters. For each fund we record the changes in quantities of each security held for each quarter. By considering changes in quantities, our study focuses on active trading of individual equity securities as opposed to the passive trades resulting from weighting changes of individual securities held in the portfolio. Trade execution is assumed to take place at the average of the beginning and end prices for the quarter (excluding transaction costs). The percentage of successful trades ("hits") across the four quarters and over the nine, five, and three-year horizons are calculated. The algorithms for the trades are displayed in the Appendix.

5.9 Further context: Trade measurement used in other literature

Carhart (1997) examines the impact of turnover on fund performance by separating the effects of buy and sell trading with the following equations:

$$Buy\ Turnover_{it} = Turnover_{it} + max(\ Mflow_{it},\ 0\ )$$

and

$$Sell\ Turnover_{it} = Turnover_{it} - min(\ Mflow_{it},\ 0\ )$$

where $Mflow_{it}$ measures the percentage change in total net assets (TNA), adjusted for returns and mergers. Turnover is the minimum of purchases and sales over average TNA (see next paragraph for more detail) plus one-half of the percentage change in TNA. These are comparatively broad measures of buy and sell turnover when compared to the method used in this study. We do not consider changes in total net assets as a variable in our calculations; rather, we use actual changes in the quantities of individual security holdings for each fund at each quarter. However, we do not ignore the concept (or influence) of turnover in this study!

In an earlier chapter we determine the static portion as a percentage of the total equity fund. The calculation of the static portion is based on weights of securities held in the fund for a period. The portion of the portfolio that is not the static portion is the residual and is referred to as the trading portion in the previous chapter. However, the residual may also be referred to as the turnover portion of the portfolio – the portion that is not static. Using this alternative description of turnover, the results from the previous chapter showed that the winning funds have higher levels of turnover than poorer performing funds. We also show that return in respect of that portion of the fund that is turned over is higher for winners than the returns in respect of the turnover portion of poorer performing funds. Our analysis of market timing and trades is expected to improve our evaluation of the results from the previous chapter.

CJW examine fund holdings and trades to evaluate the aggregate of managers' security-selection abilities. Aggregate security holding for each share i, for all funds at the end of quarter t, is measured by:

$$FracHoldin\,gs_{i,t} = \frac{Number\ \ of\ \ Shares\ \ Held_{i,t}}{Total\ \ Shares\ \ Outstanding_{i,t}}$$

and

$$Trades_{i,t} = FracHoldings_{i,t} - FracHoldings_{i,t-1}$$

where $Total\ Shares\ Outstanding_{i,t}$ is the total number of security i outstanding at that date.

As highlighted by CJW, their measure, which measures the net share trades across all funds, is different to the Grinblatt and Titman (1993) portfolio change measure that computes the change in each security's fund weighting for each fund, then averages this measure over the funds.

In support of the analysis of fund trades, CJW say: "…we expect active stock trades to represent a stronger manager opinion than the passive decision of holding an existing position in a stock, since the latter may be driven by non-performance-related reasons such as concerns over transaction costs and capital gains taxes."

We use the CJW comment to raise specific questions to which our responses will provide clarity to the distinguishing features of this study.

1. What is meant by "active" and "passive"?
2. What is a security/stock trade?
3. What is meant by "position in a stock"?

CJW refer to a "position in a stock" as the proportion of the quantity of individual shares held by all mutual funds, with respect to the total outstanding quantity for that share. "Active" trades are changes in the position of a security over a quarter. "Passive" implies that mutual funds have collectively not changed their proportion of shares held over a quarter. Therefore, they consider changes in aggregate holdings of individual securities as active trades. This contrasts with the commonly held view where deviations in weightings from a benchmark are used to describe "active" and share weightings that are the same as the benchmark weightings are considered as "passive". Since the funds in the CJW study include cash holdings, managers' trade convictions within the constraint of equity-only alternative investment choices may be dampened. Although we do use the same terminology, our "active" trades refer to changes in the quantities of each share held in each fund and "passive" refers to no change in the quantity of shares held over a period.

Whereas a reduction or increase in the total quantity of shares outstanding (e.g. after a share buy-back exercise or share split), will result in a trade in the CJW model, we do not account for share splits, buy-backs, consolidations, etc. and only a change in the quantity of shares held in the fund will constitute a trade in our model. Also, we did not adjust the quantities held in each share in our hypothetical funds to compensate for the cash exclusion and therefore managers' trade convictions may also be dampened in our model.

We now wish to elaborate on the issue of using fund quantities in the analysis of trades. As an extension of the literature review and a reference point for our discussion, we consider a recent study by Pinnuck (2003) – an additional (to Gallagher (2001)) study of Australian funds.

Pinnuck (2003) examined holdings and trades of Australian funds. His results suggest that superior returns from funds' security holdings are not received by investors. Possible reasons are transaction costs, management fees and poor market timing decisions.

The performance of security holdings is measured by taking the month-end value-weighted performance of all securities held in the fund multiplied by the individual securities' performances over the period to the end of the next month. The evaluation of trade performance is based on the change in the weight of the security at the end of the month from the previous month-end. Performance evaluation focuses on the Daniel, Grinblatt, Titman and Wermers (1997) characteristic-matching performance measure and is thus a benchmark-adjusted performance.

The portfolio performance is measured using

$$W_{ijt} = \frac{P_{it} H_{ijt}}{\sum_{i=1}^{N} P_{it} H_{ijt}}$$

where P_{it} is the price of security i at time t, H_{ij} is the quantity of shares held by fund j in security i of N shares at t.

The measure of trade is based on the change in the weight of i of j over month t and defined as:

$$W_{ijt} - W_{ijt-1}^{pt}$$

where

$$W_{ijt-1}^{pt} = \frac{P_{it} H_{ijt-1}}{\sum_{i=1}^{N} P_{it} H_{ijt-1}}$$

The author notes that the weightings are based on multiplying the quantities at the beginning and the end of the month by the same prices and, therefore, trades are separated from price momentum effects.

The attraction of the Pinnuck (2003) study as a reference point to our discussion is that it has features that are comparable to features of our analysis – small sample size and a short holding period. The analysis uses monthly equity portfolio holdings of 35 Australian funds from January 1990 to December 1997. The number of funds in the data varies between 14 and 35, with 24 to 72 months of data. The performance for holdings and trades is measured over holding periods of 1 month through to 6 months.

The results show that:

- Funds experience significant abnormal monthly returns.
- Securities that are purchased deliver abnormal returns that increase as the size of the trade increases.
- Securities that are sold do not deliver abnormal returns.

An important distinguishing feature of our measure of trades from that presented by Pinnuck (2003) is that we focus on trades for individual securities. Pinnuck (2003) measures the collective success of security trades at the fund level by considering the relative weighting changes of shares in the fund.

For example (see Table 5.1 immediately below), suppose that a fund held two hundred shares in each of two shares, Billiton (BIL) and Implats (IMP), at a price of 100 cents per share at the end of period *t-1*. A purchase of an additional two hundred BIL shares and price changes to 50 cents for BIL , would result in a weight change for both shares. Using the Pinnuck (2003) approach, the weight changes show that additional BIL were purchased but, also, that IMP shares were sold whereas the quantities held for IMP did not change. While fund value-weighting changes suggest that shares were traded, this measure shows the effective individual exposure changes with respect to the entire fund and not whether there were changes in the quantities of the individual shares held in the fund.

Changes in securities weightings (as used in Pinnuck (2003)) could be used to accommodate the effects of cash flows in the fund. However, this still masks the reality of changes in quantities of individual security holdings and hence the transparency required to identify deliberate security trades and the managers' convictions associated with those trades.

Table 5.1: Example - Changes in weights versus security holdings

Number of shares held		
	End of period t-1	End of period t
BIL	200	400
IMP	200	200
Prices		
	End of period t-1	End of period t
BIL	100	50
IMP	100	100
Weight changes		
ColumnTotals		0.00%
		End of period t
BIL		16.667%
IMP		-16.667%

5.10 Results

The tables referred to in Section 5.10 appear in Appendix 5.

5.10.1 Trading return

Table 5.2 shows average performance and timing measures for four quartiles over the 9, 5, and 3 -year horizons to the end of 2004. The quartiles have been determined using the raw returns (Total return) for the funds included for each horizon. The table clearly shows that the funds with the higher (lower) total returns generally have higher (lower) trading returns. This suggests that superior performing funds enjoy benefits due to superior trading by the fund managers.

5.10.2 Market timing

Table 5.2 also shows the average market timing statistics for the funds in the four quartiles. The results suggest that funds positively time the market over the longer period, while the 3-year horizon shows negative market timing ability timing. In contrast with the indications from trading returns, superior performing managers show lower positive market timing ability than poorer performing managers.

Table 5.3 shows the results of the regressions using the CAPM, H-M, and T-M models. Three funds – Nedbank Rainmaker, Appleton visionary growth and Nedbank Quants Core Equity - have bold p-values for all three regressions indicating that the means of the actual returns and the models' output mean returns are significantly different from zero. However, the majority of the regressions provide satisfactory correlations between the actual returns and the returns from the regression models.

Table 5.4 shows the results of the Jagannathan and Korajczyk (1986) tests for misspecification in the H-M and T-M models over 9, 5, and 3 year periods as well as for all data for each fund. The bold p-values indicate where psi (ψ) is not different from zero at the 5% significance level for a two-tailed T-test. In other words, the bold p-values are greater than 0.025 and indicate that the null hypothesis that psi is equal to zero cannot be rejected. The large numbers of bold p-values for the T-M measure indicate that the results of the T-M test for timing ability are not as spurious as those for the H-M test where there are higher indications (fewer bold p-values) of model misspecification and therefore the results of the H-M test are less reliable.

While the T-M test may appear more reliable than the H-M test, the aggregate results using both tests are similar at one level – managers possess better timing ability over longer rather than shorter periods and superior performing managers have lower positive timing ability versus poorer performing managers.

5.10.3 Security trading

Table 5.5 shows the average percentage of successful outcomes across four quarters for individual trades executed over the 9, 5, and 3 year periods. As an example, for the funds ranked in the top quartile over the nine-year period, the average percentage of purchases that experienced a positive return over the 3 quarters subsequent to the purchases, was 48%. Also in that category, 60% of the purchases made at the beginning of the first quarter and held for the subsequent 4 quarters, experienced a positive return by the end of the fourth subsequent quarter. In contrast, the top quartile funds over the nine-year period were generally less successful in selling equities, with less than a quarter (24%) declining three quarters after the sale. The exception in the sales category was across four quarters, where 53% of the equities sold and not bought back for the four quarters subsequent to the sale, declined in price over the four quarters.

The aggregate success rate of purchases improved from the nine-year to the three-year horizon while the opposite occurred for the sales. The higher success rate in purchases over sales would be expected during an appreciating equity price environment, as has occurred over the three-year period analysed in this study. Over all horizons, the aggregate success rate for purchases is better than for sales.

The average success rate for purchases and sales is indicated at the right hand side of Table 5.5. These results suggest that managers are successful with less than 50% of their trades (with a minimum of 33%) across three quarters subsequent to the execution of the trade. Managers are slightly more successful with trades that have a four-quarter horizon where the average success rate is above 50% (with a maximum of 57%). The differences in the success rates between winners and losers are too small to suggest that the one is better at trading than the other.

5.11 Conclusion

This study considers three different approaches to investigating the trading ability of managers. Using trading returns obtained from the performance attribution discussed in the previous chapter, we find that better performing funds receive higher contributions from trading than poorer performing funds. Contradicting these findings, traditional measures (Treynor-Mazuy and Henriksson-Merton) used to evaluate the abilities of managers to time the market provide weak evidence that superior performing managers possess lower positive timing ability than poorer performing managers.

We examine individual trades to evaluate abilities to successfully time purchases and sales. We find that while superior performing funds are associated with a higher success rate for purchases than sales, there is no convincing distinction between the results for superior and poorer performing managers to suggest that the one is better than the other at trading.

The study shows that winning managers provide higher returns to their funds through their trading activities but that this may be largely due to the success in picking the securities that are bought and sold than due to market timing. While managers are better at trading individual securities over four quarters than over shorter quarters, the evidence is insufficient to conclude that fund managers possess security trading ability, regardless of trading horizon.

5.12 References

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5.13 Appendix 5

5.13.1 Security trading algorithm

5.13.1.1 Purchases

<u>1 Quarter:</u>

If $Q_t > Q_{t-1}, Q_{t+1}$

then [$\max(0, (Q_t - Q_{t-1}) - \max(0, \min(Q_t, Q_{t+1}) - Q_{t-1}))$]

multiplied by [$(P_t + P_{t+1}) - (P_t + P_{t-1})$] / 2 …Ap

<u>2 Quarters:</u>

If $Q_t > Q_{t-1}, Q_{t+2}$

then [$\max(0, (Q_t - Q_{t-1}) - A - \max(0, \min(Q_t, Q_{t+1}, Q_{t+2}) - Q_{t-1}))$]

multiplied by [$(P_{t+1} + P_{t+2}) - (P_t + P_{t-1})$] / 2 …Bp

<u>3 Quarters:</u>

If $Q_t > Q_{t-1}, Q_{t+3}$

then [$\max(0, (Q_t - Q_{t-1}) - Ap - Bp - \max(0, \min(Q_t, \ldots, Q_{t+3}) - Q_{t-1}))$]

multiplied by [$(P_{t+2} + P_{t+3}) - (P_t + P_{t-1})$] / 2 …Cp

<u>4 Quarters:</u>

If $Q_t > Q_{t-1}, Q_{t+4}$

then [$\max(0, (Q_t - Q_{t-1}) - Ap - Bp - Cp)$]

multiplied by [$(P_{t+3} + P_{t+4}) - (P_t + P_{t-1})$] / 2

5.13.1.2 Sales

<u>1 Quarter:</u>

If $Q_t < Q_{t-1}, Q_{t+1}$

then [$\min(0, (Q_t - Q_{t-1}) - \min(0, \max(Q_t, Q_{t+1}) - Q_{t-1}))$]

multiplied by [$(P_t + P_{t+1}) - (P_t + P_{t-1})$] / 2 …As

<u>2 Quarters:</u>

If $Q_t < Q_{t-1}, Q_{t+2}$

then [$\min(0, (Q_t - Q_{t-1}) - A - \min(0, \max(Q_t, Q_{t+1}, Q_{t+2}) - Q_{t-1}))$]

multiplied by [$(P_{t+1} + P_{t+2}) - (P_t + P_{t-1})$] / 2 …Bs

<u>3 Quarters:</u>

If $Q_t < Q_{t-1}, Q_{t+3}$

then [$\min(0, (Q_t - Q_{t-1}) - A - B - \min(0, \max(Q_t, \ldots, Q_{t+3}) - Q_{t-1}))$]

multiplied by [$(P_{t+2} + P_{t+3}) - (P_t + P_{t-1})$] / 2 …Cs

<u>4 Quarters:</u>

If $Q_t < Q_{t-1}, Q_{t+4}$

then [$\min(0, (Q_t - Q_{t-1}) - As - Bs - Cs)$]

multiplied by [$(P_{t+3} + P_{t+4}) - (P_t + P_{t-1})$] / 2

5.13.2 Figures and tables

Table 5.2: Averages for quartiles across the three horizons

9 Years (Number of Funds = 18)					
Quartile	Total return	CAPM-β	HM-γ	TM-γ	Trading return
1	3.6%	1.0002	0.0596	0.0092	1.3%
2	3.0%	1.0022	0.2426	0.3828	1.0%
3	2.5%	1.0124	0.0766	0.0739	0.7%
4	1.7%	0.9779	0.1978	0.1849	0.9%
5 Years (Number of Funds = 35)					
Quartile	Total return	CAPM-β	HM-γ	TM-γ	Trading return
1	5.0%	0.7375	-0.0228	-0.3435	2.2%
2	3.1%	0.8879	0.0102	-0.2092	0.9%
3	2.5%	0.9672	0.1726	0.1151	1.2%
4	1.6%	0.9262	0.3004	0.1657	0.8%
3 Years (Number of Funds = 43)					
Quartile	Total return	CAPM-β	HM-γ	TM-γ	Trading return
1	6.5%	0.718	-0.061	-0.449	2.9%
2	5.1%	0.749	0.062	-0.313	2.3%
3	4.0%	0.819	-0.040	-0.333	1.8%
4	2.7%	0.914	-0.023	-0.178	1.3%

Table 5.3: Results of regressions

Results of regressions							
		CAPM		H-M		T-M	
Fund	Observations	Correlation	p-values	Correlation	p-values	Correlation	p-values
Sanlam General Equity	44	96%	0.300	97%	0.284	97%	0.412
Sanlam Growth	44	82%	0.084	86%	0.494	86%	0.315
Investec Equity	44	93%	0.546	94%	0.519	94%	0.542
Metropolitan General Equity	44	91%	0.657	92%	0.479	92%	0.566
RMB Equity	44	94%	0.160	94%	0.286	94%	0.285
ABSA General	44	89%	0.790	91%	0.640	92%	0.546
Nedbank Growth	44	84%	0.351	86%	0.201	86%	0.274
Community Growth	44	87%	0.382	89%	0.104	89%	0.210
Old Mutual Investors	44	92%	0.512	93%	0.453	94%	0.545
Old Mutual Top Companies	44	93%	0.463	94%	0.592	94%	0.618
Futuregrowth Core Growth	44	88%	0.352	90%	0.399	90%	0.398
Futuregrowth Albaraka Equity	44	68%	**0.006**	79%	0.120	76%	**0.016**
Stanlib Wealthbuilder	44	94%	0.112	95%	**0.049**	95%	0.144
Sage Fund	44	95%	0.270	95%	0.449	96%	0.436
Old Mutual Growth	33	87%	0.915	89%	0.892	89%	0.761
Stanlib Prosperity	28	98%	0.341	98%	0.403	98%	0.383
Stanlib Index	26	100%	0.375	100%	0.413	100%	0.447
Investec Index	25	100%	0.348	100%	0.384	100%	0.350
Stanlib Capital Growth	23	87%	0.469	87%	0.541	88%	0.605
Coronation Equity	21	94%	0.282	95%	0.238	95%	0.249
Investec Growth	17	87%	0.222	85%	0.527	86%	0.670
Investec Value	17	72%	0.093	72%	0.172	74%	0.167
RMB Strategic Opportunities	17	89%	0.164	88%	0.260	88%	0.340
Gryphon All Share Tracker	18	98%	0.686	98%	0.590	98%	0.600
Nedbank Value	15	78%	0.550	82%	0.810	84%	0.838
Nedbank Equity	14	96%	**0.004**	92%	0.084	93%	0.055
PSG Growth	13	70%	0.133	66%	0.207	71%	0.168
Old Mutual Value	13	79%	0.223	81%	0.242	83%	0.230
RMB Value	12	88%	0.113	87%	0.143	87%	0.176
Nedbank Rainmaker	11	95%	**0.009**	95%	**0.016**	95%	**0.015**
Allan Gray Equity	11	93%	0.284	92%	0.292	93%	0.317
Old Mutual High Yield Opportunity	11	88%	0.126	90%	0.148	90%	0.148
FNB Growth	11	90%	**0.029**	88%	0.065	88%	0.071
Sanlam Value	11	89%	0.066	89%	0.091	89%	0.095
Futuregrowth Active Quant Equity	10	97%	**0.027**	97%	0.059	97%	0.053
Appleton Visionary Growth	8	99%	**0.001**	97%	**0.013**	97%	**0.009**
Prudential Dividend Maximiser	8	89%	0.375	89%	0.392	90%	0.390
Prudential Optimiser	8	96%	0.063	96%	0.079	96%	0.084
Woolworths Unit Trust	7	92%	0.054	92%	0.070	92%	0.087
Coris Capital General Equity	6	96%	0.164	96%	0.129	96%	0.126
Tri-Linear Equity	6	95%	0.091	94%	0.135	94%	0.167
Stanlib Value	4	84%	0.280	80%	0.353	79%	0.402
Nedbank Quants Core Equity	7	95%	**0.005**	94%	**0.013**	94%	**0.010**
Stanlib MM Equity Feeder	10	99%	**0.045**	99%	0.077	99%	0.069
Average		90%		90%		91%	

Ho: The difference between the means is not significantly different from 0.
Ha: The difference between the means is significantly different from 0.
As the computed p-value is greater than the significance level alpha=0.05, accept the null hypothesis Ho.

Table 5.4: P-values for ψ in the Jagannathan and Korajczyk adjusted models for H-M and T-M

(bold p-values means accept Ho: psi = zero at 5% significance for two-tailed t-test)									
		Henriksson-Merton				Treynor-Mazuy			
Fund	Observations	9yr	5yr	3yr	All data	9yr	5yr	3yr	All data
Sanlam General Equity	44	**0.0736**	0.0000	0.0000	**0.0963**	**0.6147**	**0.7089**	**0.1219**	**0.6327**
Sanlam Growth	44	0.0000	0.0000	0.0000	0.0000	**0.3181**	**0.1143**	0.0013	**0.0717**
Investec Equity	44	0.0014	0.0044	0.0010	0.0004	0.0249	**0.5306**	**0.0411**	**0.0429**
Metropolitan General Equity	44	0.0004	0.0026	0.0008	0.0142	0.0108	**0.4858**	0.0237	0.0066
RMB Equity	44	**0.0459**	0.0006	0.0000	0.0014	**0.3484**	**0.7115**	**0.1033**	**0.6464**
ABSA General	44	0.0002	0.0000	0.0000	0.0001	0.0024	**0.7528**	**0.0792**	0.0051
Nedbank Growth	44	0.0006	0.0000	0.0000	0.0015	**0.6803**	0.0069	0.0012	**0.7933**
Community Growth	44	**0.5636**	0.0000	0.0000	**0.0605**	**0.9757**	**0.2248**	**0.1853**	**0.0625**
Old Mutual Investors	44	**0.0815**	0.0000	0.0000	**0.8841**	**0.2733**	**0.4330**	**0.0517**	**0.1318**
Old Mutual Top Companies	44	0.0030	0.0000	0.0000	0.0025	**0.5515**	**0.0989**	0.0247	**0.5152**
Futuregrowth Core Growth	44	0.0000	0.0000	0.0000	0.0000	**0.6216**	0.0104	0.0054	**0.7391**
Futuregrowth Albaraka Equity	44	0.0000	0.0000	0.0000	**0.0784**	0.0137	**0.8827**	**0.2383**	0.0006
Stanlib Wealthbuilder	44	**0.0642**	0.0008	0.0000	0.0010	**0.5171**	0.0001	0.0017	0.0148
Sage Fund	44	0.0000	0.0046	0.0000	0.0000	**0.0656**	**0.2117**	**0.4449**	**0.1443**
Old Mutual Growth	33		0.0000	0.0000	0.0020		**0.5737**	**0.1071**	**0.3496**
Stanlib Prosperity	28		0.0000	0.0000	0.0000		**0.1850**	**0.1640**	**0.3344**
Stanlib Index	26		0.0017	0.0018	0.0000		**0.8202**	0.0022	**0.0416**
Investec Index	25		**0.2502**	**0.4530**	0.0136		**0.0325**	**0.2126**	0.0010
Stanlib Capital Growth	23		0.0000	0.0000	0.0000		0.0143	0.0015	**0.0504**
Coronation Equity	21		0.0000	0.0000	0.0000		0.0191	0.0076	0.0247
Investec Growth	17			0.0000	0.0000			0.0113	**0.0951**
Investec Value	17			0.0000	0.0000			**0.7180**	**0.2593**
RMB Strategic Opportunities	17			0.0000	0.0002			**0.0380**	**0.5148**
Gryphon All Share Tracker	18			0.0002	0.0015			0.0007	0.0060
Nedbank Value	15			0.0000	0.0000			**0.4490**	**0.1233**
Nedbank Equity	14			0.0000	0.0000			**0.0386**	0.0083
PSG Growth	13			0.0000	0.0000			0.0008	0.0003
Old Mutual Value	13			0.0000	0.0000			**0.2561**	**0.1343**
RMB Value	12			0.0000	0.0000			**0.1059**	**0.1036**
Nedbank Rainmaker	11				0.0000				0.0248
Allan Gray Equity	11				0.0000				**0.1616**
Old Mutual High Yield Opportunity	11				0.0000				**0.4050**
FNB Growth	11				0.0000				0.0139
Sanlam Value	11				0.0001				**0.4420**
Futuregrowth Active Quant Equity	10				0.0000				**0.2669**
Appleton Visionary Growth	8				0.0000				**0.0920**
Prudential Dividend Maximiser	8				0.0004				0.0012
Prudential Optimiser	8				0.0000				**0.6438**
Woolworths Unit Trust	7				0.0000				**0.3560**
Coris Capital General Equity	6				0.0141				**0.1468**
Tri-Linear Equity	6				0.0004				0.0195
Stanlib Value	4				0.0036				**0.6347**
Nedbank Quants Core Equity	7				**0.9418**				**0.3981**
Stanlib MM Equity Feeder	10				0.0000				**0.5252**

Table 5.5: Trading returns and horizon success: Average hits for quartiles

		Buys				Sells					Buys and sells combined			
	Return	1Q HR	2Q HR	3Q HR	4Q HR	1Q HR	2Q HR	3Q HR	4Q HR		1Q HR	2Q HR	3Q HR	4Q HR
9 Years	1.6%	50%	52%	48%	60%	38%	31%	24%	53%		44%	41%	36%	57%
(18 Funds)	1.0%	47%	44%	44%	57%	33%	32%	28%	50%		40%	38%	36%	53%
	0.8%	49%	48%	43%	52%	34%	27%	23%	45%		42%	37%	33%	48%
	0.6%	49%	50%	45%	54%	35%	30%	37%	50%		42%	40%	41%	52%
5 Years	2.3%	53%	57%	47%	65%	24%	20%	26%	39%		38%	38%	37%	52%
(36 Funds)	1.4%	55%	54%	56%	55%	37%	34%	37%	47%		46%	44%	47%	51%
	0.9%	50%	53%	51%	59%	41%	39%	30%	45%		45%	46%	41%	52%
	0.4%	54%	51%	48%	55%	36%	33%	33%	47%		45%	42%	40%	51%
3 Years	3.5%	64%	66%	57%	71%	31%	29%	32%	42%		48%	47%	45%	56%
(44 Funds)	2.4%	66%	64%	63%	69%	29%	27%	29%	42%		48%	46%	46%	55%
	1.5%	50%	53%	51%	64%	32%	27%	31%	38%		41%	40%	41%	51%
	0.9%	54%	53%	48%	61%	36%	27%	28%	39%		45%	40%	38%	50%

Chapter 6: Summary and conclusions

The objective of this study is to present a new approach to assessing fund management and to establish whether there is empirical support for this approach.

The new approach relies on identifying empirical regularities (measured largely by correlations) that reveal new information and insights about funds and their management. The new information and insights enable improved decision making by investors with regard to their expectations for the management of their assets and hence their performance expectations. The new approach is, therefore, intended to be an addition to other approaches rather than a replacement.

As noted in Chapter 1, Lindley (1988) identifies three steps to making a sensible decision. The first step involves transforming uncertainty into risk by attaching probabilities to potential outcomes. It is precisely the formulation of these probabilities that this study aims to add value to. By acknowledging and understanding the historical relationships between variables that affect fund performance, investors will be in a better position to formulate probabilities for expected outcomes and therefore complete the first step to making a sensible decision.

This study does not suggest that expectations for future outcomes should be based entirely on history. Rather, empirical evidence and more specifically the probabilities associated with future outcomes are an important part of the formulation of expectations. More crudely, historical relationships determine future outcomes.

The formulation of probabilities will depend on the investor's knowledge of investment strategies that fund managers use to generate fund performance. Some managers generate better performance than other managers and therefore must be employing certain strategies more effectively than the poorer performing managers. This study provides updated and new information that investors may choose to add to their existing knowledge of fund management which should lead to better formulation of probabilities for outcomes and hence better decision making.

The persistence of fund performance is a widely researched topic extending over a number of decades. Amid this backdrop our contribution is via the updating of existing research since we use different data to support the existence of persistence among South African funds.

However, our contribution is also in the form of new information. Most of the prior research into persistence has focused on using published fund returns in markets outside South Africa. The research that focuses on persistence in the performance of South African funds, also, largely relies on published fund returns. Unfortunately, the results of prior research are contradictory and inconclusive. This study relies on the returns of funds constructed using the listed equity holdings of South African equity unit trusts. Therefore, our investigation provides higher resolution on the presence of fund persistence in the listed equities of funds. In other words, combinations of listed equities (as funds) are isolated and identified as a clear source of fund persistence. All the results found in this study relate to these "equity-only" funds.

In addition, we compare persistence between different performance measures and its higher concentration among the best and worst performing funds (top and bottom quintiles). The persistence is highest from one quarter to the next and fades over the subsequent three quarters despite the indication of its existence over the later quarters.

Our results indicate the likely direction of change for funds ranked in the "middle" quintiles. The poorer performing funds in the middle ranks are more likely to enjoy an improvement in their rankings than the better performing funds. The presence of persistence is greater when measuring performance using Jensen's alpha and the Omega statistic than when using the raw returns or the traditional Sharpe, Treynor and Sortino measures.

The implication for investors is that the absence of mean reversion in fund performance over this period provides an opportunity to make abnormal profits from allocating funds to winning managers. Also, once invested in a fund in the "middle" quintiles, there is a greater chance of performance improving rather than deteriorating. At the very least, the investor should avoid investing in bottom quintile funds.

The contemporaneous relationships between the performance of a fund and the characteristics of the organisation of a fund offer insights to the formulations for the future performance of that fund. We address the contributions in two parts.

Our study introduces a new approach to fund attribution. We decompose fund performance into two parts: that which is attributable to the static portion and the remainder which is attributable to the trading portion. Alternatively, this decomposition may be viewed as distinguishing between performance attributable to a buy-and-hold strategy and that which is attributable to market timing and trading strategies.

Our analysis shows that better performing managers achieve better results from their static and trading portions than their poorer performing counterparts. Moreover, managers generally achieve better performance from their buy-and-hold strategies than their trading strategies.

While comparisons between the performances of buy-and-hold and trading strategies have been widely presented, these have been largely based on performance attributable to changes in asset class allocations. To the best of our knowledge, Lo (2007) is the only research that proposes a performance attribution along similar lines to that proposed in our study. Lo (2007) proposes attributing fund performance to a static portion and a "dynamic" portion. However, our new method for achieving the distinction is entirely different from that of Lo (2007).

Our attribution involves considering the period for which each equity security is held. Individual holdings that are maintained for a year (four quarters) constitute the static portion of the fund and the performance of this static portion is calculated and subtracted from the total (hypothetical) fund performance to obtain a residual, which we identify as the performance attributable to the trading portion.

Our investigation into persistence is applied to a new area of research into fund analysis. We focus on the structure of the fund with respect to its individual holdings and how those compare with the weights of equity securities in publicly available market indices.

The comparison facilitates an evaluation of the extent to which funds' holdings deviate from certain indices. These deviations are often referred to as active bets. Our analysis examines the overlap that funds have with indices that provide market segmentation according to market capitalisation (size). In a market (such as is the case for South Africa) with a high capitalisation concentration among a few shares, it can be expected that greater overlaps with the large capitalisation index (ALSI Top40) would reduce the potential for achieving peer-beating fund performance since those stocks would be most widely held, particularly among the larger funds. Our results support this intuition and indicate that the size (market capitalisation) of individual holdings is a determinant of performance. While the study of relationships between size and performance is not new, the incorporation of the concept into analysing fund structure and interpreting managers' distinguishing preferences for fund structure is new in the South African context.

We contribute to the investor's knowledge of these relationships by highlighting the presence of persistence in these relationships. This contribution is new in the South African context, particularly with respect to the use of the Omega statistic as a performance measure.

Our use of traditional market timing measures to examine the timing abilities of managers (or funds) with equity-only holdings is a unique refinement of previous studies that largely use total fund or asset class performances.

To develop conviction in our results from using traditional timing measures, we provide two new departures from all other investigations into timing and/or trading abilities of managers. Firstly, we borrow the results from our new proposal for performance attribution. These results provide new information in that they do not suggest that managers do not add value through timing, rather that these timing strategies are a secondary source for fund performance (and that static holdings are the primary source). Secondly, we examine the direction of changes in equity securities that managers buy and/or sell subsequent to the transaction of those trades. More importantly, we examine the success of the individual trades over one, two, three and four quarters.

Consistent with the results of earlier studies into the success of trading strategies, our results do not support the intuition that managers possess trading abilities, nor that market timing or trading strategies are an optimal source for adding value to funds.

While it is important that this study provides a contribution to existing knowledge, it is also important that it provides an entrée to further research. Using the presentation of our research as a base we provide suggestions, below, for further research that may provide further contributions to existing knowledge and the contributions made by our research.

- The topic of persistence has been widely researched but there are many aspects that require further investigation. Our study reveals an interesting opportunity for further studies in performance persistence by decomposing fund returns into static and trading components. If, as we show, there is evidence of performance persistence in equity-only funds, then there may be components within these equity-only funds that are the main source(s) of persistence. Perhaps the static portion is a stronger source of performance persistence than the trading portion. In addition, our approach to identifying aspects of fund structure provides further starting points to exploring sources of persistence. For example, greater degrees of performance persistence may exist in the (collective) large-cap holdings of a fund than in the small-cap holdings.
- Another interesting area of research in performance persistence among South African funds lies in the potential link (or relationship) between fund characteristics and attribute values (or factor loadings) for individual holdings as highlighted by van Rensburg and Robertson (2003).
- The decomposition of returns into static and trading portions opens an interesting window into the debate around active and passive management and the extent to which investors pay for each (or both). Questions that are not easily answered but that require further exploration are:
    - Do the static portions represent a passive component of a fund or does this "inactive" component have an active sub-component and if so, how does one identify and measure the active component and its performance?
    - Should investors pay active fees for the trading portion if it generates inferior performance to the static portion? If superior fund value (performance) generation is due to the static holdings (as we demonstrate) then one may argue that trading securities is a means to implementing an active "bet" in the static portion and the activity of trading should not be compensated. In addition, since trading is a suboptimal source of fund value generation, investors should be compensated for excessive levels of trading in their funds.
- Our research provides an entry point to investigating individual manager investment strategy preferences. It seems reasonable to expect that there are certain shares that some managers would prefer to trade more often or hold for longer and that these shares are different to the shares that another manager may prefer to trade or hold for longer. Indeed, it is widely accepted that large-caps are easier to trade than small-caps. However, evidence of managers' preferences may be explained by the managers' experiences

during the earlier years of a career in investments. For example, its seems reasonable to expect that a fund manager that has spent the larger part of a career in analysing securities in the resources sector may display greater success in trading those securities than a fund manager who has little or no experience in that area. On the other hand, a manager who is known to have little or no experience in analysing resource shares and is observed to be trading resources securities extensively may raise investor concerns for the management of the fund, particularly if it affects the expected fund performance.

- If the finding by Chen, Jegadeesh and Wermers (2000), that equity securities which are more widely held among funds underperform those that are not, can be found to be relevant to the South African market, then it would be interesting to identify the less commonly held stocks which are held in the static portion of a fund that show persistence in their superior performance. These stocks would be expected to be a superior source of performance for funds. This is a controversial issue among fund managers since it implies that investment decisions are made by considering other fund managers' investment decisions and therefore the "copying" manager should not receive compensation for active management. Indeed, using other funds' holdings to determine your fund's holdings is one of the factors that stimulates the "herding" among funds that is so readily condemned – or so one may argue.
- An extension of our study into trading would be to consider the value and number of the individual trades. While the success rate of individual trades may be low, it is feasible that the net value of the trades may be sufficiently substantial and significant to suggest that managers have the ability to successfully combine the value of their trades to ensure that their trades add value to their funds over different periods. The number of shares traded will provide evidence of the nature of the bets that managers make. Trades spread over a large number of securities may suggest that those trades are part of a market-timing strategy, while a small number of large trades may indicate more specific and focused changes in security selection. Also, we have mentioned a number of different components to the trading portion of our return decomposition. It would be interesting to decompose this trading portion further and separate return contributions to the fund from each of the trading components.
- Comparisons between groups of funds will provide clarity on whether there is a distinction between how equity funds are managed. For example, it is often claimed that equity funds within an investment house each receive the same treatment, particularly in terms of the investment strategy that is implemented. However, some investment

professionals will readily note that equities within pension funds are necessarily managed differently to those in, say, a fund in the general equity unit trust category - largely because the utility functions are different between the groups. Since there are unit trusts (such as those within the domestic asset allocation prudential categories) that can be considered as appropriate proxies for pension funds and for which there is data available, replication of this study (using the additional data) should provide results that would facilitate improved evaluation of the manner in which equities are managed (holdings, structure and trading) between groups of funds.

6.1 References

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