Characterising Persistence of Performance Amongst South African General Equity Unit Trusts

Lance Collinet

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Lance Collinet

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DECLARATION

I, Lance Collinet, declare that this research report is my own, original work and that all sources have been accurately reported and acknowledged. This research has not been submitted before for any degree or examination at this or any other university.

Signed by candidate

Lance Collinet 3 May 2001

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ABSTRACT

This study analyses the relative performance of general equity unit trusts from 1980 to 1999, using a database that has been verified for accuracy and is free of survivorship bias. It characterises the behaviour of performance persistence in order to explain the conflicting results of previous persistence studies and to provide a framework for further research into the causes of persistence.

This research shows that the relationship between past and future performance rankings is positive, but weak. The results of persistence studies are highly sensitive to the length of the holding period used to evaluate performance and to the time period covered in the analysis. As the holding period lengthens, the persistence results become more sensitive to the beginning date and ending date of the period under examination.

Regardless of the ending date chosen, persistence of winning funds and losing funds was evident when holding periods of 6 months were used. Persistence was particularly evident during the 1995 to 1999 period. However, even in this period, there were situations where rankings from one holding period to the next appeared random and situations where rankings reversed.

It was shown that individual unit trusts do not perform consistently over multiple holding periods. However, when using a trading strategy of buying the top performing fund over the last 6 months and holding it for 6 months, it was shown that, in *most* cases, an investor would have earned a return over 5 years that beat the average return of all general equity unit trusts *after* taking switching costs into account.

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1.1 Unit trust industry growth

The growth in the unit trust industry over the past 15 years, both in terms of the funds under management and the number of funds available, is evidence that unit trusts are a popular investment vehicle for investors. Despite lack of evidence that fund managers are able to consistently outperform the market, unit trusts have remained popular for the following reasons:

- They are fairly liquid and easily accessible – it is easy to deposit and withdraw funds.
- They are transparent - unit prices are published daily allowing the investor to monitor the value of his/her portfolio.
- The investor does not need market expertise – this is provided by portfolio managers in return for a management fee.
- The administration of the investment is minimal on the part of the investor.
- The industry is regulated and the investment is regarded as fairly safe.
- They give the small investor exposure to equities at a reasonable cost.
- Diversification is achievable even when small amounts are invested.
- No time is required on the part of the investor to research, select and monitor securities held in the portfolios.

Unit trust funds have also become a popular investment vehicle for pension fund money. Over the past 10 years many pension funds have converted from defined benefit to defined contribution funds, and with that administration of the funds has been outsourced to life assurance companies or Linked Investment Service Providers, more commonly known as

Linked Product companies. Linked Product companies have also promoted unit trusts by offering packaged tax efficient unit trust products to replace traditional (and less transparent) retirement annuities and endowment policies. Unit trust funds are the ideal investment vehicle for linked product pension portfolios because:

- They are easier to administer than share/bond portfolios.
- They are transparent – prices are published daily.
- The responsibility for portfolio returns is shifted to the unit trust management companies.
- They are fairly liquid as the management companies guarantees the repurchase price.
- The funds are classified according to mandate, making asset allocation and portfolio construction easier.

Wrap funds also use unit trusts as investment vehicles. These financial products are relatively new to the South African market. They consist of two or more unit trust funds "wrapped" up to form a portfolio with a specific risk profile.

The growth in net inflows to the industry and the demand for unit trust funds with varying risk profiles, investment universes and mandates has led to an exponential increase in the number of funds available to the investing public. Despite growth in assets under management, the number of account holders has been dropping since 1998. This can be attributed to the wrap funds and linked product providers that have taken over the administration of individual accounts and used their market power to negotiate lower entry costs. Investors are now paying wrap funds and linked product companies to administer their portfolios, monitor fund performance, achieve diversification across funds and hold

the optimal portfolio of funds for the investor's risk profile. They are paying for expert advice, but *is* there any expertise amongst the experts?

1.2 Motivation for research

Unit trust selection has become a daunting task for the relatively unsophisticated individual investor. Most investment advice that is provided by experts in the South African unit trust industry is centred on diversification, asset allocation and matching a portfolio's mandate to an investor's risk profile. Little guidance is given on how to objectively select specific unit trusts from within a fund category. Over the 5 years ended 31 December 2000, the worst performing unit trust in the domestic general equity sector lost 3.6%, while the best performing fund returned 220.4% (Hugo Lambrechts – Unit Trusts Survey p.7).

This huge disparity in returns, for funds of seemingly equal risk, has made investors look for professional advice. Despite every advert stating that short-term performance is not an indication of future long-term returns, investors are not prepared to wait five years to find out that their investment has not even kept pace with inflation. The need for expert advice has created a demand for wrap funds and linked product companies to offer multi-manager portfolio selection services in return for an administration fee and/or a slice of the initial invested amount.

The multi-manager approach advocated by an increasing number of unit trust companies suggests that superior portfolio selection and periodic portfolio optimisation is possible. But is there sufficient evidence to support this? And more importantly, can the selection and monitoring process provide returns sufficient to cover the fees charged? These questions have recently become far more relevant than before because a recent shift in market power from unit sellers to buyers within the industry has lowered barriers to entry

and made trading of funds more economically viable. Recent developments in the industry that have affected cost structures are:

- Linked product companies in South Africa have gained significant market power as they have the mandate to move large amounts of money from one unit trust to another. Their ability to "buy in bulk" allows them to negotiate reductions in initial fees and sometimes management fees. This enables them to offer their customers (investors) the facility to switch funds at relatively low cost, even when switching from one Management Company to another.
- Automated Internet based administration services have reduced the cost of administering client records and have resulted in further savings being passed onto the investor.
- The introduction by the JSE of exchange traded funds (e.g. Satrix40) eliminates the need for the more expensive index unit trust funds and gives the small investor direct access to the share market. As the exchange traded funds gain popularity, unit trust funds will be pressured to provide consistently superior risk-adjusted returns or reduce costs significantly.

Lower switching costs have made the question of short-term persistence economically significant. Most studies, both locally and internationally, have not found significant evidence of long-term (over 5 years) persistence in unit trust performance. However, the results of studies on short-term persistence are less conclusive and require further research.

This study looks at performance persistence of unit trusts relative to each other. The performance of unit trusts as a group relative to a market proxy is not the focus of this study. The question is not whether unit trusts can outperform the market, but whether a

certain group of unit trusts can consistently beat another group of unit trusts on a risk-adjusted basis. This is the question asked by most individual investors and wrap fund managers.

If evidence of relative persistence is found and the superior funds do beat the market, it suggests that the market is not efficient or that the results are a function of the data set used. The latter possibility will be mitigated by testing the data points for accuracy and varying the time periods studied to ensure that results are not specific to a particular business cycle or starting point. Where persistence is found, trading strategies that maximise the after-costs returns will be investigated. Reasons for persistence and out-performance, which contradicts the efficient markets hypothesis, will be proposed, but the causes of persistence (if it exists) are likely to require further research.

If persistence is not found, it raises a question about the ability of wrap fund managers and multi-manager unit trust companies to select a superior unit trust portfolio. If this is the case, investment strategies that maximise diversification, while minimising costs are likely to produce superior risk-adjusted returns in the long run. Such strategies will be investigated in an attempt to provide insight to those involved in the unit trust portfolio selection process.

1.3 Outline of this report

The structure of this report is as follows:

Chapter 2 reviews the local and international research relevant to this study. It describes the variety of research methodologies used and notes the results. It also tries to identify gaps and weaknesses in past research to highlight the areas that require further attention.

Chapter 3 formalises the research propositions, states the research hypotheses and describes the assumptions and limitations of this research. Chapter 4 then describes the data set and the research methodology used to test the hypotheses.

Chapter 5 presents and interprets the results of the tests performed. Chapter 6 concludes and suggests areas of further research.

2 LITERATURE REVIEW

2.1 Introduction

Mutual funds (the international equivalent of "unit trusts" in South Africa) have been the subject of considerable research in the United States since the 1960's. Strong investor awareness resulting from the high degree of transparency and competition in the industry and the public availability of return data arising from the daily pricing process has made mutual fund performance analysis a popular topic of research. According to Wermers (2000) equity mutual funds in the United States now manage over $3 trillion, but the debate of how to select a winning fund continues. Interestingly, the worlds two largest mutual funds are the *actively* managed Fidelity Magellan Fund and the *passively* managed Vanguard Index 500 Fund, each managing about $97 billion. This reflects the inconclusive results of research over the past 35 years. The academic debate is centred on three areas of concern to investors:

- Do actively managed mutual funds outperform the market? In other words, is the market efficient?
- Is it worth paying an investment professional to manage a portfolio actively? Do the rewards gained from active management exceed the costs incurred?
- Does mutual fund performance persist? Can past performance be used to predict future performance?

Although these questions are closely related they are subtly different. For example, if actively managed equity funds do not outperform the market, it does not necessarily imply that fund managers are not able to select shares that perform better than the shares in a passively managed portfolio. It may be the case that equity managers do possess share

selection or timing abilities sufficient to at least cover their costs, but other factors such as administration expenses and non-equity holdings may cause equity funds to under-perform a passive benchmark. If active managers as a group do possess skills worth paying for, it does not imply than individual managers can perform consistently over time.

The studies aimed at answering the above questions have been aided by the development of modern portfolio theory. The efficient frontier devised by Markowitz (1952), the Efficient Markets Hypothesis proposed by Fama (1970), the Capital Asset Pricing Model developed independently by Sharpe (1964), Lintner (1965) and Mossin (1966) and the Arbitrage Pricing Theory developed by Ross (1976) were the most significant early developments. Much of the research since the development of these theories has focussed on their practical application and their shortcomings. The result has been a wealth of empirical research on mutual fund performance that has produced somewhat disparate results. The differing results are mainly a function of the following three factors:

- the benchmark and method of performance measurement chosen,
- the time periods selected and the quality of the data set used, and
- the statistical method used to measure the relationship between mutual fund returns and the chosen benchmark.

This review focuses on the literature relating to *persistence of performance*. However, some relevant studies that address performance measurement and sample bias issues are also reviewed to provide a background to the persistence literature. The research on South African unit trusts is covered separately to highlight the differences between local and international research in this area.

2.2 Common performance measurement methods

The Treynor measure, the Sharpe ratio and Jensen's alpha were the first composite measures that combined risk and return into one ratio that could be used to evaluate portfolio performance. These measures have been used extensively in research since they were developed in the 1960's. They are all derived from capital market theory, which is based on the following assumptions, as summarised by Reilly & Brown (1997, p.279):

- All traditional investors are risk-averse.
- All investors attempt to maximise the expected utility of their terminal wealth.
- All investors have the same one-period decision horizon.
- All investors have homogeneous expectations regarding investment opportunities.
- All investors can borrow any amount of money at the risk-free rate.
- All investors choose among portfolios solely on the basis of expected returns and variance of returns.
- All transaction costs and taxes are zero.
- All assets are infinitely divisible.
- Any change in interest rates or inflation is fully anticipated.
- Capital markets are in equilibrium (i.e. all investments are properly priced).

The Treynor measure

Treynor (1965) postulated that investment risk could be split into two components: (a) risk produced by general market fluctuations (systematic risk) and (b) risk resulting from unique fluctuations in particular securities held by a fund (unsystematic risk). Because holding a fully diversified portfolio can eliminate exposure to unsystematic risk, Treynor

was concerned only with adjusting returns for exposure to general market fluctuations. He plotted the return of a fund over time on the x-axis, against the return on a "suitable" market average (he used the Dow-Jones Industrial Average) on the y-axis and called the line-of-best-fit through these points, the *characteristic line*. The slope of the characteristic line represents the variability of the portfolio return relative to the market return and is known as the portfolio beta (β_p).

After computing a fund's historical beta and average historical return, Treynor plotted the fund's risk-return co-ordinates relative to the security market line (SML). A fund that plotted below the SML was regarded as having under-performed the market and a fund that plotted above the SML as having outperformed the market on a risk-adjusted basis. Figure 1 illustrates the calculation of a fund's beta (the slope of the characteristic line) and the plotting of its risk-return co-ordinates relative to the SML. Note that the market portfolio has a beta of 1 and in this example the fund has outperformed the market based on raw returns, but has under-performed the market on a risk-adjusted basis.

The ratio of excess return to beta can be used to rank the past performance of different funds relative to the market and to each other. The Treynor measure can be represented by the following equation:

$$T_p = \frac{r_p - r_f}{\beta_p}$$

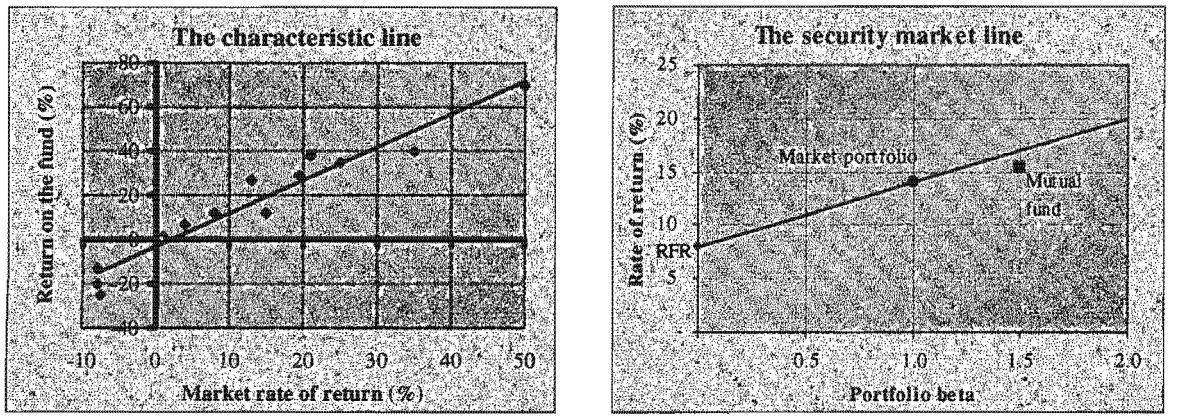
Where :

r_p = average historical portfolio return over the period (usually geometric mean)

r_f = average risk - free return over the same period

β_p = portfolio beta (slope of characteristic line using past returns over the same period)

Figure 1: The calculation of a fund's beta and the evaluation of its risk-adjusted return relative to the security market line.



The Treynor measure assumes that the portfolio being evaluated is perfectly diversified and the portfolio beta is stable over time. Therefore if the portfolio being evaluated holds securities with returns that are correlated with each other or the portfolio's variability in relation to the market changes over time, the Treynor measure will be an unreliable measure of risk-adjusted performance. For this reason, Sharpe (1966) regarded the Treynor measure as an inferior measure of past performance. However, he noted that if these assumptions are expected to hold in future, the Treynor measure was superior to the Sharpe ratio for predicting future performance, because it does not take into account temporary unsystematic deviations from the market return that are expected to cancel out over time in a diversified portfolio.

The Sharpe ratio

Sharpe (1966) devised the reward-to-variability ratio (R/V), which measures a fund's average return in excess of the risk-free rate relative to its standard deviation of returns. This ratio is similar to the Treynor measure, but adjusts the risk premium for total risk borne by the investor, rather than just systematic risk. If the funds being evaluated are all perfectly diversified the Treynor and Sharpe measures will produce the same relative rankings. In terms of capital market theory, the R/V ratio (now known as the Sharpe ratio)

compares a fund's performance to the capital market line (CML). A fund that plots above the CML is regarded as having outperformed the market. The Sharpe ratio can be represented by the following equation:

$$S_p = \frac{r_p - r_f}{\sigma_p}$$

Where:

r_p = average historical portfolio return over the period (usually the geometric mean)

r_f = average risk - free return over the same period

σ_p = standard deviation of return on the portfolio over the period

Using the R/V ratio, Sharpe (1966) compared 34 funds of varying objectives across two 10-year periods and found the relationship between past and future rankings to be statistically significant. This implied that performance was persistent and could be predicted, although imperfectly. Since returns had already been adjusted for a measure of total risk, Sharpe asserted that the differences between R/V ratios of the sampled funds was not a result of differing fund objectives, but rather differing manager skills and expense ratios. However, Horowitz (1966) showed that the correlation between past and future Sharpe ratios weakened after adding a dummy explanatory variable to control for "fund objective" in Sharpe's regression. This study highlighted the fact that the Sharpe ratio is nothing more than the reciprocal of an adjusted (for a fixed interest factor, r_f) coefficient of variation and is thus simply a measure of relative dispersion, which has limited power to explain performance across different types of funds.

Levy (1968) pointed out that the arithmetic mean is inferior to the geometric mean as a measure of central tendency because it is inaccurate when averaging over periods of

different lengths and it assigns greater weight to increases than decreases. Therefore the Sharpe ratio should be calculated with reference to the geometric mean. Levy calculated the adjusted ratio using the following equation: (logarithm of the geometric mean of the sub-period returns – logarithm of the period risk-free rate) ÷ standard deviation of the logarithms of the sub period returns.

The "double" Sharpe ratio

Vinod & Morey (1999) state that "the small-sample distribution of the Sharpe measure is non-normal and hence the usual method based on the ratio of the statistic to its standard errors is biased and unreliable." The authors argue that, because of the presence of random denominators in the definition of the Sharpe ratio and the difficulty in determining the sample size needed to achieve asymptotic normality, it is difficult to evaluate the estimation risk in the point estimate (i.e. the ratio) itself. The fact that the statistical significance of the Sharpe ratio is difficult to measure means that generating confidence intervals and conducting hypothesis tests are problematic.

Jobson and Korkie (1980) first attempted to solve this problem by employing the Taylor series expansion to derive the approximate moments and sampling distribution of the Sharpe ratio and then developing tests to evaluate its statistical significance. However, the tests were only valid under certain conditions and could result in confidence intervals that were too wide to be of practical use.

Vinod and Morey (1999) use a Monte-Carlo type procedure (with replacement) on the available sample values to approximate the sampling distribution of the Sharpe ratio. The traditional Sharpe ratio is then divided by the standard deviation of the sampling distribution to calculate a ratio the authors call the "double" Sharpe ratio. They find that

fund rankings (over a 10-year period) based on the "double" Sharpe ratios and the traditional ratios are not correlated. This highlights the sensitivity of risk-adjusted measures to estimation risk, which increases as the evaluation period is shortened.

Jensen's alpha

Jensen (1968) derived a performance measure from the Capital Asset Pricing Model (CAPM). The CAPM model is derived from the security market line (SML) and calculates the expected one-period return on a portfolio using the following equation:

$$E(r_p) = r_f + \beta_p [E(r_m) - r_f]$$

Where:

$E(r_p)$ = the expected return on the portfolio in the next period

r_f = the one - period risk free interest rate

$\beta_p = \frac{\text{cov}(r_p, r_m)}{\sigma^2 r_m}$; the systematic risk (beta) of the portfolio relative to the market

$E(r_m)$ = the expected one - period return on the market portfolio of risky assets

Assuming the asset pricing model is empirically valid, it can be rearranged and expressed in terms of the realised returns over time period t as follows:

$$r_{pt} - r_{ft} = \beta_p [r_{mt} - r_{ft}] + e_{pt}$$

In this equation, e_{pt} represents the random error term (residual) with $E(e_{pt}) = 0$ and is assumed to be serially independent and normally distributed. If the market is efficient and all the capital market theory assumptions are met, the error term will be zero. If the market is not efficient and is out of equilibrium, it is possible for superior (inferior) portfolio managers to consistently earn higher (lower) risk premiums than implied by the CAPM

model, resulting in a positive (negative) error term. If the consistently positive residuals in the regression equation are separated from the error term, the above equation can be written with an intercept constant, known as the portfolio's alpha (α_p):

$$r_{pt} - r_{ft} = \alpha_p + \beta_p [r_{mt} - r_{ft}] + e_{pt}$$

The portfolio alpha is a measure of the portfolio's performance and is described by Jensen (1969, p. 242) as "the difference between the actual returns on a portfolio in any particular holding period and the expected returns on that portfolio conditional on the riskless rate, its level of systematic risk and the actual returns on the market portfolio".

When the α_p value is positive, it suggests that the portfolio has outperformed the market and has often been attributed to superior manager skills. Note that when alpha is defined with respect to the SML, it must be assumed (as with the Treynor measure) that all unsystematic risk has been diversified away in order to relate the alpha value to a manager's forecasting abilities or some other fund specific attribute.

To make inferences regarding a fund manager's forecasting ability, given a non-zero alpha and stationary beta, we need to measure the standard error of the intercept estimate, α_p, to evaluate its significance. In ordinary least squares (OLS) regression theory, the sampling distribution of the estimate, α_p, is a student t distribution with n_p-2 degrees of freedom. Therefore OLS regression provides the information required to statistically test the significance of the performance measure.

2.3 Data selection biases

Spurious results can easily arise when there are biases in the sample data, particularly when the sample is small. The most common biases that have been identified in the

persistence of fund performance literature are: the use of an inefficient benchmark; the use of one specific sample period only; and survivorship bias.

Benchmark inefficiencies

Carlson (1970) showed empirically that the choice of the market proxy (benchmark) had a significant effect on fund performance rankings relative to the market and that the rankings of the standard deviations of different proxies were not consistent over time.

Roll (1980) demonstrated that when a benchmark that is not mean/variance efficient is used to measure fund performance, it could result in fund rankings that differ significantly from the ranking obtained when using another market proxy. Therefore, even if the period studied is the same, two persistence studies could yield different results if different benchmarks are used.

Nagorniak (1982) demonstrated that equity performance measurement using the S&P 500 as a benchmark is inferior to that using a broader based index that includes bonds and real estate as well as common shares. Since this study many researchers have attempted to create a non-biased benchmark to be used for evaluation purposes.

Lehmann and Modest (1987) tested the sensitivity of performance measurement methods to the chosen benchmark. They found that Jensen alphas and Treynor measures were sensitive to the method used when constructing an Arbitrage Pricing Theory (APT) benchmark. In addition, when results were analysed using the standard CAPM benchmark the results conflicted with those obtained when using the APT benchmark.

Time period studied

While Sharpe (1966, p. 137) stated that "the odds are greater than 100 to 1 against the possibility that the average mutual fund did as well as the Dow-Jones portfolio from 1954 to 1963", Carlson (1970, p.15) found (using the same test) that the odds were "greater than 1000 to 1 in favour of the possibility that the average common stock mutual fund did better than the Dow-Jones portfolio from 1958 to 1967". This clearly indicates that the sample period chosen can dramatically affect the results, especially when the period is relatively short.

The time period chosen is often central to the conflicting results obtained from similar studies. For example, Brown & Goetzmann (1995) concluded that the repeat-winner and repeat-loser phenomena were "strongly dependent upon the time period of study" and Malkiel (1995) found that the evidence of persistence reported by Goetzmann & Ibbotson (1994) diminished as the time period was extended.

Survivorship bias

Brown, Goetzmann, Ibbotson and Ross (1992) showed that where a sample was truncated as a result of the returns history of terminated (dead) funds being excluded from the population, the sample was biased towards finding positive persistence of performance. They also noted that a biased sample would induce a spurious relationship between volatility and return. Since the identification of this sample bias, most studies of unit trust persistence have tried to address the issue of survivorship bias, to avoid obtaining spurious results.

2.4 Persistence of performance studies

If mutual fund returns are significantly inferior to the market return, Levy & Sarnat (1972) argued that it still makes sense for individual investors to invest in mutual funds. Owing to the indivisibility of investments in an imperfect market, most investors have insufficient resources to diversify sufficiently. The benefit of diversification, together with the cost reductions obtained when dealing in large volumes, makes mutual funds a viable "second best" alternative to gain exposure to the market. The exponential growth internationally of the mutual fund industry over the past 30 years certainly supports this view.

Even if mutual funds on average do not beat the market, it is possible that some funds outperform the market consistently and others are persistent under-performers. Alternatively, if individual unit trusts do not perform consistently over a long period, it is possible that persistent performance could prevail long enough to take advantage of past information by switching from one fund to another.

Unit trust investors and financial advisors frequently consult past performance rankings in making decisions about which unit trust to invest in. Asset management companies advertise favourable past results to attract more capital and investment companies devote considerable resources to rate and track the performance of funds. This implies that past performance is indicative of future performance, but is it? Given that the asset allocation and sector selection decisions have been made, is it possible to use past performance to make predictions about the future performance of funds that have similar investment objectives and universes? That is the question the more recent persistence studies have tried to answer.

If abnormal returns (after costs) can be earned consistently over time by making investment decisions based solely on past information, it suggests that the market is weak form inefficient. Positive persistence relative to other mutual funds (but not relative to the market) could conceptually exist in an efficient market. However, such a finding would only be important from an economic point of view, if the information could be used to outperform a low cost, passively managed, index fund.

Long-term persistence

Initial studies indicated that the market is efficient. Jensen (1969) found that managers, in general, had no ability to predict the future prices of securities. However, when comparing individual fund performance from one decade to the next (between 1945 and 1964) he observed some persistence in the performance of the 56 funds studied. The persistence was attributed mainly to persistent under-performers and since "it is very simple to consistently hold an inferior portfolio" (p.236) by incurring substantial expenses, Jensen did not consider consistent under-performance to be significant. When repeating the analysis for *annual* holding periods over a 20-year period (using gross risk-adjusted returns), 60% of the funds had more negative alphas than positive alphas and no fund had positive alphas more than 80% of the time. In a later study, Lehman & Modest (1987:264) also reported the "persistent incidence of large and negative Jensen measures".

Jensen (1969) also used a runs test to calculate the probability of a fund earning an excess return in one year given a run of positive alphas in the previous years. No evidence was found to refute the hypothesis that the returns were independent of prior period performances. Therefore, Jensen concluded that past performance could not be used to predict future performance and managers were unable to consistently outperform the market.

Dunn & Theisen (1983) ranked the raw annual returns of 201 surviving US institutional portfolios of varying objectives over a 10-year period ending in 1982. Using 3-year and 5-year formation periods, and 1-year, 3-year and 5-year holding periods, they tested whether these portfolios tended to remain in the same quartile from one holding period to the next. No evidence of consistent rankings was found. Changing the initial ranking period and/or subsequent ranking period from 1 year to 3-year or 5-year periods did not change the result. The portfolios in this sample had different investment styles and mandates and, hence different risk levels. As no attempt was made to group similar funds or risk-adjust the returns, the results were biased towards finding no consistency.

Grinblatt & Titman (1992) tested specifically whether past performance predicts future performance. Using 120 monthly returns and dividend distributions of 279 mutual funds of all types from 1974 to 1984, they found that mutual funds exhibited significant persistence of positive abnormal returns. The data was subject to survivorship bias, but Grinblatt & Titman (1989a) found that the bias was negligible in this sample.

Grinblatt & Titman (1992) calculated excess returns for each fund relative to an eight-portfolio (P8) benchmark, which was found not to exhibit a persistence bias when evaluated against well-known passive portfolios (index funds). They then performed a cross-sectional regression of the excess returns (alphas) in the last five years on those of the first five years and compared the slope coefficients to those obtained from similar tests on a constructed control sample of 109 passive portfolios. The relationship between abnormal returns from one period to the next was significant for mutual funds, but not for the passive portfolios. The study showed that the result could not be fully explained by the persistence of abnormal returns in individual shares found by Jegadeesh and Titman (1993) or by persistent differences in fees and transaction costs across funds. Although persistence

was found, no economically significant strategies were suggested to make use of this information.

Kahn & Rudd (1995) found no evidence of the repeat-winner phenomenon among 300 non-index equity funds, using the two 3-year sub-periods between 1988 and 1993. The first period corresponded to a time when equity "value" managers outperformed "growth" managers and the second period to a time when "growth" managers typically outperformed "value" managers. Persistence over shorter sub-periods, as studied by Goetzmann & Ibbotson (1994), was not investigated. The fact that these results oppose those obtained by Grinblatt and Titman (1992) suggests that persistence may be a function of the time period studied and emphasises the danger of drawing conclusions from studies over too short a period (even 10 years may be too short).

Aware of these problems, Blake and Morey (2000) examined the predictive ability of the Morningstar rating system over different time horizons, periods, fund investment styles and fund ages and compared the results to the predictive ability of the Sharpe ratio, mean monthly excess returns, a modified Jensen alpha and a four-index alpha. The Morningstar return is roughly the fund's net return in excess of the risk-free rate divided by a measure of downside risk. The Morningstar rating is then a weighted average of these returns over a 3-year, 5-year and 10-year period and is thus a measure of long-term performance.

Using cross-sectional regression analysis and Spearman-Rho rank correlation tests, Blake and Morey (2000) found that Morningstar ratings could be used to predict low-performing funds, but not above average funds. There was little evidence that the Morningstar rating system performed better that other traditional measures of performance measurement.

Evidence of long-term persistence has also been drawn from the pension fund industry, even though the performance of mutual funds may differ from that of institutional portfolios. Persistence of superior performance may be less common among mutual funds as good managers are likely to move towards managing larger pools (pension funds) of money where the compensation is higher. Also, poor managers may survive for longer in the mutual fund industry where investors are less sophisticated and may be reluctant to withdraw funds due to cost or tax implications. Results obtained using pension fund data may also be more favourable due to returns usually being calculated before commissions, whereas mutual funds returns are measured after commissions. Nevertheless, the following studies of institutional funds are of interest:

- Beebower & Bergstrom (1977) found that managers of pension funds and profit-sharing portfolios that performed well over one 5-year period performed well over the next 5-year period.
- Christopherson, Ferson & Glassman (1998) found, using the approach of Ferson & Schadt (1996) to address the concern that expected returns, betas and investment styles may vary through time, that economically significant persistence was evident, but mainly amongst the poor performing portfolios.

Short-term persistence

Bogle (1992) ranked the raw annual returns of over 330 equity mutual funds for 10 successive years ending in 1990. Funds that ranked in the top twenty in any given year ranked, on average, 249 out of 554 in the subsequent year. From a review of the descriptive statistics generated, Bogle concluded that there was no evidence of persistence in rankings from one year to the next or from one decade to the next. This study was very simplistic in that no adjustment was made for risk or for the differing types of the funds.

However, it highlighted the seemingly unpredictable volatility of fund performance rankings from year to year.

In order to minimise the chance that differences in fund performance are attributable to variations in risk or differences in transaction costs across funds, Hendricks, Patel & Zeckhauser (1993) restricted their sample to no-load equity growth funds only. Examining quarterly returns of 165 funds over the 1974-88 period, they found statistically significant short-run persistence of performance relative to other funds and to a number of benchmarks. They termed this the "hot hands" phenomenon. The results showed that it was possible to predict the quarterly octal rank of a fund using past results (particularly when using a one-year formation period) and thereby improve risk-adjusted returns by 6% p.a. using an ex ante investment strategy. They found that these results were not attributable to the characteristics of shares held by the growth funds, the sample period chosen, the seasonality of quarterly returns, the time variation of betas or survivorship bias.

Although they did not test investment strategies directly, Goetzmann & Ibbotson (1994) also found that historical short-run returns could be used to "beat the pack" over the long term. Using monthly total returns of over 275 surviving funds from 1976 to 1988, they examined whether winners (top 50% of funds) and losers repeated over successive one- and two- year sub-periods, based on raw returns and excess returns (using Jensen's alpha). The focus on relative rankings avoided the problem of choosing an appropriate benchmark for comparison. This study indicated that, overall, past performance is indicative of future performance, although in a few of the sub-periods the repeat-winner phenomenon was dramatically reversed. The results were consistent irrespective of the evaluation period chosen. Repeating the test on a sample of only growth funds yielded similar results, suggesting that fund style was not the cause of the repeat-winner phenomenon.

When Malkiel (1995) extended the sample period of Goetzmann & Ibbotson (1994) to 1991 and incorporated non-surviving funds, evidence of persistence amongst general equity funds in the mid to late 1980's weakened significantly. The positive bias caused by excluding non-surviving funds was greater than expected. Following a trading strategy of buying past winners in the late 1980's based on 1-year past returns yielded a return lower than the return on the S&P500, whereas the same strategy beat the S&P500 in the late 1970's.

Persistence studies outside of the United States have also yielded mixed results. Otten & Bams (2000) found strong year-on-year persistence amongst UK equity funds from 1991 to 1998, but less conclusive evidence when studying other European based funds over the same period.

In a study of Australian rollover funds, Hallahan (1999) concluded that past performance was an unreliable guide to future performance. In his analysis, there was strong evidence for persistence of performance in fixed interest funds, but not for multi-sector (general equity) growth funds. Hallahan (1999) found that the information content of the performance history varied inconsistently across different fund styles and was affected by both the methodology used and the measurement method employed.

2.5 Causes of persistence

Evidence of persistence from various sources prompted studies into the underlying causes of this persistence and their effect on active investment strategies.

Brown, Goetzmann & Ross (1997) suggested that the results of Hendricks, Patel & Zeckhauser (1993) and Goetzmann & Ibbotson (1994) could be a result of failing to eliminate survivorship bias. They did not test the data specifically, but illustrated the effect

on performance measures of eliminating the poorest performers. Truncating from the bottom of the sample was considered reasonable, because poor performers are the funds that are least likely to survive. This study showed that truncating the bottom 5% of funds had a significant effect on the t-statistics and cross-product ratios used to evaluate persistence in the studies of Hendricks, Patel & Zeckhauser (1993) and Goetzmann & Ibbotson (1994), respectively. However, in a later study, Hendricks, Patel & Zeckhauser (1997) demonstrated that their "hot hands" phenomenon generated persistence beyond the distinctive J-shaped curve induced by survivorship bias.

Volkman & Wohar (1995) investigated the relationship between persistent fund performance and mutual fund size, stated goal, load fee and management fee by comparing persistence between decile portfolios sorted on these factors. They found some evidence that medium sized funds exhibited positive persistence of performance, whereas small and large funds exhibited negative persistence, supporting the hypothesis that small funds can be risky and large funds can become inefficient. They also found that funds with low management fees demonstrated significantly positive persistence, whereas as funds with high management fees demonstrated significantly negative persistence.

Brown & Goetzmann (1995) suggest that the occasional reversal of the Goetzmann & Ibbotson (1994) repeat-winner phenomenon in certain years is an indication that persistence is correlated across managers. This means that persistence is probably not due to individual managers possessing share-selection abilities that are superior to others. Their study showed that the removal of "bottom feeders" (defined in the study as funds that ranked in the lowest octile over a two-year period) from the sample, eliminated the economic significance of any performance persistence. Therefore, relative persistence of performance is a result of the market's failure to fully discipline poor performers rather

than the superior abilities of fund managers. This is consistent with a later study by Porter and Trifts (1998) that examined the performance of 93 fund managers who had managed one fund for more than 10 years. They found that superior past performance was not indicative of future performance, but that poor performance tended to persist.

In contrast, Elton, Gruber & Blake (1996) found persistence over 1-year and 3-year evaluation periods using a survivorship bias free sample of 188 funds from 1977-1993. This study used a four-index model to consider portfolio composition changes when adjusting returns for risk. Although evidence of persistence of raw returns was weak, it was highly significant when analysing risk-adjusted performance. Persistence of bottom feeders was found to be largely due to high expenses (management fees), but unlike Volkman & Wohar (1995) they found expense ratios did not explain the persistence in rankings of better performing funds. Following a strategy of investing equal amounts in each fund in the top decile from the previous year resulted in excess returns in the following 1-year and 3-year periods. Furthermore, using Modern Portfolio Theory to calculate the optimal amount to invest in each top decile fund improved excess returns significantly at the 1% level.

Carhart (1997) found, using a survivorship bias free sample of mutual funds from 1962-1993, that the persistence (particularly prevalent in the 70's and early 80's) could be largely explained by Jegadeesh & Titman's (1993) one-year momentum in share returns anomaly. Carhart (1997) suggests, "Funds that earn higher one-year returns do so not because fund managers successfully follow momentum strategies, but because some mutual funds just happen by chance to hold relatively larger positions in last year's winning stocks". This is in contrast to Grinblatt, Titman & Wermers (1995) who found that "funds following

momentum strategies realised significant excess performance, while contrarian funds realised virtually no performance".

By analysing the stock holdings and trades of actively managed mutual funds from 1976 and 1994, Chen, Jegadeesh & Wermers (2000) found that shares widely held by funds do not outperform shares not widely held, suggesting that mutual fund managers do not have superior share selection skills. However, shares *bought* by funds produced returns 2% higher than shares *sold* by funds in the year following the transaction. This indicates that fund managers hold shares for a longer horizon than they can predict returns (possibly because of transactions costs or Capital Gains Tax). In support of this contention, the authors also found that funds with high turnover had marginally better returns than funds that traded less often.

When considering the causes of persistence, Chen, Jegadeesh & Wermers (2000) found that shares passively held by winning funds out-performed the passive holdings of losing funds, but shares newly bought by winning funds only marginally outperformed shares bought by losing funds, indicating that persistence is more likely caused by the momentum effect than by persistent share selection skills.

Although very little evidence exists that managers have superior share selection abilities, Wermers (2000) contends that managers do have share selection abilities. However, the excess returns earned from active trading are only sufficient to cover their costs.

Studies that have used multi-factor models to measure excess returns (e.g. Hendricks, Patel and Zeckhauser (1993) and Gruber (1996)) have found that persistence remains despite accounting for the different characteristics of shares (e.g. market capitalisation and book-to-market ratios) held by funds. Other studies (e.g. Daniel, Grinblatt, Titman & Wermers

(1997)) that have identified abnormal performance using benchmark portfolios that mimic the characteristics of the shares held by the mutual funds have found similar results. In these studies, the benchmark portfolios themselves are constructed from multi-factor models.

Fama and French (1992) found that the cross-sectional variation in share returns could be explained by the factor loadings on firm size and book-to-market equity. These two factors were identified as proxies for systematic risk factors priced by investors. However, Daniel & Titman (1997) questioned whether the time-series estimates of loadings (coefficients) in a multi-factor model adequately explain the cross-section of expected share returns. They found that expected share returns were related directly to firm characteristics (e.g. firm size and book-to-market ratio), but not to the factor loadings relating to these characteristics. In other words, the cross-sectional variation in returns could be explained by firm characteristics, but not by the covariance of the returns with systematic risk factors.

Detzel & Weigand (1998) developed a model that directly related the median firm characteristics of the shares held by a fund to the funds return. Consistent with previous studies, persistence remained after adjusting for expense ratios and market risk. However, they found that firm size and fund manager investment styles (characterised by book-to-market, earnings-to-market and cash flow-to-market ratios) explained "all the persistence in mutual fund returns from 1976-1985, the period in which persistence is most prevalent". This finding, together with the fact that there are periods when there is little momentum in mutual fund returns, suggests that underlying market trends may drive persistence. If this is true, then, for example, buying into a "high growth" fund in a period when growth shares are outperforming value shares will yield superior returns. In this example, the momentum

in the "high growth" fund's returns will break down when value shares begin to outperform growth shares.

Detzel & Weigand's findings lend some support to those of Khorana & Nelling (1997) who found that managers of sector funds were unable to outperform other managers in the same sector. These studies imply that if one cannot predict changes in underlying market trends, then it is not possible to switch funds into the next period's top performing fund sector.

2.6 South African fund performance and persistence studies

Due to the limited research on *persistence* of performance in South Africa, some of the early unit trust performance studies are reviewed here to provide a background to the research surrounding unit trust funds in South Africa.

The first studies of unit trusts in South Africa were limited by the lack of data available from an infant industry. Kerbel (1974) plotted the mean return and standard deviation (calculated over 15 quarters to December 1970) of six unit trusts relative to a constructed security market line (SML). This study found that all the mutual funds lay below the SML indicating that, in terms of mean-variance analysis, funds were not well managed.

Taylor (1977) examined ten unit trusts over the 1970 to 1976 period. Risk-adjusted returns were calculated using the methodologies of Treynor (1965), Sharpe (1966) and Jensen (1968) despite finding that the betas were neither stationary, nor stable. He found that the funds under-performed the market by 2.4% p.a. on average. This result was not significantly different from zero at the 5% level.

Because of observed beta instability, Gilbertson & Vermaak (1982) placed particular emphasis on the Sharpe measure when calculating risk-adjusted returns. This measure

adjusts returns for total volatility, which is not necessarily appropriate when evaluating diversified portfolios. In a study of eleven unit trusts over the 8-year period 1974 to 1981, they found that unit trusts, on average, outperformed the ALSI, industrial index and RDM-100 index on a risk-adjusted basis, but not without risk adjustment. There was also some evidence that at least one fund consistently outperformed the market and all other funds.

Carter, Affleck-Graves & Money (1982) plotted the JSE All Share Index (ALSI) and the "Association of Unit Trusts Portfolio" (T) against a constructed Markowitz efficient frontier for three consecutive 5-year periods. The T portfolio consisted of all the shares held by the 12 existing unit trust funds over the 15-year period ending in 1980. The JSE-sector weightings in the T portfolio were compared to that of the ALSI. A relative weighting in T > unity would indicate a favourable expected outcome in the future performance of that sector relative to the market and vice versa. The study found that the T portfolio was considerably more overweight in the inefficient sectors than the ALSI. In addition, the unit trusts showed a preference towards owning shares in conglomerates, thereby paying a premium for diversification that they could have achieved by buying shares in the listed subsidiary companies themselves. The authors concluded: "large and sophisticated investors on the JSE are operationally inefficient".

Knight & Firer (1989) updated the study of Gilbertson & Vermaak (1982). Finding evidence of beta stationarity and stability, they studied the returns of ten unit trusts over 10 years on a non-risk adjusted basis and a risk-adjusted basis using the Treynor, Sharpe and Jensen measures. On average, the mutual funds returned 1.8% less than market per annum. However, an average beta of 0.631 (partly due to significant cash equivalent holdings) indicated that the unit trusts were less risky than the market. After adjusting for risk, they found that no fund performed significantly worse than the market in the first or second 5-

year period studied. The same winning fund identified by Gilbertson & Vermaak (1982) continued to be the best performer. Evidence of consistent rankings (at the 5% level) from the first 5-year period to next was also found, indicating that some managers appeared to be persistent performers.

Biger & Page (1993) obtained results consistent with that of Knight & Firer (1989) when testing 25 unit trusts in the period 1988 to 1992 using two, single-factor, APT-based benchmarks and the CAPM model to calculate alpha coefficients. However, when using multi-factor benchmarks, the explanatory power (measured by adjusted R-squared) of the variability of rates of return improved and most of the unit trusts produced negative alphas. Although none of the individual trusts had significantly negative alphas, the average alpha was significantly negative at the 1% level. In addition, Spearman's Rank Order tests showed that there was no correlation between rankings based on the single- and multi-factor models, again emphasising the effect of the chosen benchmark on the results of performance studies.

To avoid the problems associated with choosing an appropriate benchmark, Garvin (1995) adopted the benchmark-free methodology of Grinblatt & Titman (1993) in studying the performance of 32 equity unit trusts from inception to the end of 1992. Using gross returns to calculate the Portfolio Change Measure (PCM) with one-quarter and four-quarter lags, Garvin found that unit trusts "do not exhibit any sign of 'significantly' superior performance over and above the returns that could have been obtained by an 'uninformed' manager or investor". Performing rank correlation tests over two consecutive 5-quarter periods and two consecutive 10-quarter periods demonstrated that, on average, performance did not persist.

Nicholson (1996) also found no evidence that unit trusts performed significantly better or worse than the market in the ten years ending in December 1994, based on Jensen's alpha. After regressing alphas from the first 5-year period on those of the second 5-year period, Nicholson concluded, consistent with Garvin (1995), that evidence of persistence was not significant at the 5% level.

Using the traditional performance measures, Meyer (1997) found that over 60% of SA unit trusts outperformed the market in the 10 years ending June 1995, but when the industry as a whole (i.e. all unit trusts) was compared to the market it was found that the average return did not beat the market. Meyer also tested the "repeat-winner" phenomenon of Goetzmann and Ibbotson (1994) using evaluation periods of varying lengths. Consistent with US studies, but contrary to Garvin (1995) and Nicholson (1996), she found the repeat-winner phenomenon existed over successive two-year periods for nominal as well as risk-adjusted returns. In addition, the repeat-loser phenomenon was more prevalent and existed over successive one-, two- and four-year periods.

For the 10-year period ending June 1995, Meyer analysed the relative rankings of 13 funds that included mining funds, bond funds and an index fund as well as 7 general equity funds. Funds that did not exist for the *entire* 10-year period were omitted from the test sample. In addition, the 5-year period ending June 1995 was analysed separately to increase the sample size to 33 funds, but again no distinction was made between different types of funds and funds that started after June 1990 were omitted from the sample. Returns on all funds were risk-adjusted using Jensen's alpha with the JSE All Share Index (ALSI) used as the market proxy. This sample selection would have caused the following biases in her results:

- The inclusion of non-diversified portfolios (e.g. mining funds) is likely to amplify the repeat-winner and repeat-loser phenomena, because these funds are likely to perform *consistently* better (worse) than general equity funds over short periods (1-2 years) when the relevant market sectors rise (fall) faster than the market average.
- Using the ALSI as a market proxy when risk adjusting the performance of bond funds is inappropriate and therefore ranking bond funds with general equity funds is likely to interfere with the fund rankings. The exclusion of bonds from the market proxy will result in the portfolio beta of equity funds being too small and consequently risk adjustment will be insufficient to equate their performance with bond funds. As a result, the equity funds are likely to rank above the bond funds, creating a repeat-winner and repeat-loser phenomenon.
- Excluding newly started funds from the sample reduces the practical application of the results. In practice, these funds would be available for investment and would affect the rankings of existing funds. If, for example, newly started funds outperformed more established funds, their inclusion in the rankings would cause some of the borderline old fund "winners" to be classified as "losers", thereby altering the persistence results.
- All test periods started in July and ended in June. Therefore, although monthly returns were available, the results are dependent on a specific set of annual returns.

Meyer concluded that "some persistence in performance of unit trusts in the South African environment does exist", but did not attempt to test this result using trading strategies that take transactions costs into account and eliminate the benefits of hindsight that can occur when selecting a test sample.

Using a modified version of the methodology employed by Hendricks, Patel and Zeckhauser (1993), Von Wielligh & Smit (2000) observed the performance of return-

sorted portfolios formed on 1-year lagged returns for the 5-year period and the 10-year period ending in December 1997. Unit selling prices were used to calculate returns, so changes in initial fees and commissions over time would have had an impact on the performance results. Although the study included tests on portfolios formed from the entire population of South African unit trusts, only the results from the portfolios formed from the population of general equity unit trusts are reviewed here, as the other results are not relevant to this research.

For the 5-year period and 10-year period tested, the performance of three equally weighted portfolios (based on high, medium and low 1-year lagged excess returns) created from the population of general equity unit trusts was measured. Each year, the portfolios were reconstructed based on the previous year's returns. The result was the top ("winners") portfolio produced the highest excess return over the 5-year period and the 10-year period, but, contrary to the repeat-loser phenomenon found by Meyer (1997), the bottom ("losers") portfolio performed better than the middle portfolio in both test periods. The authors concluded that the superiority of the top portfolio provided some evidence of persistence.

Although monthly data was available to Von Wielligh & Smit, only annual calendar-year returns were used to construct the return-sorted portfolios and measure their subsequent performance. Because the results were analysed by comparing the mean excess returns generated by each constructed portfolio over a specific 5-year and 10-year period only, there is little evidence that the results are not purely a function of the specific period chosen for the analysis.

In another test, Von Wielligh & Smit track the return of the 3 return-sorted portfolios formed on 1-year (1992) returns. In this test, the portfolios were not reconstructed each

year, but left unchanged and observed for 5 years. It was observed that the performance of the top portfolio did not persist for more than 1 year. Once again this result is specific to the formation and evaluation periods selected. Contrary to this finding, the study concludes that there is evidence of persistence in performance of general equity unit trusts and "even more evidence of long-term persistence" (p. 128).

As can be seen from the two most recent and comprehensive studies on performance persistence amongst South African unit trusts, namely the studies by Meyer (1997) and von Wielligh & Smit (2000), the results of persistent studies are dependent on the period studied, the sample selected and the method of testing chosen. Furthermore, because of the limited amount of South African data available, it is important that *all* the data is *used* to obtain as much evidence as possible, before concluding on whether or not the results are sample specific.

Evidence of market efficiency from the above portfolio performance tests is mixed. There is some evidence that the JSE is at least "operationally efficient" defined by Keane (1986) as "inefficiencies perceptible only to a few experts but non-transmittable to others because of the rapid market response to its disclosure". Tests of market-timing abilities (using unit trusts as an investment medium) by Firer, Ward & Teeuwisse (1987); Cassidy (1991); Firer, Sandler & Ward (1992) and Firer, Gray, Sandler & Ward (1996) find no evidence that fund managers are able to beat the market using timing strategies.

Studies of the impact of fund size on returns have also produced mixed results. Cassidy (1991) tested the correlation between nominal rankings and fund size rankings as well as between risk-adjusted returns and fund size. She found that larger funds tended to outperform small funds. In contrast, Moles (1981) and Nurse (1998) found that there was

no statistically significant correlation between fund size and risk-adjusted performance over the two 10-year periods studied.

This evidence, together with studies on price dependence, market reactions to earnings announcements, share splits and capitalisation issues as well as the lack of significant anomalies as reported by Bhana (1990), suggest that the JSE is efficient.

However, evidence of persistence in unit trust returns reported by Meyer (1997) and Von Wielligh & Smit (2000), the findings of Knight & Firer (1989) and South African studies on insider trading, the performance of experts reported by Thompson & Ward (1995) and the profitability of momentum strategies on the JSE reported by Fraser & Page (2000) cast doubt on the operational efficiency of the JSE. The evidence of persistence in unit trust performance is most disturbing as this implies that the market is not even weak form efficient. This may mean that certain fund managers have superior skills and/or access to information over prolonged periods and can achieve abnormal returns by acting on publicly available historic information. The existence of economically significant performance persistence and the possible causes thereof need to be examined in more detail in the light of recent US studies and the conflicting evidence obtained from past South African studies.

2.7 Summary of the results of persistence studies

It is clear from the above studies that the results of persistence tests are inconclusive. The results appear to be a function of the time period analysed, the length of evaluation period (holding period) used and the testing method employed. There is very little evidence of long-term persistence, but the results of most short-term persistence studies suggest that at least a weak relationship between past and future rankings does exist. The wealth of

literature exploring the *causes* of persistence also supports this conclusion. Most of these studies have attributed persistence to the momentum effect and differences in expense ratios between funds.

Prior period return is probably the most commonly used measure of fund performance, because it is intuitively appealing and is objective information that is easy to obtain. Most investors consider portfolio performance history when selecting funds and asset management companies generally pick and remunerate fund managers based on their track record. Investors and fund managers monitor recent (short-term) performance closely despite being told that they should regard unit trusts as a medium to long-term investment.

In the literature, there is little evidence that long-term performance persists. Jensen (1969), Dunn & Theisen (1983), Kahn & Rudd (1995) and Porter & Trifts (1998) all concluded that persistence did not exist for a prolonged period. Studies that did find evidence of long-term persistence were later attributed to being the result of sampling biases. For example, Malkiel (1995) suggests that survivorship bias and the specific time-period chosen may explain the persistence found by Grinblatt & Titman (1992).

Many studies conducted in the United States have found that both superior and inferior fund performances have persisted in the short term. Short-term persistence was reported by Hendricks, Patel & Zeckhauser (1993), Goetzmann & Ibbotson (1994), Brown & Goetzmann (1995) and Elton, Gruber & Blake (1996) and was initially attributed to "hot hands" (managers with superior abilities under certain market conditions). More recent studies have attempted empirically to isolate the systematic factors that explain persistence. Although the existence of persistence has been confirmed by these studies, the causes have been attributed to other factors such as share momentum and investment styles.

Evidence of persistence outside of the United States is less compelling. Otten & Bams (2000) found significant short-term persistence amongst UK mutual funds, but not other European funds, while Hallahan (1999) failed to find persistence amongst Australian equity funds. In South Africa, Garvin (1995) failed to find persistence in the short-term (6 months to 1 year) and Nicholson (1996) did not find evidence of persistence over successive five-year periods. In contrast, Meyer (1997) found that the repeat winner and repeat loser phenomenon did exist over successive four-year periods and von Wielligh & Smit (2000) found evidence of both short term and long term persistence, particularly amongst General Equity unit trusts.

3 RESEARCH HYPOTHESES

3.1 Preamble

This study aims to reduce the confusion caused by contradictory research results and to analyse the nature of performance persistence amongst general equity unit trusts. The aim is to build a foundation on which to conduct further research on the causes of persistence, if it in fact exists. This research extends prior research on persistence of performance amongst South African general equity unit trusts in the following ways:

- Use is made of an extensive database of monthly returns that spans 20 years. This will reduce the chances of the results being a function of the time period selected and may explain why studies of different periods have produced disparate results.
- By analysing relative returns and rankings, the danger of the results being a function of an inefficient performance model or an inappropriate benchmark is avoided.
- Unlike past studies, this research makes use of all monthly return data, by re-performing tests using all 12 months of the year as starting points. This adds to the robustness of the results by ensuring that the observations are not related to market cycles. For example, if certain funds are biased towards technology stocks and the technology cycle happened to peak at the end of two consecutive years, such funds would be observed as persistent winners if returns were measured at the end of December and perhaps persistent-losers if the technology cycle dipped in the middle of two consecutive years and returns were measured at the end of June.
- The samples are free of survivorship bias and selection biases. All funds that existed at *any time* during the evaluation period are included in the test samples.

- This study tests trading strategies to examine the economic consequence of using investment strategies based solely on past information. The recent popularity of financial products that consist of a number of different unit trust portfolios (e.g. wrap funds and living annuities) and the lowering of costs brought about by bulk buying has made switching between funds more desirable and more economically viable.

3.2 Hypotheses

Hypothesis 1: Information content of past performance rankings

H_0: There is *no relationship* between the relative performance (ranking) of a fund in the formation period and the relative performance of that fund in the subsequent holding period.

H_1: There *is a relationship* between the relative performance (ranking) of a fund in the formation period and the relative performance of that fund in the subsequent holding period.

The *formation period* is the period immediately prior to investment that is used to make an investment decision. The *holding period* is the period immediately following the formation period over which an investment is held and its performance evaluated.

This hypothesis aims to answer the following question. Can the performance of a fund in one period be used to predict the performance of that fund in the next period? If performances in adjacent periods *are* related, we need to characterise the nature of that relationship in order to gain insight into the probability of that relationship continuing in future, and to aid in explaining conflicting research results regarding persistence. More specifically we need to answer the following questions:

- What historical formation period length has the most predictive power?
- How significant is the relationship between past and future performances?

- If future performance is related to past performance what is the optimal holding period length?
- Is the relationship between past and future performances consistent over time?

This hypothesis will be tested in the long run and the short run. In order to reject the null hypothesis, we would have to find a non-random relationship between past and future rankings for a significant number of periods within the time period analysed. We would have to show that there is momentum in portfolio returns, even if only for a short period. Such a finding would enable us to select a group of funds that would consistently provide a non-random return profile for a prolonged period.

Hypothesis 2: Persistence in the performance of individual funds

H_0: Using pre-defined formation and holding period lengths, the past performance of individual funds *cannot* be used to consistently predict future performance across multiple periods.

H_1: Using pre-defined formation and holding period lengths, the past performance of individual funds *can* be used to consistently predict future performance across multiple periods.

Hypothesis 1 focuses on persistence in a two-period framework. It does not test whether a *series* of adjacent periods provides a non-random pattern of returns. Hypothesis 2 focuses on the series of relative returns of an individual fund. It aims to determine whether or not an investor can select a fund that will outperform the average consistently over time, ignoring transaction costs.

Note that it is the time-series pattern of returns and not the distribution of returns that matters. A fund (or group of funds) that beats the average in more than, say, 65% of the

sub-periods studied, will not be regarded as being a *persistent* out-performer if the distribution of those returns is random.

In this case, rejecting the null hypothesis should be extremely difficult, as one would need to find an investment portfolio that has been a "sure bet" over the period studied.

Hypothesis 3: Economic viability of investment strategies

H_0: Past return patterns cannot be used to devise strategies to earn returns in excess of the costs of carrying out such strategies.

H_1: Past return patterns can be used to devise strategies to earn returns in excess of the costs of carrying out such strategies.

Some popular investment strategies will be used to test whether past performance information can be used to achieve after cost returns in excess of returns generated by a passively managed portfolio. Patterns evident from the empirical work performed while testing hypothesis 1 will also be used to devise additional trading strategies.

3.3 Limitations and assumptions

This study assumes that the investor wants to invest in general equity unit trusts and is concerned with the performance of one fund *relative* to the performance of another fund. It does not address the performance of unit trusts relative to a market proxy or the performance of funds across different sectors (asset classes).

The small number of funds and the short time period that they have been in existence limits the strength of the results that can be obtained from this study. The option to increase the sample size by either going further back in history or by including funds from sectors other than the General Equity sector was rejected on the basis that it would decrease the significance and limit the implications of the results.

The hypotheses will be tested using more than one methodology where appropriate. It is not considered valuable to use all the measurement methods used in previous research to see how they compare. Certain methodologies are not easily applied to the South African market (because of the lack of data) and others have biases that are likely to result in confusion rather than clarity. The methodologies applied in this research have been chosen using the following guidelines:

- They are intuitively appealing to investors.
- Few assumptions are required.
- The results can be tested for statistical significance.

Problems associated with performance measurement such as benchmark inefficiencies, estimation risk and portfolio beta instability, have been deliberately avoided. Because these problems are likely to be much more pronounced in the South African industry than in the United States, market models have not been used to characterise fund performance. This approach thus avoids spurious results that could be caused by the use of inappropriate models or benchmarks.

4 RESEARCH METHODOLOGY

4.1 Data sample

The source database contains the month-end selling and repurchase prices as well as information on distributions of all actively managed Domestic General Equity funds from each fund's date of inception to 31 December 1999. This study analyses the performance of funds for the 20-year period starting 1 January 1980. Returns for the period 31 December 1976 to 31 December 1979 are used as out-of-sample data to give existing funds an initial ranking so that persistence can be evaluated as from 1 January 1980. For a fund to be included in the sample, it must have a formation period of at least 6 months to be evaluated and a holding period of at least 6 months for persistence to be measured. Therefore funds that did not exist on 31 December 1998 (i.e. funds that had a performance history of less than 1 year) were excluded on the basis that they would have no impact on this study.

The four passively managed index funds, namely Fedsure Index Fund, Gryphon Imperial SA Tracker Fund, Investec Index Fund and Standard Bank Index Fund have been excluded for two reasons. Firstly, as the performances of these funds are likely to be highly correlated, their inclusion would amplify the persistence results. Secondly, including these funds would weaken any observations regarding manager skill.

As a point of reference, all non-index funds included in the General Equity Funds sector of the University of Pretoria's Unit Trusts Survey for the quarter ended 31 December 1998 were included in the sample. These funds have remained in the sample, despite the fact that some of them may have subsequently moved sectors when the Association of Unit Trusts

implemented the new Fund Classification Code in 1999. The sample also includes newly launched funds and terminated funds not reported in the 1998 Unit Trusts Survey.

Many unit trusts have changed names during the sample period and some have changed names since 31 December 1999. For identification purposes funds have been named according to their reported names on 31 December 1999. The funds included in the sample are listed in Table 1 below.

A total of 47 actively managed general equity funds existed during the 20-year period. As shown in Figure 2, the sample size grew from 7 funds on 1 January 1980 to 14 funds over the first ten years and then to 43 funds on 31 December 1998. Because of the small sample size, caution needs to be exercised over the interpretation of results obtained from the first 10 years of data.

Figure 2: Number of general equity funds included in each year of the sample period.

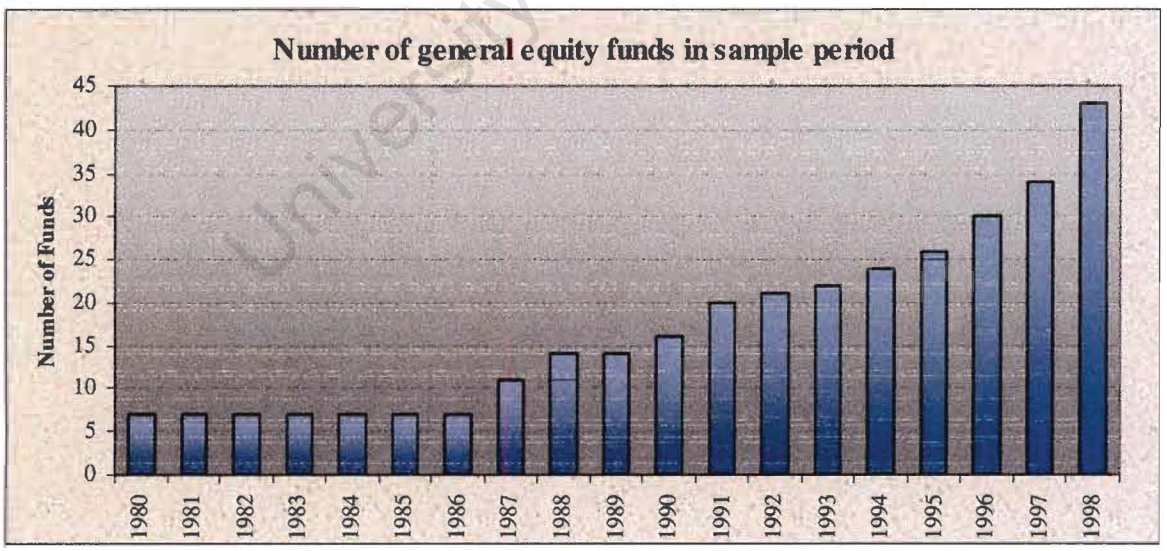


Table 1: Actively managed General Equity unit trust funds included in the sample.

Fund Name	Fund No.	Short name	First month end	Last month end	No. of return months used
Sage Fund	1	SAGgen	31-Jul-65	31-Dec-99	277
Old Mutual Investors	2	OLDinv	30-Nov-66	31-Dec-99	277
Sanlam General	3	SANgen	31-Jul-67	31-Dec-99	277
UAL Blue Chip Growth	4	UALblu	31-Jul-67	30-Jun-98	277
Sanlam Prime Growth	5	SANpri	31-Aug-69	31-Dec-99	277
Guardbank Growth	6	GUAgro	28-Feb-70	31-Dec-99	277
Standard Bank Mutual	7	STAgen	30-Jun-73	31-Dec-99	277
NIB Growth	8	NIBgro	31-May-87	31-Dec-99	152
NIB Selected Opportunities	9	NIBsel	31-Aug-87	31-Mar-99	149
Investec Equity	10	INVequ	31-Dec-87	31-Dec-99	145
RMB Equity	11	RMBequ	31-Dec-87	31-Dec-99	145
Fedsure General	12	FEDgen	30-Sep-88	31-Dec-99	136
Marriot Equity	13	MARequ	30-Sep-88	31-Dec-99	136
Souther Equity	14	SOUequ	30-Nov-88	31-Dec-99	134
Commercial Union Growth	15	CMUgro	31-May-90	31-Dec-99	116
BOE Growth	16	BOEgro	31-Jul-90	31-Dec-99	114
Fedsure Growth	17	FEDgro	31-Mar-91	31-Dec-99	106
ABSA General	18	ABSgen	31-May-91	31-Dec-99	104
Metropolitan General	19	METgen	30-Nov-91	31-Dec-99	98
Old Mutual Top Companies	20	OLDtop	31-Dec-91	31-Dec-99	97
Community Growth	21	COMgro	31-Jul-92	31-Dec-99	90
Old Mutual Growth	22	OLDgro	31-May-93	31-Dec-99	80
NIB Prime Select	23	NIBpri	31-May-94	31-Dec-99	68
Guardbank Prosperity	24	GUApro	30-Sep-94	31-Dec-99	64
Standard Bank Growth	25	STAgro	31-Mar-95	31-Dec-99	58
Guardbank Capital Focus	26	GUAcap	31-Dec-95	31-Dec-99	49
NIB Defensive	27	NIBdef	31-Jan-96	31-May-99	49
NIB Strategic	28	NIBstr	31-Jan-96	31-May-99	48
Fleming Acorn Growth	29	FLEaco	29-Feb-96	31-Dec-99	47
Coronation High Growth	30	CORgro	31-May-96	31-Dec-99	44
Investec Growth	31	INVgro	30-Jun-97	31-Dec-99	31
NIB Wealth Creator	32	NIBwea	31-Aug-97	31-Dec-99	29
Nedbank Growth	33	NEDgro	31-Dec-97	31-Dec-99	25
Nedbank Synchro	34	NEDsyn	31-Dec-97	31-Dec-99	25
mCubed Capital Growth	35	MCUgro	31-Jan-98	31-Dec-99	24
PSG Growth	36	PSGgro	28-Feb-98	31-Dec-99	23
Brait Accelerated Growth	37	BRAgro	31-Mar-98	31-Dec-99	22
ABSA Growth FOFs	38	ABSgro	31-Aug-98	31-Dec-99	17
Brait Growth FOFs	39	BRAfof	31-Aug-98	31-Dec-99	17
Franklin Equity	40	FRKequ	31-Aug-98	31-Dec-99	17
RMB Performance FOFs	41	RMBper	31-Aug-98	31-Dec-99	17
Fedsure Pioneer	42	FEDpio	30-Sep-98	31-Dec-99	16
Standard Bank Aggressive FOFs	43	STDfof	30-Sep-98	31-Dec-99	16
Allan Gray Equity	44	ALGequ	30-Nov-98	31-Dec-99	14
FNB Growth	45	FNBgro	30-Nov-98	31-Dec-99	14
Guardbank RSA Equity	46	GUArsa	30-Nov-98	31-Dec-99	14
Sanlam Future Trends	47	SANfut	30-Nov-98	31-Dec-99	14

4.2 Data collection

The database was built from price information collected by a research team at Old Mutual. For each unit trust in existence, the following information was collected: month-end selling and repurchase prices, the distribution rate per unit for each distribution, the distribution declaration date, the payment (reinvestment) date and the selling price on the date of reinvestment.

Considerable effort was invested in checking the accuracy of the data collected. The buy-sell spreads were calculated at the end of each month and compared over time. Significant fluctuations in the spread from one month to the next were investigated and the prices corrected using price information from other sources. In a few cases wild fluctuations in the spread were caused by the selling price being captured as the repurchase price or obvious data capturing errors, such as the decimal point being inserted in the wrong place. These types of errors were also found in the price data of other information service providers.

A 10-year historical daily price database was purchased from Sharenet for the period 1990 to 1999. The selling and repurchase prices in this database were compared to the collected data and used to correct any errors found. In addition, for the period 1995 to 1999, price information from I-Net, Micropal and Profile Media's Unit Trust Handbooks was used verify the accuracy of information. In a few cases, where no two sources were consistent, information was obtained from the management companies concerned.

It is interesting to note that no one data source was complete or consistently accurate. In some cases two sources would report different prices for the same fund on a particular day. This could be caused by one source capturing the daily prices one day too late or too early

or by conflicting prices issued by the management companies as a result of pricing re-runs to correct errors on already issued prices. Other errors found included the omission of distribution reinvestments and the reinvestment of distributions at the repurchase price instead of the selling price.

The accuracy of month-end prices is important for studies of short-term persistence. Data capturing errors can cause outliers in the statistical tests performed and more minor errors such as timing differences can create patterns in the time series data that in fact do not exist. For example, if an error that overstated the return was made in one month, the reporting of the correct price at the end of the following month will result in the return calculated for the second month being understated. This would create a false impression of return reversals.

Despite the time invested in eliminating pricing errors, small inaccuracies are likely to remain from one month to the next. Because of the noise that could be created by these small inaccuracies, periods of less than six months are not analysed. However, all tests are performed on a rolling basis to ensure the results obtained are not specific to the starting month and to ensure that every month-end price is incorporated in the results.

4.3 Calculation of returns

The return for the first month of a fund's existence is excluded from the sample, as it is unlikely to be comparable to its peer group for the following reasons:

- The initial portfolio may be built up over a period prior to the launch of the fund and as a result, the cost price of the shares included in the portfolio will be lower than the price of the shares on launch date. This will cause the return for the first month to be overstated.

- A newly launched fund with significant inflows is likely to have abnormally high average cash holdings and therefore its return in the first month is likely to differ substantially from the market and other general equity funds.
- The fund may be launched in the middle of the month and therefore returns will not be comparable to those of established funds.

For every other month, t, the discrete monthly return (r_t) is calculated using the repurchase price at the end of each month as follows:

$$\text{Monthly return } (r_t) = \frac{P_t}{P_{t-1}}\left(1 + \frac{d_t}{P_{tr}}\right) - 1$$

Where :

P_t = Repurchase price at the end of the month

P_{t-1} = Repurchase price at the end of the previous month

d_t = Distribution per unit paid during the month

P_{tr} = Price at which the distribution was reinvested

Note that the repurchase price (P_t) is the net asset value per unit *less* accrued administration fees, asset management fees, dealing costs and taxes, but is before taking initial load fees, broker commissions and compulsory charges into account. Therefore the returns calculated are net of on-going fund expenses, but are before taking investor transaction costs into account.

The discrete monthly returns calculated above are transformed into continuous returns by taking the log of the value relatives i.e. the natural log of ($1 + r_{at}$). The holding period return over any number of months, n, is then easily calculated by taking the inverse of the natural log of the sum of the continuous monthly returns *minus* 1.

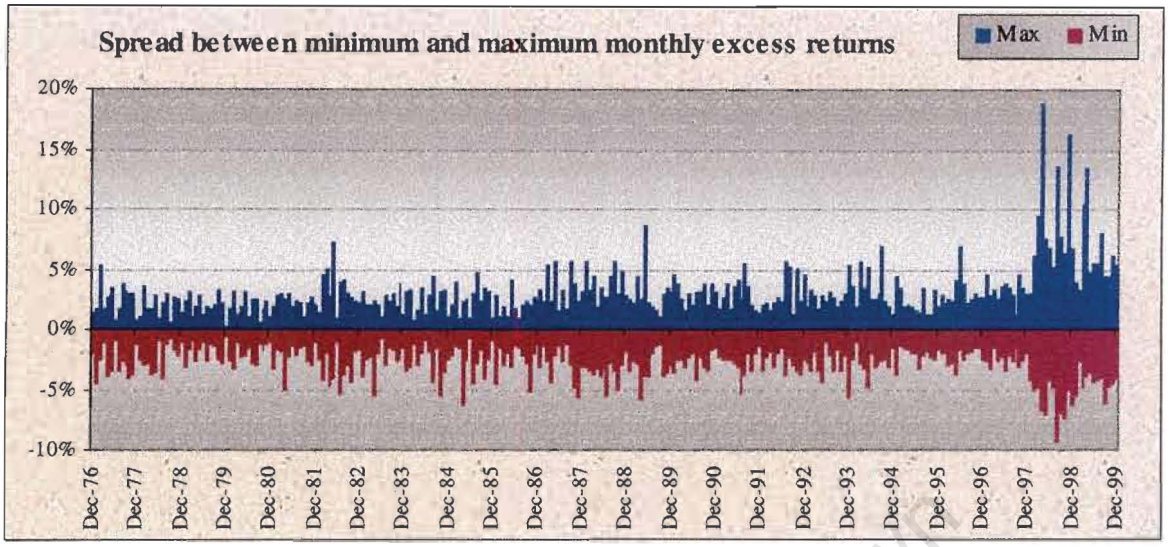
Formally, the holding period return (r_h) over n months is calculated as follows:

$$r_h = e^{\sum_{t=1}^{n} \ln(1+r_t)} - 1$$

Relative excess returns

Fund performances are first evaluated in terms of relative excess returns. The relative excess return is the return for the period (as calculated above) *less* the equal-weighted mean return of all the funds in existence during the period. Thus, by definition, the excess returns across all funds in any period will sum to zero. However, the number of funds with a positive excess return will not necessarily equal the number of funds with a negative excess return. Figure 3 shows how the difference between the maximum and minimum monthly excess return has varied through time. The size of the spread is an indication of the economic importance of picking the right fund. In some months being invested in the wrong fund can have a significant impact on cumulative returns, whereas in other months the choice of fund is less significant. The fact that one period can have a disproportionate effect on the cumulative return highlights the danger of using cumulative returns or the size of the return to make inferences about the degree of persistence. When persistence is described as consistent out-performance or under-performance relative to other similar funds, the size of the return spread should not impact on the persistence results. Therefore, in this study, more emphasis is placed on *rankings* so that general market volatility does not affect the persistence results. The effect of differences in returns will be seen when implementing trading strategies.

Figure 3: Spread between maximum and minimum monthly excess returns: 1977 – 1999.



As can be seen from Figure 3, the excess return spread increased significantly from 1998 onwards. This was most likely caused by the increase in general market volatility and increased competition amongst funds. The average spread over the last two years of the sample period is 12.9% compared to 5.7% over the previous two-year period. This dramatic increase in performance differences is not due to outliers and emphasises the increasing importance of being able to identify high performing funds, or at least to avoid the poorly performing ones.

Risk-adjusted returns

Funds with the same mandate can exhibit differences in volatility due to a number of factors including fund size, investment style and degree of liquidity. Therefore it is desirable to rate funds based on returns in excess of the risks borne by each fund. When evaluating portfolio performance, the risk-adjustment measures mostly commonly used are Jensen's alpha, the Sharpe ratio, the Treynor measure and the information ratio.

Jensen's alpha, Treynor's measure and the information ratio require the use of a market index as a proxy for Markowitz's market portfolio. Roll (1980) demonstrated that the use of an index, which is not an ex ante mean-variance efficient portfolio, as a market proxy results in a benchmark error that could affect the rankings of risk-adjusted returns. Lehman and Modest (1987) also found fund rankings to be sensitive to the asset-pricing model and benchmark chosen to measure normal performance.

The use of the JSE All Share Index (ALSI) as a market proxy is likely to introduce benchmark error into the risk adjustment process. The following studies support the contention that the ALSI is not an appropriate market proxy for risk adjustment:

- Gilbertson and Vermaak (1982), consistent with earlier studies, found that estimated beta parameters were neither stable nor stationary.
- Although Knight & Firer (1989) found evidence of beta stability and stationarity over the 10 years ending December 1986, a more recent study by Firer, Beale, Edwards, Hendrie & Scheppening (2001) found that unit trust portfolio betas were neither stable nor stationary in the 10-year period ending December 1999.
- Bowie & Bradfield (1993) argued that because of market segmentation on the JSE, the relevant Financial, Industrial or Mining indices should be used instead of the ALSI as market proxies for beta estimation.
- Van Rensburg & Slaney (1997) showed that using a two-index Arbitrage Pricing Theory (APT) model (using the All Gold Index and the Industrial Index) was more appropriate in asset pricing applications on the JSE than using the CAPM with the ALSI as the market proxy.

- Von Wielligh & Smit (2000) showed that the CAPM using the ALSI as a market proxy does not explain the cross sectional variations in returns of South African unit trusts.

As Chen & Knez (1996) pointed out, performance evaluation focuses on the *small difference* between the return on the fund and the return on the market. Therefore a small amount of model misspecification may corrupt the entire inference. To prevent the risk of arbitrary results arising from the selection of an inappropriate benchmark, the Sharpe ratio is used as the method of risk adjustment.

Sharpe ratios

Although the Sharpe ratio also requires the identification of a market portfolio proxy to make inferences about superior manager abilities and market efficiency, it can be calculated without identifying such a proxy. Therefore Sharpe ratios can be used to compare fund performances relative to each other without the risk of the relative rankings being a function of the chosen benchmark. Note that the Sharpe ratio, which measures returns relative to total risk (volatility), fully incorporates market (systematic) risk without specifically identifying it. The historic Sharpe ratio, which is the ex post average excess return to volatility ratio, is calculated in this study as follows:

$$S_p = \frac{r_p - r_f}{\sigma_p}$$

Where:
r_p = geometric mean monthly return achieved by the portfolio over the period
r_f = geometric mean monthly risk - free return over the same period
σ_p = standard deviation of monthly portfolio returns over the period

Sharpe ratios are not calculated for periods shorter than 3 years, because the small number of returns is likely to result in an unreliable point estimate of the standard deviation of

monthly returns. Sharpe ratios calculated over 36 months are used in the 3-year contingency table tests. The results are compared to those obtained from using raw returns to assess the impact on the results of adjusting for risk. Sharpe ratios calculated over 60-month periods are also used to measure the risk-adjusted return of constructed multi-fund portfolios when testing trading strategies.

4.4 Periods studied

To avoid making conclusions about results that are time period specific, each test will be performed numerous times with formation and holding periods of 6 months, 1 year, 2 years and 3 years. To increase the robustness of the results, the starting point of the analyses is altered and formation and holding periods of different lengths are combined.

Formation and holding periods of less than 6 months have not been incorporated into this study to avoid reporting results that are dependent on inaccurate data. The return data over short periods is particularly sensitive to pricing data inaccuracies. If the price data contains random inaccuracies, then the analysis of returns will be affected. The shorter the evaluation period the more the inaccuracies are amplified in the returns and the greater the impact on a fund's ranking relative to other funds. If the inaccuracy occurs in one month and is corrected in the subsequent month then the returns of both months will be affected. Common sources of pricing inaccuracies are:

- Data capture errors on the part of data providers who accumulate information from unit trust management companies and make it available to researchers.
- Pricing errors made by management companies when valuing units on a daily basis. These errors are most likely to occur when abnormal transactions occur in the fund or when pricing has to be done manually as a result of system problems.

- Differences in policies and methodologies between different funds. For example some funds may mark the value of their securities at 2pm while others may use the closing prices for the day. On days when the market moves substantially, this will impact short-term relative returns, but will be immaterial in the longer term.

4.5 Survivorship bias

The return data in this sample are free from survivorship bias. All funds that were listed in the General Equity unit trusts sector at any time in the 19-year period ending 31 December 1998 are included from the date of inception to the date of termination. Funds generally "terminate" by being merged with other funds, or by being transferred to another sector as a result of a change in mandate. Name changes and management changes, such as the conversion of the NBS Hallmark Fund to the Marriot Equity Fund and Metfund to the Investec Equity Fund are not terminations and have no effect on the returns to unit holders.

As can be seen from Table 1, only four funds terminated prior to 31 December 1998. In all the persistence tests performed, these funds were held until the last month-end before termination. If the fund terminated in the middle of a holding period, it was held until termination and the proceeds were then invested equally in the remaining funds until the end of the period.

4.6 Contingency tables of winners and losers

Hypothesis 1 is tested using contingency table analysis to measure the degree of independence of data from two different periods: the formation period and the holding period. Contingency table tests are non-parametric tests used to analyse ordinal data such as fund rankings. These tests have the advantage that no assumption needs to be made about the distribution of returns (e.g. normality).

Winner-loser contingency table tests similar to those performed by Kahn & Rudd (1995) will be used as a simple test for consistent over- or under-performance. Kahn & Rudd (1995) ranked funds based on raw returns, cumulative selection returns and information ratios and defined the top half of the funds (i.e. those exceeding the median return) as winners and the bottom half as losers. In this study funds are ranked on raw returns and Sharpe ratios and winners are defined as those funds that beat or equalled the mean rate of return. Using the mean rate of return as a reference point is appealing as it is the return that would be earned by an investor investing equally in all funds. Therefore, by definition, increasing the weighting of a winning fund in a unit trust portfolio will increase the investor's average return *if* persistence exists.

To produce results comparable to that of Khan & Rudd (1995) and Meyer (1997), the following procedures are repeated for each formation and holding period combination studied:

- The return (r_h) is calculated for the formation period and the adjacent holding period.
- The funds that produce a return above the mean return are labelled as winners and those below the mean are labelled as losers. Funds that have a return exactly equal to the mean are labelled as winners. When a fund terminates during the holding period, it is labelled as a winner if it beats or equals the mean return up to the date of termination; otherwise it is labelled a loser.
- The winners and losers are recorded in contingency tables, which show the number of funds that were winners in both periods (WW), losers in both periods (LL), winners then losers (WL) and losers then winners (LW).
- The results are tested for statistical independence using the chi-square test statistic.

If the formation period positions (i.e. winner or loser) and holding period positions are statistically independent, then the observed frequency in each contingency table block will equal the product of the corresponding row and column marginal probabilities. In other words, the observed frequency will equal the expected frequency, which is calculated for each cell as (row total) × (column total) / (grand total). The chi-square test statistic, which is used to measure the statistical significance of the goodness of fit between the observed values and the expected values, is calculated using the following formula:

$$\chi^2 = \sum_{i=1}^{4} \frac{(O_i - E_i)^2}{E_i}$$

Where :

O_i = the observed frequency in quadrant i

E_i = the expected frequency in quadrant i

The degrees of freedom in an R × C contingency matrix is (R-1)(C-1) which in the case of a 2 × 2 matrix is one. Thus the critical values are 3.841 at the 5% level of significance and 6.635 at the 1% level of significance.

The chi-square test statistic (χ^2) measures the probability of independence, but if the null hypothesis of independence is rejected, the χ^2 value does not indicate the direction or strength of the implied dependence relationship. Therefore the Cross-Product Ratio (CPR) is also calculated to measure the degree and direction of dependence. The CPR is calculated as (WW×LL)/(WL×LW) and gives a ratio of 1 if the performance in the holding period is independent of the performance in the formation period. The CPR has a range of zero to infinity. A ratio greater than one indicates performance persistence and a ratio less than one indicates performance reversal. The test statistic for the CPR is referred to as the

z-statistic and is the standard deviation of the log of the CPR. It is calculated by taking the square root of the sum of the reciprocals of the cell counts in the contingency table.

To increase the robustness of the results, the contingency table tests are repeated using different starting points and consecutive periods of varying lengths. Periods of 6 months, 1 year, 2 years and 3 years are analysed and compared.

4.7 Regression analysis

Contingency tables of winners and losers highlight significant trends in performance, but are quite crude in that they do not make use of all the available information. For example, the relative rankings of funds within the repeat-winner and repeat-loser categories are ignored. Also, no distinction is made between a fund that moves from being the top fund in one period to the bottom fund in the next and a fund that moves from a percentile rank of say 53% (winner) in one period to a percentile rank of say 47% (loser) in the next period.

To analyse relative fund performances more closely, cross-sectional regressions are performed on fund rankings (i.e. fund rankings in the holding period are regressed on their rankings in the formation period). The *slope* of the regression line is a measure of the relationship between fund rankings from one period to the next. A t-test is applied to the slope coefficient to determine whether or not it is significantly different from zero. A significantly positive slope indicates that past performance persists in the subsequent period, whereas a significantly negative slope indicates that performance reverses in the subsequent period. The closer the absolute value of the slope is to unity, the stronger the relationship is between past and future performance.

The approach used is similar to that of Grinblatt & Titman (1992), Goetzmann & Ibbotson (1994) and Hallahan (1999), except that fund rankings are used as the measure of relative performance rather than alphas, to avoid the benchmark error problem discussed earlier. Because the number of funds is not constant over time, relative performance is measured based on the funds' percentile rank rather than their absolute rank, so that comparisons can be made from one period to the next. The percentile rank is the rank of the fund expressed as a percentage of the total number of funds being ranked in the period.

An Ordinary Least Squares (OLS) regression slope is calculated for each pair of adjacent periods. For example, Figure 4 shows the regression line (in black) produced by regressing the percentile rankings for the 6-month period ending December 1999 on the percentile rankings for the 6-month period ending June 1999. The dotted diagonal line represents a slope of 1 that would indicate perfect persistence if $R^2 = 1$.

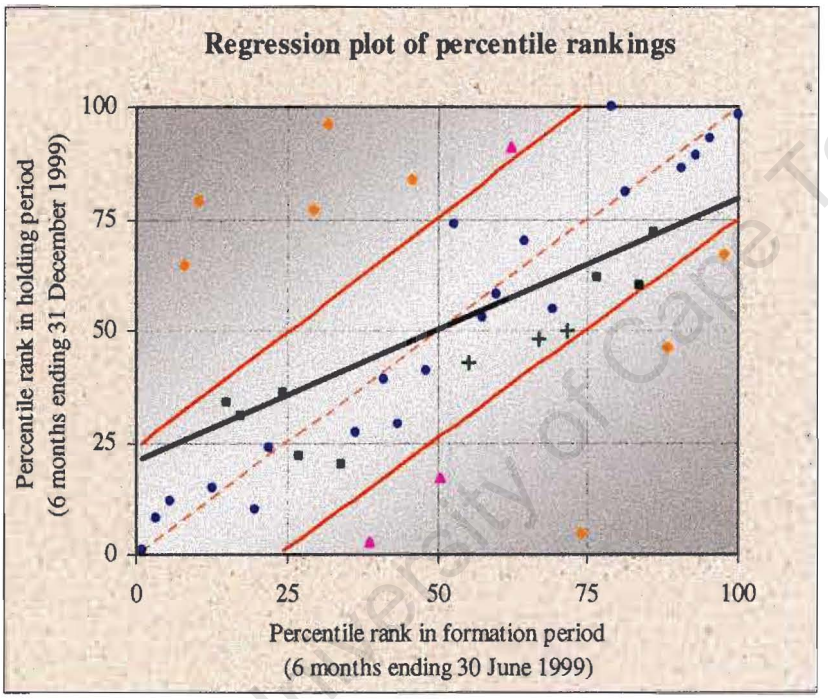
To illustrate the loss of information that can occur by classifying fund performances into groups such as winners and losers or quartiles, the regression points are plotted in various shapes and colours as described below. Plotted points that fall within the diagonal band (shown in red) represent funds whose percentile rankings have moved by less than 25% since the previous period. In Figure 4, 74% of the plotted points fall within these bands. A study of persistence based on *quartile* rankings would show that only 49% of the funds (shown as ●) performed consistently. This would understate the degree of persistence, as the green points (✚ & ■) within the diagonal band, which represent funds that are equally persistent, would be classified as non-persistent.

Similar distortions occur when classifying funds as winners and losers. In this example, the triangle points (△), which represent funds whose rankings have changed by more than

25%, would be regarded as persistent (WW or LL), whereas the plus points (+) would be regarded as non-persistent (LW) even though they represent funds that changed rankings by less than 25% since the previous period.

Using the regression slope coefficient with percentile rankings enables us to incorporate *all* the relative rankings information without distortion.

Figure 4: Example of a regression line formed from independent rankings from two adjacent 6-month periods



Slope = 0.580

Standard error = 0.127

R^2 = 0 .337

t-statistic = 4.562

p-value = 0.000

n = 43

In the figure above, the slope of the regression line is strongly positive and significantly different from zero (at the 1% level) as indicated by the high t-statistic and low p-value. This shows that the performance in the holding period is positively related to the performance in the formation period. Although the low R^2 value indicates that the relationship between past and future rankings is weak, there is evidence of significant persistence in the graph above.

Regression slope coefficients are calculated for each holding period over the 12 years ending December 1999. Regressions are not performed on the rankings from the early 1980's because there are insufficient data points to reliably fit a regression line. The 12-year test period is convenient, because it is divisible by each holding period studied.

Once a regression slope coefficient has been calculated for each adjacent holding period in the chosen 12-year period, the following information is gathered and reported in Appendix II:

- **Total points plotted**: This is the number of points in [x;y] space used to calculate the slope coefficient of the overall OLS regression line for the 12-year period covered. Each point represents the holding period percentile rank (y) for a particular unit trust fund in relation to that same fund's percentile rank (x) in the formation period.
- **Overall slope coefficient**: This is the slope of the OLS regression line drawn through all of the plotted points. It represents the average relationship between a fund's holding period rank and its formation period rank over the 12-year period.
- **Standard deviation of slopes:** This is the standard deviation of the slope coefficients of the two-period regression lines within the 12-year period. This statistic is an indication of the degree of variability in the slopes of the two-period regression lines. This statistic should be used with caution where the holding period is more than 6 months, as the small number of adjacent periods in 12 years is likely to result in a high degree of estimation error for the standard deviation.
- **The t-value (t^*) of the slope coefficient**: This is the standardised t-statistic of the overall slope coefficient, calculated as follows:

$$t^* = \frac{\text{slope coefficient (b)}}{\text{estimated standard deviation}} = \frac{b}{\sqrt{\frac{\sum_{i=1}^{n}(Y_i - \hat{Y}_i)^2}{(n-2)\sum_{i=1}^{n}(X_i - \overline{X}_i)^2}}}$$

Where :

X_i = the i^{th} observed formation period percentile ranking

Y_i = the i^{th} observed holding period percentile ranking

$\overline{X}_i$ = mean of the observed formation rankings

$\hat{Y}_i$ = estimated slope coefficient of the regression line.

- **The p-value**: This is the probability under the t-distribution that the population slope coefficient is zero.
- **R-squared**: This is the coefficient of determination for the overall regression and represents the proportion of the total variation (over 12 years) in the holding period rankings (y) that is explained by the variation in the formation period rankings (x).
- The **number of periods** that had **positive** slopes and the number of periods that had **negative** slopes expressed as a percentage of the total number of two-period regression lines.
- The number of positive and negative slope coefficients that was **significantly different from zero** at the 5% level of significance.

Once the summary statistics have been gathered for the 12-years ending 31 December 1999, the ending date is rolled back one month and the entire process outlined above is then repeated for the 12-year period ending 30 November 1999. Each 12-year test is repeated 36 times, each time rolling back the ending date by one month. The last test performed covers the period 31 January 1985 to 31 January 1997.

The same multiple ending date procedures are applied to formation and holding period combinations of 6 months, 1 year, 2 years and 3 years, resulting in 16 different combinations. For each of the 16 combinations of formation period and holding period lengths there are 36 sets of regression tests. Therefore there are $16 \times 36 = 576$ sets of regression tests in total.

Each of these sets of regression tests span 12 years and contain 144/h two-period OLS regression lines, where h is the holding period length in months. For example (as can be seen in Appendix II), the set that uses a formation period of 6 months and a holding period of 6 months for the 12 years ending 31 December 1999 has an overall slope coefficient of 0.2612 formed from the 528 points making up 144/6 = 24 two-period regression lines. For a given formation period and holding period combination, the parameters for each of the 36 sets of tests differs from one another only by the ending month of the analysis, which ranges from January 1997 to December 1999 (i.e. 36 different ending months).

Therefore, 36 average slope coefficients are obtained for each of the 16 combinations of formation and holding periods. For each combination, the best (highest) slope, the worst (lowest) slope and the median (18^{th} highest) slope are depicted graphically to show the extent of the variation in slopes in relation to the length of the formation and holding periods used.

For selected 12-year test cases, the variation of the regression slopes over time will be graphed to illustrate the dangers of using average statistics to make inferences about persistence relationships.

4.8 Runs tests

To determine whether or not it is possible to select an individual fund that performs consistently across multiple evaluation periods, a one-sample runs test is used to test the randomness of the *sequence* of the relative returns of a fund over time. Here it is the *order* of events rather than the frequency of events over the test period that we are interested in.

In this test, a *run* is defined as a succession of wins or loses, where a win (W) represents a holding period return that is equal to or greater than the average return, and a loss (L) represents a return that is below the average return of all funds. The total number of runs (r) in a sample of any given size provides an indication of whether or not the sample is random. If a few runs occur, a time trend or lack of independence is suggested. Conversely, if many runs occur, it suggests that systematic short-term fluctuations are causing reversals of relative fund returns over time. If the number of runs falls within the upper and lower bounds of the number of runs that would be expected when returns are random, the null hypothesis stated in Hypothesis 2 (in section 3.2) cannot be rejected.

If n_w is the number of wins and n_l is the number of loses then $N = n_w + n_l$ is the number of consecutive holding periods tested. If both n_w and n_l are less than or equal to 20, then Appendix III gives the critical values of r under H_0 at the 5% level of significance. If the observed value of r falls between the critical values we accept H_0, otherwise we reject it. The lower limit table gives values of r that are so *small* that the probability associated with their occurrence under H_0 is $p = 0.025$. The upper limit table gives values of r that are so *large* that the probability associated with their occurrence under H_0 is $p = 0.025$. Thus any observed value of r that is equal to or less than the lower limit, or greater than or equal to the upper limit is in the region of rejection at the 5% level.

If either n_w or n_l is larger than 20, the tables in Appendix III cannot be used. In such cases a good approximation of the sampling distribution of r is the normal distribution (Siegel 1956, p.56) with the mean (μ_r) and standard deviation (σ_r) calculated as follows:

$$\text{Mean} = \mu_r = \frac{2n_w n_l}{n_w + n_l} + 1$$

$$\text{Standard deviation} = \sigma_r = \sqrt{\frac{2n_w n_l (2n_w n_l - n_w - n_l)}{(n_w + n_l)^2 (n_w + n_l - 1)}}$$

H_0 is then tested by $z = \frac{r - \mu_r}{\sigma_r}$

The values of z under H_0 are approximately normally distributed with mean = 0 and variance = 1. Therefore the significance of any observed value of z may be determined by reference to the areas under the standard normal curve.

If the number of wins (n_w) or loses (n_l) is too few, the number of runs (r) cannot be evaluated for statistical significance. As can be seen from the tables in Appendix III, this will always be the case if N is less than 9 or either n_w or n_l is less than 3. Therefore only the unit trust funds that have existed for a sufficient number of consecutive holding periods can qualify for evaluation under this method. This test is performed across all qualifying funds using holding periods of 6 months, 1 year and 2 years over the entire 20-year sample period. When a holding period of 6 months is used, a fund must have been in existence for at least 4½ years (i.e. 9 consecutive holding periods) to qualify for testing. As a result of the history of return data required, almost half of the funds in the sample are excluded from this test.

For each runs test employing holding periods of 6 months, 1 year and 2 years, three different ending months will be chosen. All three tests will be run over the 20-year period

ending 31 December 1999, so as to incorporate as many funds as possible. The other two ending months will be chosen based on the results of the "best-case" and "worst-case" scenarios reported from the regression analysis. For example, in the regression analysis, the "best-case" from the results of the 6-month holding period tests will be the specific sample period that results in the highest overall slope coefficient that is generated when regressing the returns of each 6-month holding period (over 12 years) on the returns from the prior 6-month period. This particular 12-year period represents the case in which evidence of persistence was strongest and therefore provides the best chance of finding individual funds that exhibited persistent performance. If the "best case" test does not find evidence of a non-random pattern of returns, then it is unlikely that such evidence would be found using any other sample period.

4.9 Trading strategies

Fifteen trading strategies are evaluated over a 5-year time horizon. For a trading strategy to be successful it must consistently produce a high terminal value after 5 years. To measure the success at achieving this goal, each trading strategy is implemented on the first day of each month starting 1 January 1980 and ending 1 January 1995. This results in 180 (15 years × 12 months) terminal values at the end of each of the months December 1984 through to December 1999.

For each of the 180 5-year evaluation periods and for each strategy, the portfolio composition is monitored on a monthly basis. This establishes the number of fund switches required to carrying out the strategy, the monthly returns to the portfolio and the standard deviation of monthly returns over 60 months. The resulting terminal value is used to calculate the annual compound rate of return earned over the 5-year period. The 180 annual compound returns are then averaged to obtain the overall average annual return to

the strategy. Average annual compound returns are also calculated for the holding periods ending 1985-1989, 1990-1994 and 1995-1999 to see how the strategies fared in different periods.

Using the standard deviation of monthly returns over 60 months as a measure of portfolio risk and the monthly return on a 3-month NCD as a proxy for the risk free rate, 180 Sharpe ratios are also calculated and then averaged for comparison with other strategies.

The strategies tested are described below. These strategies will be implemented using the optimal formation period and holding period obtained from the contingency table and regression results.

- **Invest equally in all funds**, rebalancing the portfolio at the end of each holding period and buying into newly formed funds that have a performance history at least as long as the optimal formation period used. The return on this portfolio is the equal-weighted arithmetic mean return on all established managed General Equity Unit Trusts. It is the base case portfolio against which all other strategies will be measured.
- **Switch to the top fund** over the last formation period and hold for the optimal holding period. If the selected fund terminates during the holding period, buy into the fund that was second best on the formation date.
- **Switch to the worst fund** over the last formation period and hold for the optimal holding period. If the selected fund terminates during the holding period, buy into the fund that was second worst on the formation date.
- **Switch to the second best fund** over the last formation period and hold for the optimal holding period. This strategy is used as a control on the "switch to the top fund" strategy. If switching to the top fund results in switching to outliers that are temporary

winners, the switching to the second best fund should provide better results. For example, a mediocre fund may be the best performer during a market crash, because it happened, by chance, to have a high cash ratio because of a recent large inflow or pending outflow. Switching to this fund would result in a poor return in the following period. If temporary out-performance occurs frequently, it may be better to select the second best fund to avoid the temporary outliers.

- **Switch to the second worst fund** over the last formation period and hold for the optimal holding period. This strategy is used as a control on the "switch to the worst fund" strategy.
- **Hold all the winners** from the previous formation period (i.e. the funds that have positive excess returns) and reconstitute the portfolio at the end of each holding period.
- **Hold all the losers** from the previous formation period (i.e. the funds that have negative excess returns) and reconstitute the portfolio at the end of each holding period.
- **Hold all the winners that earned an excess return greater than 2%** in the previous formation period and rebalance at the end of the holding period. This strategy aims to identify the true winners, by eliminating the funds that were "only just" winners in the previous period.
- **Hold all the winners that earned an excess return greater than 5%** in the previous formation period and rebalance at the end of the holding period. This strategy aims to hold only the funds that had exceptional performance in the prior period. Where no fund achieves this return, the top fund is held.
- **Hold all the losers that earned a return more than 2%** ***below*** the average return in the formation period and rebalance at the end of the holding period. This strategy aims

to identify the true losers, by eliminating the funds that "only just" missed being winners in the previous period.

- **Hold all the losers that earned a return more than 5% *below*** the average return in the formation period and rebalance at the end of the holding period. This strategy aims to hold only the "bottom feeders" i.e. the exceptionally poorly performing funds. Where no fund achieved such a poor return, the worst performing fund is held.
- **Hold the top Quartile** of funds from the formation periods and rebalance at the end of the holding period. The quartile portfolios are tested because of the frequency with which quartile rankings are analysed in the literature.
- **Hold the second Quartile** of funds from the formation periods and rebalance at the end of the holding period.
- **Hold the third Quartile** of funds from the formation periods and rebalance at the end of the holding period.
- **Hold the bottom Quartile** of funds from the formation periods and rebalance at the end of the holding period.

In all strategies a market related switching cost of 1.25% of the invested capital is charged on the purchase of each fund. The returns reported are thus net of these transaction costs. Sales charges, which form part of the selling-repurchase price spread, are the only costs not taken into account in this analysis. These costs are now avoidable if an investor invests through certain linked product companies. However, it must be noted that these costs were not fully avoidable over the 20-year sample period. Therefore the reported returns would only have been available to investors who were able to negotiate away these commissions – a formidable achievement in an industry that was far less competitive than it is now.

The strategies are evaluated based on their returns over every 5-year period in the 20 years ending December 1999. A notional R100 is invested in each strategy on 1 January 1980 and the terminal value after 5 years is then compared to the terminal value of the other strategies. This exercise is then rolled forward one month and repeated. The exercise is rolled forward by one month and repeated 180 times in total until the last 5-year period ends in December 1999. In Figure 16, the resulting 5-year terminal values for selected strategies are plotted relative to the 5-year terminal values of the average (all unit trusts) portfolio over a 15-year period.

Rolling the analysis forward one month over a holding period of 5 years is equivalent to giving R100 to 60 people who each follow the same strategy, but start investing one month apart. After 5 years, one investor will realise a 5-year terminal value and the remaining investors will realise their returns over the following 5 years. At the end of the ten year period the most successful strategy will be regarded as the one which has the least dissatisfied group of investors, given that an investor would be dissatisfied if his/her investment returns less than the average return realised by the "all funds" strategy.

To relate the results to the market conditions that existed over the sample period, the following notional portfolios are created and measured against the trading strategies:

- **JSE All Share Index (ALSI) nominal returns**. R100 is invested in the ALSI and the 5-year terminal values are compared to the terminal values of the trading strategies.
- **JSE ALSI simulated tracker fund**. To make the ALSI returns comparable to the "switch to the top fund" strategy, an index fund with a zero tracking error is simulated. The notional fund provides the investor with a continuous monthly return equal to 5% of the monthly risk-free rate (approximated by the interest rate on a 3-month NCD)

plus 95% of: the monthly return on the ALSI *less* a management fee of 1.14% p.a. and brokerage charges of 0.75% p.a. (charged monthly). Because each unit trust fund in South Africa must, by law, hold 5% of its assets in cash, this portfolio is only exposed to 95% of the ALSI return.

- **Return on 3-month NCDs.** This portfolio provides the investor with a return approximately equal to the risk free rate.
- **Perfect hindsight switching – best case**. This portfolio is not realistically achievable (except by random chance), but it provides an indication of the upper limit that could potentially be earned by investing in unit trusts and switching to the top fund in the coming holding period.
- **Perfect hindsight switching – worst case**. This portfolio provides an indication of the poorest return that could be earned by the unlucky investor that happens to consistently select the next period's worst- performing fund.

5 RESULTS AND INTERPRETATION

5.1 Contingency table results

Following the methodologies of Brown & Goetzmann (1995) and Kahn & Rudd (1995), the winning and losing funds are tracked over the twenty-year sample period and reported in 2×2 contingency tables. The degree of positive persistence is determined by the extent to which the WW and LL cells outnumber the WL and LW cells. This test is repeated using different holding periods and different ending months.

Table 2: Frequencies of repeat performers and related test statistics

Period length (months)	Ending month	No. of observations (n)	% WW	% LL	Chi-square statistic	Chi-square p-value	Cross product ratio (CPR)	CPR Z statisitc	Normal probability value (CPR Z statistic)
Results based on raw returns									
6*	Dec-99	640	28.4%	30.5%	20.28	0.0000	2.0548	4.4792	1.0000
6*	Oct-99	623	28.3%	30.5%	18.98	0.0000	2.0252	4.3341	1.0000
6*	Aug-99	616	27.6%	31.5%	20.13	0.0000	2.0794	4.4615	1.0000
6*	Jul-99	608	26.0%	29.6%	7.47	0.0063	1.5619	2.7281	0.9968
12	Dec-99	294	25.5%	28.2%	1.62	0.2033	1.3465	1.2710	0.8981
12	Sep-99	286	27.6%	27.3%	2.74	0.0978	1.4813	1.6531	0.9508
12	Jun-99	280	24.3%	28.9%	1.09	0.2965	1.2845	1.0432	0.8516
12*	Mar-99	273	26.7%	33.0%	9.99	0.0016	2.1748	3.1400	0.9992
24	Dec-99	128	28.1%	26.6%	1.12	0.2900	1.4554	1.0566	0.8547
24*	Jun-99	122	27.0%	36.1%	8.02	0.0046	2.8696	2.7978	0.9974
24	Dec-98	117	26.5%	29.9%	1.90	0.1686	1.6692	1.3728	0.9151
24	Jun-98	104	27.9%	30.8%	3.09	0.0786	2.0087	1.7502	0.9600
36	Dec-99	70	31.4%	28.6%	2.81	0.0937	2.2564	1.6644	0.9520
36	Jun-99	66	25.8%	33.3%	2.08	0.1496	2.0549	1.4330	0.9241
36	Dec-98	63	25.4%	30.2%	0.75	0.3866	1.5510	0.8641	0.8062
36	Jun-98	62	29.0%	35.5%	5.12	0.0237	3.2727	2.2294	0.9871
Results based on Sharpe ratios									
36	Dec-99	70	34.3%	30.0%	5.67	0.0172	3.2308	2.3476	0.9906
36*	Jun-99	66	36.4%	31.8%	9.05	0.0026	4.8462	2.9245	0.9983
36	Dec-98	63	33.3%	31.7%	5.77	0.0163	3.5000	2.3635	0.9909
36	Jun-98	62	33.9%	32.3%	6.46	0.0110	3.8182	2.4942	0.9937

** Chi-square statistic is significant at the 1% level of significance*

Details of all the tests performed can be found in Appendix I. Table 2 summarises the results of the contingency table tests. It shows the results of tests using consecutive 6, 12, 24 and 36-month periods. In all these tests the formation period and holding period are the

same length. For each period length studied, four different ending points are used to test the sensitivity of the results to the specific test period selected. Tests that result in the null hypothesis of independence (Hypothesis 1) being rejected at the 1% level of significance are marked with an asterisk.

The χ^2 test statistic is used to evaluate the degree of independence and the cross-product ratio is used to determine whether the relationship between winners and losers from one period to the next is positive or negative. For the periods ending in December 1999, independence can be rejected at the 1% level (based on the chi-square p-values) for the 6-month period test only. The null hypothesis of independence can be rejected at the 10% level for the 3-year period test, but not for the 1-year and 2-year period tests.

Even though these tests have been performed over a fairly long period of 20 years, they are sensitive to the particular time period chosen. For example, by moving the ending date of the 2-year test back by six months and the 1-year test back by nine months we can reject the hypothesis of independence at the 1% level. This highlights the dangers of making inferences based on the results of one particular test period.

Table 2 shows that in the long run winner-winner and loser-loser persistence is very strong over consecutive 6-month periods. These tests have a large number of observations, making the results fairly robust. The results of the tests over longer periods are erratic and highly sensitive to the ending date chosen. Based on the p-values of the chi-square statistic, there is no conclusive evidence that performance repeats over holding periods of one year or longer. However, in all the tests performed, the cross-product ratio (CPR) exceeds unity and the percentage of repeat performers (WW or LL) ranges from 53% to 68%. Therefore there is strong evidence that in the long run, past performance is positively related to future

performance. Based on the contingency table analysis, there is no evidence that performance consistently reverses from one period to the next.

To further illustrate the nature of the repeat-winner or repeat-loser phenomenon, the results of each 6-month, 12-month, 2-year and 3-year period for the 20 years ending in December 1999 are graphed in Figure 5, Figure 6, Figure 7 and Figure 8 respectively.

Figure 5: Winners and losers over consecutive 6-month periods

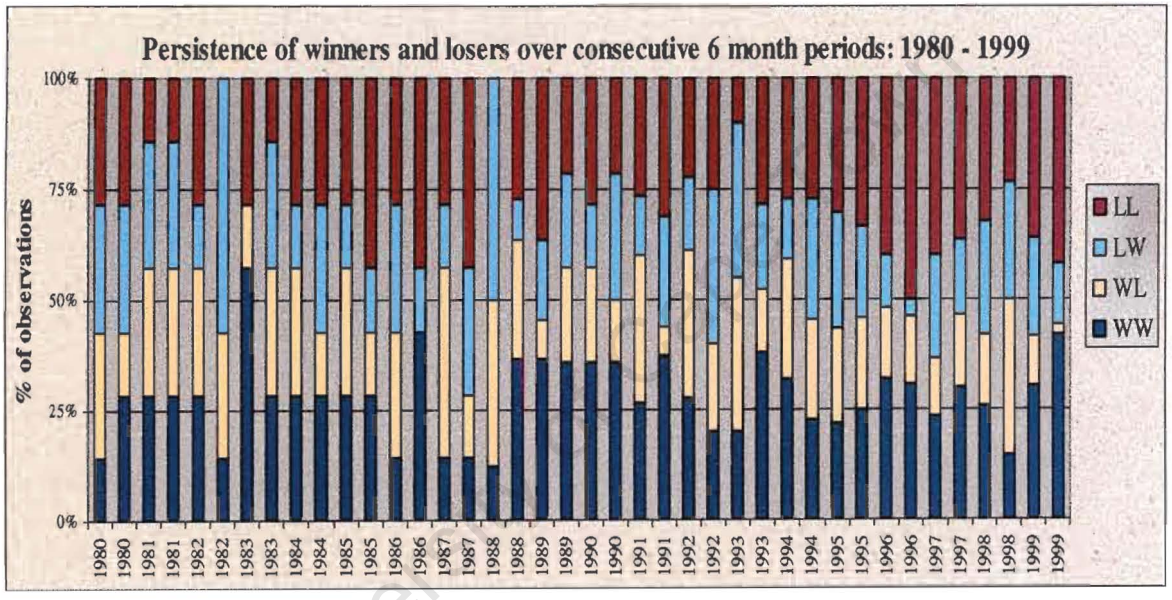
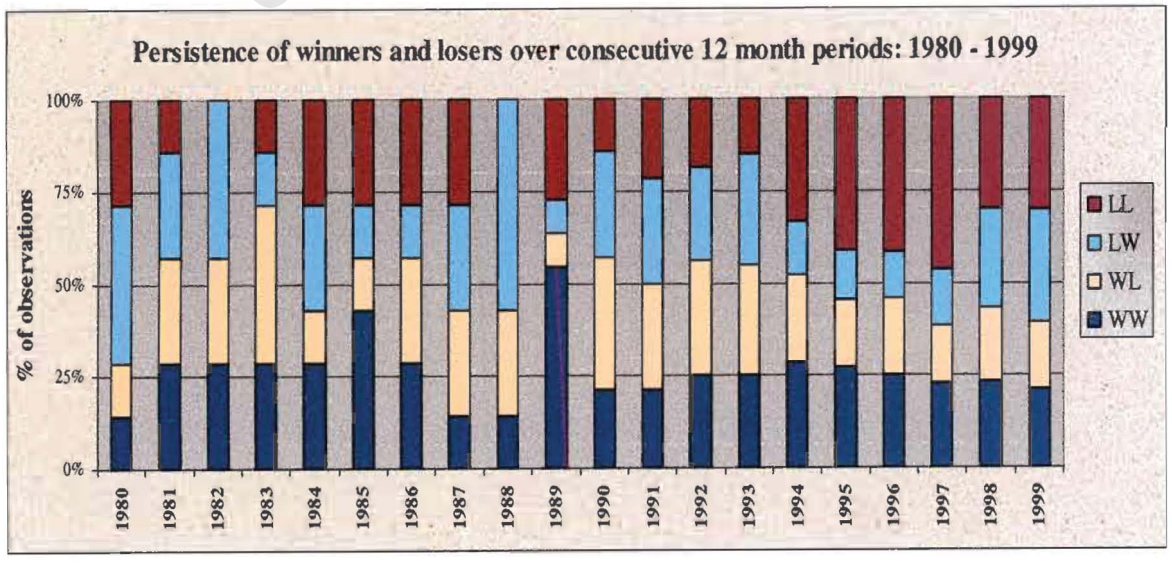


Figure 6: Winners and losers over consecutive 12-month periods



For the 6-month period test, there are four periods in which over 80% of the funds repeat their performance and two periods (both in the 1980's) in which over 80% of the funds fail to repeat their performance. In the remaining 34 periods, more than 25% of winners repeat in 22 of the periods and more than 25% of the losers repeat in 25 of the periods. The repeat loser phenomenon is slightly more prevalent, particularly in the 1994-1999 period.

Figure 7: Winners and losers over consecutive 2-year periods

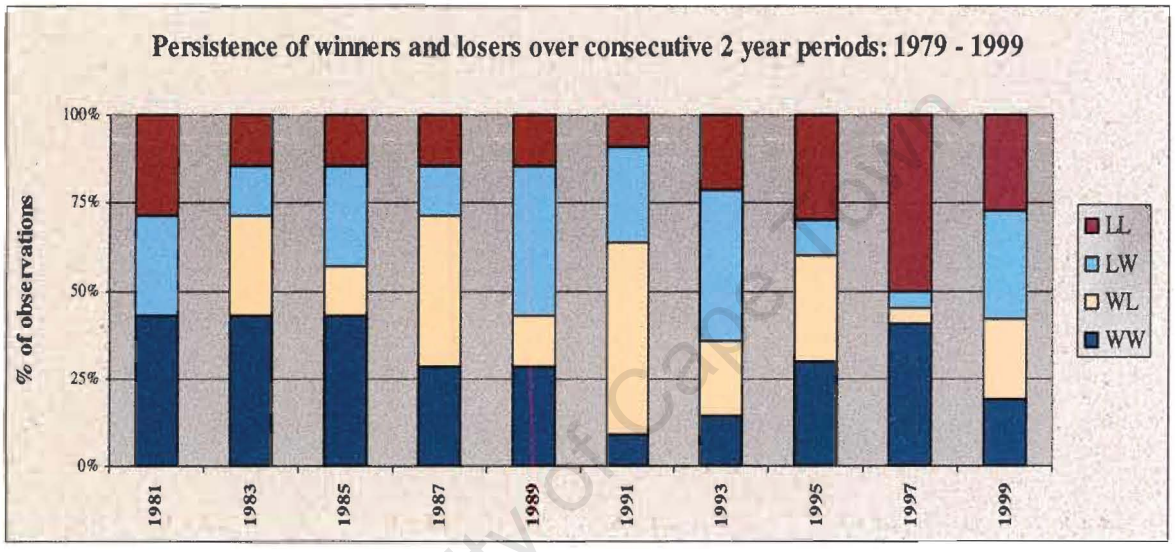
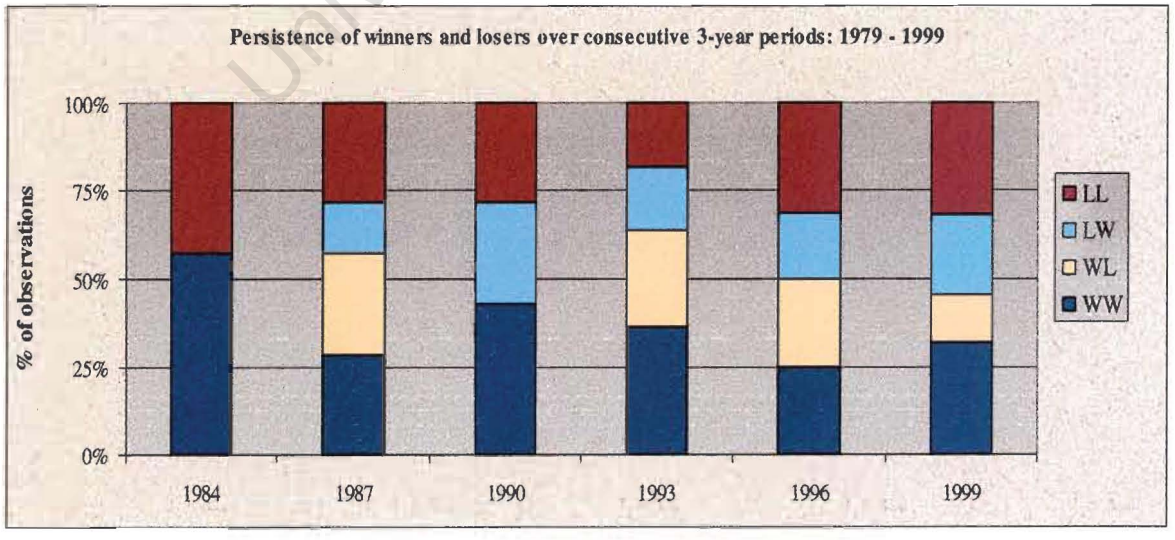


Figure 8: Winners and losers over consecutive 3-year periods based on Sharpe ratios



For the 12-month holding period test, there is only one year (1989) in which more than 80% of the funds repeat their performance and two years (1982 and 1988) in which 80% of the funds fail to repeat their performance. In this test there is little evidence that winners repeat more than often than would be expected by random chance. As with the 6-month period test, the repeat loser phenomenon seems prevalent in the 1994-1999 period.

For the 2-year period test, the repeat winner phenomenon seems prevalent in the 1980-1986 period and the repeat loser phenomenon in the 1994-1999 period. However the results from the 1980's are unlikely to be significant due to the small number of funds in existence. Consistent with the statistics in Table 2, Figure 7 provides no evidence of long-term persistence when 2-year holding periods are used.

Figure 8 presents the 3-year holding period case using Sharpe ratios instead of raw returns to evaluate funds as winners or losers. From Table 2 it appears that the use of Sharpe ratios greatly improves the level of persistence, with persistence (WW or LL) occurring in more than 64% of funds regardless of the starting point used. However, from the graph it can be seen that the statistics in the table are skewed by a short period of perfect persistence in the early 1980's. For the periods after 1984, only mild persistence is evident.

From these tests the following results stand out:

- Persistence of winners and losers is significant over the long-term when performance is evaluated from one 6-month period to the next.
- The repeat-loser phenomenon is particularly prevalent over the 1994-1999 period. It is interesting to note that the repeat-loser population (i.e. the funds that were losers in two consecutive periods) changed during this 5-year period, so the result is not due to a group of consistently poor performers. The observed phenomenon could be as a result

of the volatility and growth of the information technology sector during this period. Funds that adhered to 'value' investing methodologies during this period would have under-performed consistently during the boom phases of the technology cycle and then suddenly over-performed during the downturns when the 'growth' orientated funds would have under-performed consistently. This proposition is consistent with the fact that the repeat-loser population changed most significantly after the technology led stock market crash in August 1998.

- The results of the tests using holding periods longer than 6 months are highly sensitive to the specific periods selected for testing. While Meyer (1997) came to the conclusion that "it seemed that the longer the evaluation period, the better the results", this study indicates that although long evaluation periods can produce strong evidence of the repeat-winner and repeat-loser phenomena, they can also show no persistence if a different starting point is selected. Therefore it appears that *reliable* evidence of persistence strengthens as the evaluation (holding) period is shortened.

5.2 Regression test results

Percentile rankings from holding periods of 6 months, 12 months, 2 years and 3 years are regressed on formation periods of 6 months, 12 months, 2 years and 3 years over the 12-year period ending December 1999, resulting in 16 separate tests. In each of these tests there is n-1 two-period cross sectional regressions, where n is the number of consecutive holding periods in 12 years. Each of these tests are then repeated 36 times, each time rolling the ending date back by one month. The summary statistics of the 576 tests are reported in 16 tables in Appendix II. From each of these tables, the median case, the best case and worst case (based on the overall slope coefficient) are extracted to form Table 3, Table 4 and Table 5 respectively, which are reported below.

The R^2 values of the overall (12-year) regressions are extremely low in all cases suggesting that past performance has very limited explanatory power. It seems that future performance is driven by other significant variables. Manager skill in the form of timing abilities and share selection abilities are unlikely to be explanatory variables, because these variables should be consistent over time and would thus already be incorporated in the past performance rankings. However, other manager factors such as fund management styles, which are suited to different market conditions, could contain some additional explanatory power.

Table 3: Slope coefficients for each formation-holding period combination over 12 years (median case).

Formation period (months)	Holding period (months)	No. of adjacent periods	Last month in test period	Total points plotted	Overall slope	t-value	p-value	R-Squared	% of positive slopes	% of negative slopes	Significant positive slopes (5% level)	Significant negative slopes (5% level)
6	6	24	Mar-97	377	0.214	4.233	0.000	0.046	75.0%	25.0%	8.3%	0.0%
12	6	24	Feb-97	350	0.208	3.964	0.000	0.043	75.0%	25.0%	12.5%	4.2%
24	6	24	Jan-97	314	0.149	2.662	0.008	0.022	70.8%	29.2%	12.5%	0.0%
36	6	24	Jun-97	296	0.119	2.055	0.041	0.014	54.2%	45.8%	8.3%	4.2%
6	12	12	Apr-99	231	0.201	3.101	0.002	0.040	83.3%	16.7%	16.7%	0.0%
12	12	12	Nov-98	208	0.167	2.436	0.016	0.028	75.0%	25.0%	8.3%	0.0%
24	12	12	Mar-98	172	0.110	1.441	0.151	0.012	41.7%	58.3%	8.3%	0.0%
36	12	12	Feb-99	170	0.104	1.355	0.177	0.011	58.3%	41.7%	8.3%	0.0%
6	24	6	Mar-97	88	0.193	1.823	0.072	0.037	66.7%	33.3%	0.0%	0.0%
12	24	6	Aug-99	108	0.168	1.752	0.083	0.028	50.0%	50.0%	16.7%	0.0%
24	24	6	Jun-98	83	0.109	0.984	0.328	0.012	66.7%	33.3%	16.7%	0.0%
36	24	6	Dec-99	89	0.129	1.209	0.230	0.017	66.7%	33.3%	16.7%	0.0%
6	36	4	Jun-98	65	0.139	1.115	0.269	0.019	75.0%	25.0%	0.0%	0.0%
12	36	4	Nov-99	67	0.140	1.141	0.258	0.020	50.0%	50.0%	0.0%	0.0%
24	36	4	Mar-98	49	0.137	0.950	0.347	0.019	50.0%	50.0%	25.0%	0.0%
36	36	4	Jun-97	43	0.122	0.787	0.436	0.015	50.0%	50.0%	0.0%	0.0%

Although the dependency relationship is weak some relationship does exist. To measure persistence of performance over a long period, we look at the overall slope coefficient (formed from all the data points throughout the period) and the frequency of the significantly positive two-period slope coefficients.

The median slopes shown in Table 3 represent the "average" slope for each combination of formation period and holding period tested. The median is preferred to the mean, because the mean slope would not represent an observable case. From the table above it appears that the shorter the formation period and the holding period, the higher the slope coefficient. For holding periods of 6 months, the t-statistics for the slope coefficients are significantly different from zero at the 5% level of significance regardless of the formation period length chosen. As the holding period lengthens, the slope coefficients become less significant.

Generally, when the holding period is 6 months, a high percentage of the two-period slope coefficients are positive, indicating that the risk of facing return reversals is lowest. In this case, using a formation period of 6 months and a holding period of 12 months produces the most consistent performance with 83.3% of the slope coefficients being positive, 16.7% of the slopes being significantly different from zero at the 5% level and none of the negative two-period slopes being significantly different from zero.

The low slope coefficients, the low R^2 values and the small percentage of positive slopes that are significantly different from zero indicate that, on average, the relationship between past performance and future performance is weak. However, the fact that some of the overall slope coefficients are highly significant, none of the overall slope coefficients are negative and in most cases the number of positive two-period slope coefficients exceeds the number of negative coefficients suggests that some positive persistence does exist.

When analysing the best-case scenarios in Table 4, evidence of persistence increases as the holding period increases. This is the *opposite* result of the one obtained from analysing the data in Table 3! This clearly shows that by selecting a specific starting point, formation

period and holding period, long-term persistence can be found. The fact that such contrasting results have been obtained by changing the ending date of a 12-year test period by not more than 3 years illustrates how sensitive the persistence results are to the chosen variables. Note that the ending dates (column 4) for the different formation and holding period combinations vary significantly indicating that the best-case scenarios are not caused by market specific conditions in isolated periods.

In the best-case scenarios, using a holding period of 3 years produces high overall slope coefficients. Regardless of the formation period chosen, all four of the consecutive 3-year periods produce positive slope coefficients, one of which is significant at the 5% level. For holding periods of 6 months the best-case statistics are only marginally better than the median statistics reported in Table 3.

Table 4: Slope coefficients for each formation-holding period combination over 12 years (best case).

Formation period (months)	Holding period (months)	No. of adjacent periods	Last month in test period	Total points plotted	Overall slope	t-value	p-value	R-Squared	% of positive slopes	% of negative slopes	Significant positive slopes (5% level)	Significant negative slopes (5% level)
6	6	24	Dec-97	412	0.278	5.852	0.000	0.077	92%	8%	21%	0%
12	6	24	May-98	408	0.245	5.095	0.000	0.060	75%	25%	17%	0%
24	6	24	May-98	362	0.185	3.579	0.000	0.034	63%	38%	8%	0%
36	6	24	Mar-99	354	0.162	3.087	0.002	0.026	71%	29%	17%	0%
6	12	12	Feb-98	203	0.303	4.509	0.000	0.092	75%	25%	33%	0%
12	12	12	Apr-97	172	0.246	3.304	0.001	0.060	75%	25%	17%	0%
24	12	12	Jul-98	179	0.202	2.737	0.007	0.041	75%	25%	0%	0%
36	12	12	Jul-98	161	0.216	2.783	0.006	0.046	75%	25%	8%	0%
6	24	6	Feb-99	108	0.391	4.379	0.000	0.153	100%	0%	33%	0%
12	24	6	May-99	106	0.356	3.880	0.000	0.126	83%	17%	33%	0%
24	24	6	May-97	76	0.352	3.234	0.002	0.124	83%	17%	33%	0%
36	24	6	Jul-99	85	0.366	3.584	0.001	0.134	83%	17%	33%	0%
6	36	4	Feb-98	59	0.438	3.683	0.001	0.192	100%	0%	25%	0%
12	36	4	May-98	59	0.422	3.519	0.001	0.178	100%	0%	25%	0%
24	36	4	Jun-98	52	0.401	3.093	0.003	0.161	100%	0%	25%	0%
36	36	4	Jun-99	52	0.451	3.575	0.001	0.204	100%	0%	25%	0%

The worst-case scenarios in Table 5 show that as the holding period increases, the slope coefficient decreases and the number of negative two-period slope coefficients overtakes the number of positive slopes. For holding periods of 2 years and 3 years, the slope

coefficients are negative, but not significantly different from zero even at the 10% level. Hence it can be shown that no persistence exists over successive 2-year and 3-year periods.

By comparing Table 4 and Table 5, we see that when using a 6-month formation period and a 3-year holding period the results of persistence tests over a 12-year period can be changed from finding very strong persistence to finding no evidence of persistence simply by changing the ending date by 6 months from February 1998 to August 1998.

Table 5: Slope coefficients for each formation-holding period combination over 12 years (worst case).

Formation period (months)	Holding period (months)	No. of adjacent periods	Last month in test period	Total points plotted	Overall slope	t-value	p-value	R-Squared	% of positive slopes	% of negative slopes	Significant positive slopes (5% level)	Significant negative slopes (5% level)
6	6	24	Jan-99	467	0.143	3.111	0.002	0.020	71%	29%	17%	8%
12	6	24	Jul-99	466	0.134	2.921	0.004	0.018	71%	29%	21%	13%
24	6	24	Aug-99	416	0.090	1.842	0.066	0.008	50%	50%	17%	4%
36	6	24	Jun-99	365	0.077	1.468	0.143	0.006	50%	50%	13%	4%
6	12	12	Jul-99	241	0.043	0.670	0.504	0.002	75%	25%	0%	8%
12	12	12	Sep-99	230	0.113	1.724	0.086	0.013	75%	25%	8%	0%
24	12	12	Feb-97	153	0.036	0.438	0.662	0.001	50%	50%	0%	0%
36	12	12	Oct-99	182	0.023	0.311	0.756	0.001	50%	50%	0%	8%
6	24	6	Jul-97	89	(0.149)	(1.402)	0.164	0.022	17%	83%	0%	0%
12	24	6	Sep-97	88	0.039	0.359	0.721	0.001	33%	67%	17%	0%
24	24	6	Oct-97	77	(0.089)	(0.777)	0.440	0.008	33%	67%	17%	33%
36	24	6	Oct-97	71	(0.004)	(0.031)	0.976	0.000	33%	67%	0%	0%
6	36	4	Aug-98	65	(0.112)	(0.891)	0.376	0.012	25%	75%	0%	0%
12	36	4	Feb-97	49	(0.110)	(0.755)	0.454	0.012	50%	50%	0%	25%
24	36	4	Aug-97	49	(0.214)	(1.501)	0.140	0.046	25%	75%	0%	0%
36	36	4	Dec-97	48	(0.040)	(0.270)	0.789	0.002	50%	50%	0%	25%

However, Table 5 shows that when using a holding period of 6 months (with a formation period of 6 months or 12 months), the overall slope coefficient is significantly positive and 71% of the two-period slope coefficients are positive even in the worst-case scenario. This suggests that fund performance rankings persist from one 6-month period to the next with considerable dependability, regardless of the ending date selected.

Figure 9: Overall regression slope coefficients for a 12-year period (best case)

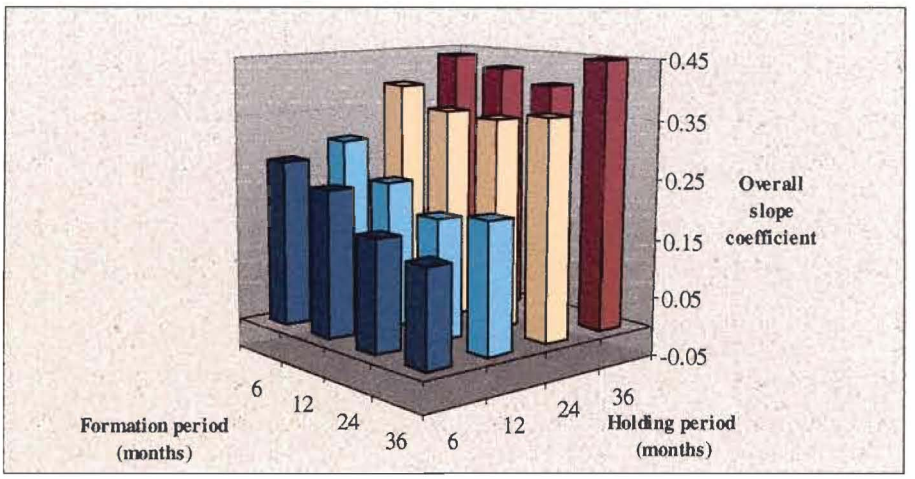


Figure 10: Overall regression slope coefficients for a 12-year period (median case)

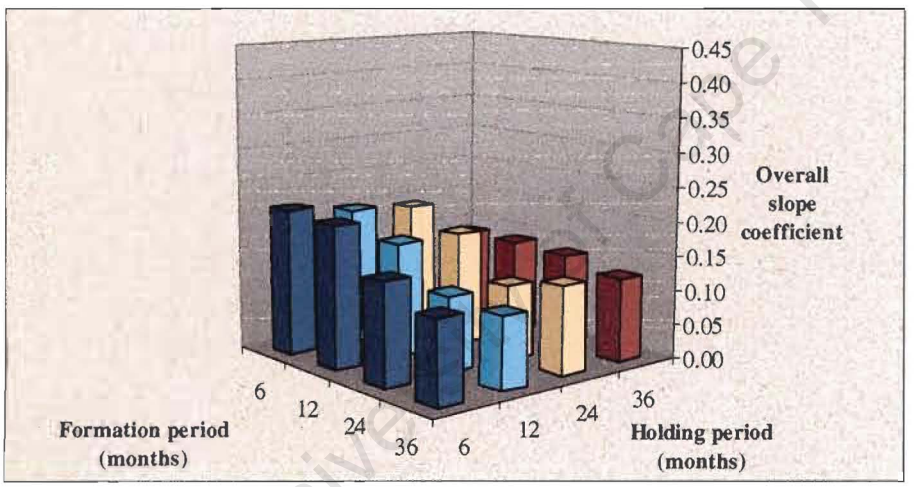
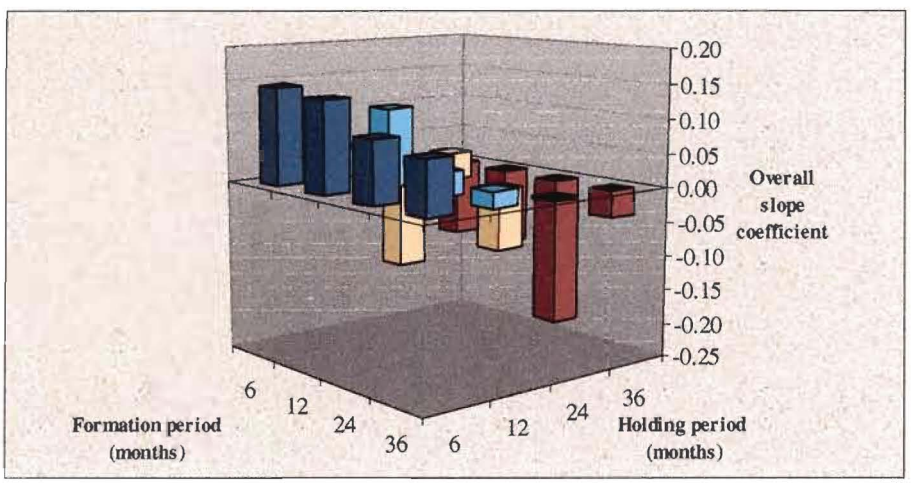


Figure 11: Overall regression slope coefficients for a 12-year period (worst case)



The overall slope coefficients reported in Table 4 (best case), Table 3 (median case) and Table 5 (worst case) are depicted graphically in Figure 9, Figure 10 and Figure 11 respectively. These graphs clearly show that increasing the holding period length increases the range of possible slope coefficients that could be obtained when varying the ending date of the analysis. By analysing fund performances over the last 6 months, it seems that an investor would be able to predict performances in the next 6 months with reasonable reliability and with the lowest risk of experiencing performance reversals.

Caution must be exercised in interpreting the above results as the summary statistics shown in Appendix II and the above tables do not show how the relationship between past and future performances vary *over time*, once a starting point has been chosen.

Figure 12 and Figure 13 are common examples of how the two-period slope coefficients vary from one period to the next, using holding periods of 1 year and 3 years respectively. The horizontal lines on the right hand side of these graphs represent the average slope coefficients reported in Appendix II for the 12-year period ended 31 December 1999. These two examples show that in most cases the shorter formation periods give better persistence results, but this relationship is not consistent over time.

Although all the average slope coefficients in these graphs are positive, the individual two-period slope coefficients vary significantly from one holding period to the next and are sometimes significantly negative. This highlights the volatility of persistence results and their sensitivity to the sample period chosen. Therefore, despite the extensive multi-period testing performed in this analysis and the relatively long period studied (in relation to similar South African studies) the results obtained are still specific to the sample period covered. Using the results of this study to make inferences about future performance

patterns are based on the assumption that the already weak relationship between past and future performances does not weaken further in future.

Figure 12: Regression coefficients for the twelve 1-year periods ending December 1999.

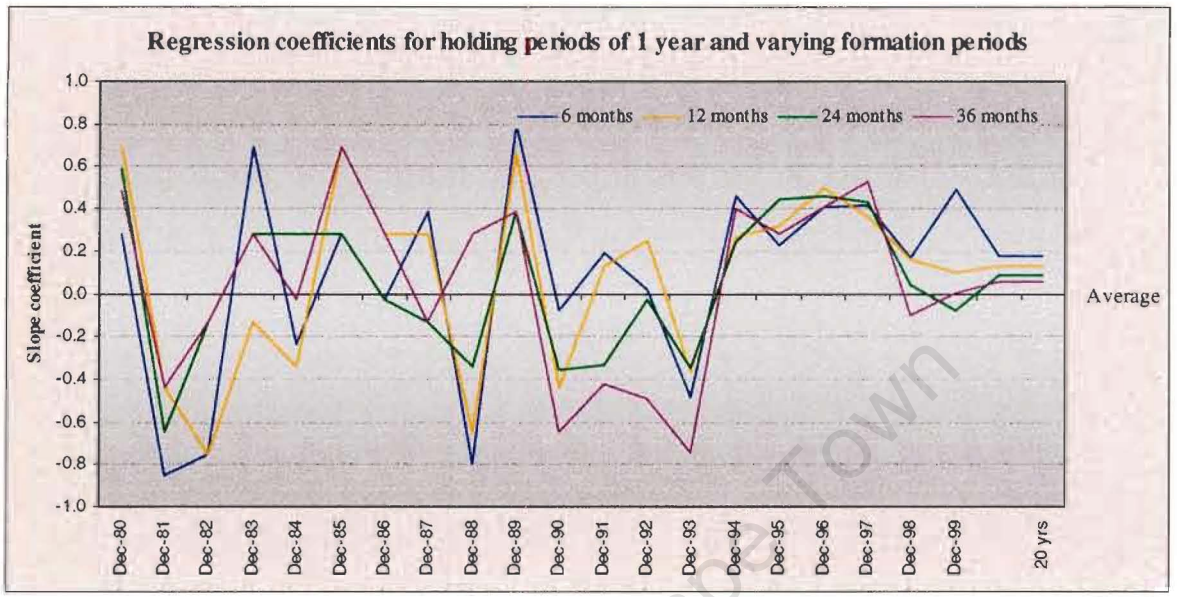
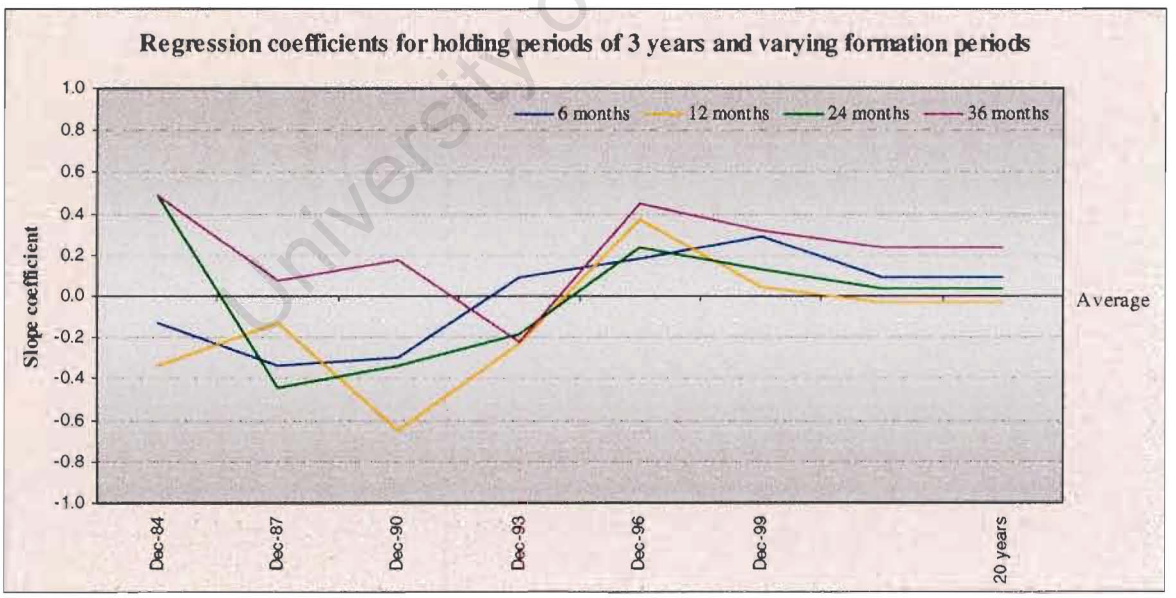


Figure 13: Regression coefficients for the four 3-year periods ending December 1999.



From the analysis above, the following general conclusions can be made:

- Although performance reversals do occur, positive persistence in rankings occurs much more frequently. However, at very best, only one third of the two-period regression slope coefficients are significantly different from zero, indicating that most of the time the relationship between rankings from one period to the next is random.
- Over prolonged periods there is a weak, but consistent relationship between fund rankings from one 6-month period to the next. This conclusion holds regardless of the ending date chosen.
- The longer the holding period, the more volatile the results of the persistence study. On average, the longer the holding period, the weaker the evidence of persistence. For holding periods greater than 6 months, the results are highly dependent on the ending point and the formation period length chosen.
- The slope coefficients decrease as the formation period length increases, but the shorter formation periods do not consistently provide better results than other formation periods' lengths.

5.3 Runs test results

A runs test is used to determine whether the persistence evident from the above tests is caused by a few funds that consistently repeat their performance from one period to the next. If individual funds do not perform consistently over long periods, then the observed persistence must be caused by different funds that exhibit short-term persistence. Table 6 reports the results of applying the methodology described in section 4.8.

Table 6: Runs test results for the period 1980 to 1999

Holding period	Unit trust	Wins (n_w)	Loses (n_l)	Runs (r)	Non-random?	Wins (n_w)	Loses (n_l)	Runs (r)	Non-random?	Wins (n_w)	Loses (n_l)	Runs (r)	Non-random?
6 months		*Sample period: 20 years ending December 1999*				*Best-case: 12-year sample period ending December 1997*				*Worst case: 12-year sample period ending January 1999*			
	ABSgen	13	4	9	No	10	3	7	No	4	11	6	No
	BOEgro	14	4	2	Yes	14	-	1	Yes*	14	3	4	No
	CMUgro	14	5	8	No	11	4	6	No	5	12	9	No
	COMgro	6	8	6	No	4	6	4	No	7	6	7	No
	FEDgen	15	7	11	No	12	6	9	No	11	9	12	No
	FEDgro	7	10	10	No	7	6	9	No	10	5	9	No
	GUAgro	25	15	16	No	28	12	15	No	23	17	19	No
	GUApro	3	7	3	No	1	5	2	No*	2	6	3	No*
	INVequ	15	9	13	No	13	7	11	No	11	11	9	No
	MARequ	8	14	11	No	5	13	9	No	8	12	12	No
	METgen	10	6	6	No	7	5	4	No	6	8	6	No
	NIBgro	14	11	10	No	13	8	8	No	13	10	8	No
	NIBpri	11	-	1	Yes*	7	-	1	Yes*	9	-	1	Yes*
	NIBsel	9	14	10	No	7	13	8	No	10	12	12	No
	OLDgro	6	7	5	No	5	4	4	No	7	4	5	No
	OLDinv	23	17	21	No	23	17	20	No	27	13	19	No
	OLDtop	11	5	7	No	9	3	6	No	7	7	5	No
	RMBequ	14	10	11	No	12	8	9	No	13	9	14	No
	SAGgen	21	19	20	No	18	22	19	No	17	23	20	No
	SANgen	16	24	15	No	17	23	17	No	12	28	18	No
	SANpri	17	23	20	No	16	24	19	No	19	21	16	No
	SOUequ	7	15	9	No	6	12	7	No	6	14	7	No
	STAgen	17	23	20	No	16	24	20	No	19	21	22	No
	STAgro	3	6	6	No	2	3	4	No*	2	5	4	No*
	UALblu	16	22	17	No	17	23	18	No	16	23	21	No
1 year		*Sample period: 20 years ending December 1999*				*Best-case: 12-year sample period ending April 1997*				*Worst case: 12-year sample period ending September 1999*			
	FEDgen	7	4	4	No	4	4	3	No*	8	3	4	No
	GUAgro	12	8	9	No	11	8	8	No	14	6	9	No
	INVequ	7	5	10	No	4	5	2	Yes	5	6	6	No
	MARequ	4	7	5	No	-	8	1	No*	5	6	5	No
	NIBgro	5	7	2	Yes	5	4	2	Yes	6	6	3	Yes
	NIBsel	7	5	8	No	5	4	5	No	6	6	8	No
	OLDinv	12	8	10	No	9	10	12	No	13	7	9	No
	RMBequ	8	4	9	No	6	3	6	No	8	3	7	No
	SAGgen	12	8	14	No	9	10	9	No	9	11	12	No
	SANgen	7	13	8	No	7	12	8	No	10	10	11	No
	SANpri	7	13	13	No	7	12	11	No	6	14	12	No
	SOUequ	4	7	4	No	2	6	3	No*	2	8	3	No*
	STAgen	8	12	13	No	6	13	11	No	7	13	14	No
	UALblu	8	11	8	No	7	12	10	No	8	11	8	No
2 years		*Sample period: 20 years ending December 1999*				*Best-case: 12-year sample period ending May 1997*				*Worst case: 12-year sample period ending October 1999*			
	SAGgen	7	3	6	No	6	3	6	No	7	2	5	No*
	OLDinv	6	4	3	No	5	4	6	No	7	2	5	No*
	SANgen	3	7	6	No	2	7	5	No*	3	6	7	No
	UALblu	4	6	8	No	6	3	3	No	4	5	8	No
	SANpri	5	5	9	No	2	7	2	No*	3	6	7	No
	GUAgro	6	4	7	No	7	2	2	No*	6	3	5	No
	STAgen	3	7	3	No	3	6	3	No	2	7	5	No*

Results marked with an asterisk (*) indicate tests in which n_w or n_l were too small for r to be statistically evaluated. In such cases, the return sequence is classified as random ("No") or non-random ("Yes") based on what the result would be if r were increased by 1 and the smaller of n_w and n_l were increased by the marginal amount required to obtain a critical value from the lower limit table in Appendix III. The "best" and "worst" cases are selected as described in section 4.8.

From Table 4 it can be seen that when the formation period and the holding period is 6 months, the sample period that provides the strongest evidence of persistence (i.e. the "best-case") is the 12-year period ending in December 1997. Similarly, when the formation and holding periods are 6-months it can be seen from Table 5 that the 12-year period ending January 1999 provided the weakest evidence of persistent performance as is therefore represent the "worst-case" scenario. The best-case (worst-case) sample period is used in the runs tests to test for persistence of performance of individual funds, because it is the period in which persistent winners (losers) are most likely to be observed.

The runs tests could only be applied to those funds with a history long enough to be able to attribute statistical significance to the results. Table 6 reports the number of holding periods (n_w) in which each fund achieved a return in excess of the mean return of all funds in the sector and the number of periods (n_l) in which they returned less than the mean. The number of runs (r) is then evaluated for statistical significance at the 5% level.

Where both n_w and n_l do not exceed 20, the number of runs (r) is evaluated against the lower and upper limits obtained from the tables of critical values in Appendix III. If r is less than or equal to the lower limit or greater than or equal to the upper limit, the null hypothesis of random returns can be rejected. Where n_w or n_l exceeds 20, the sampling distribution of r is well approximated by the normal distribution. In such cases, the return sequence is evaluated as non-random if the observed z-statistic (defined in section 4.8) is equal to or more extreme than ±1.96.

Table 6 reports the results of nine runs tests. The tests differ only by the holding period length (which is equal to the formation period length) and the ending month chosen for the

analysis. As can be seen from the fourth column in each test, the choice of ending date does not have a significant effect on the results.

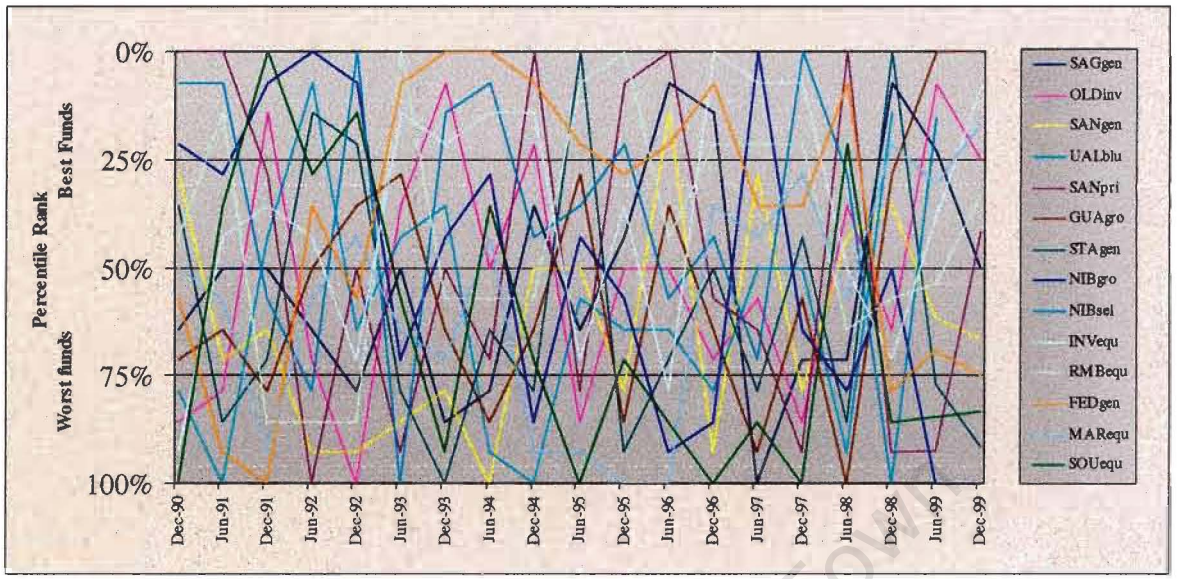
Only three funds (highlighted in bold in Table 6) produced a time series pattern of returns that appears not to be random. When measuring performance based on 6-month holding periods, the BOE Growth Fund and NIB Prime Select Fund exhibit patterns of consistent out-performance.

Using 1-year holding period returns, the NIB Growth Fund exhibits patterns of consistent performance. However, the result is not conclusive as this fund was a consistent out-performer in the first five years of its existence and then a consistent under-performer for the following seven years. Also, when dividing each of its return periods into 6-month periods, the sequence of its relative returns appears to be random.

Based on these results there is little evidence that individual funds consistently out-perform or under-perform relative to the other funds in the sector. This conclusion is supported by Figure 14, which shows that relative fund rankings are largely random. Although some short-term quartile persistence can be identified, few funds consistently performed above or below the mean for a significant period of time in the 1990's. There are isolated cases where funds appear to be consistent performers, but there is no way of identifying these funds in advance.

Figure 14 shows that using past performance to pick the next period's winning fund with some degree of certainty is an impossible task. Every fund has been a top quartile performer in at least one of the holding periods and every fund has been a bottom quartile performer at least twice over the 10-year period.

Figure 14: The random nature of relative fund rankings (based on 6-month holding periods) for all funds in existence on 31 December 1990.



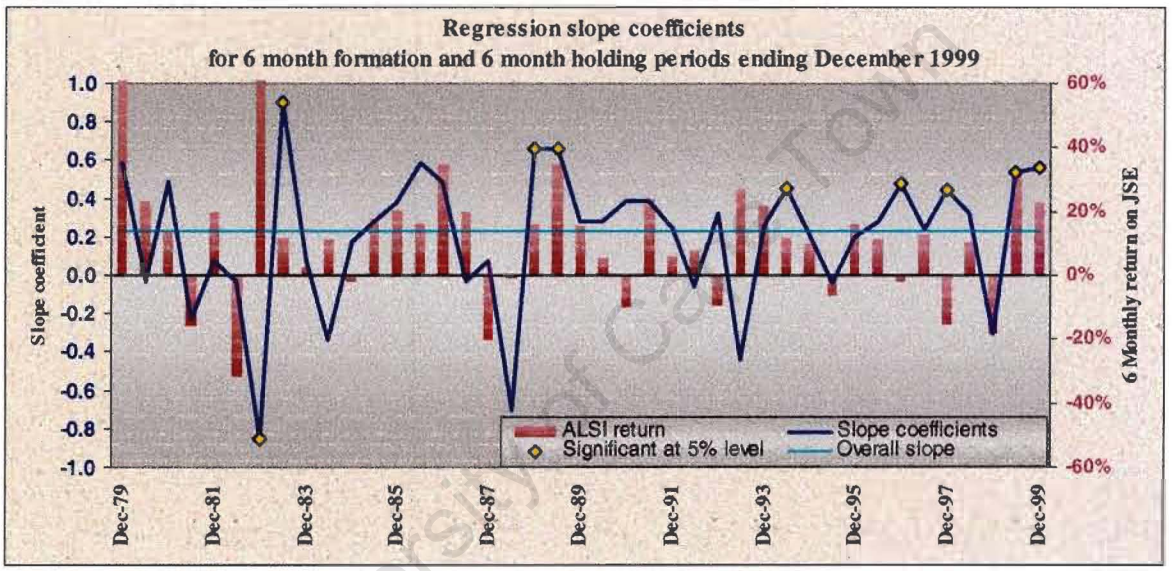
5.4 Devising a trading strategy

To determine whether the observed persistence is economically significant we need to devise a trading strategy that consistently produces returns in excess of the mean return. Identifying a fund that is likely to be the best performer in the long run (3 to 5 years) is clearly an impossible task, so the next best option is to select a group of funds or a fund-trading portfolio that is likely "beat the pack" in the long run. If funds are traded the transaction costs will be significantly higher than the costs incurred by a buy-and-hold investor. Such a strategy would have to be superior enough to beat the average return after taking these additional transaction costs into account.

It appears that using a 6-month formation period with a 6-month holding period is the investment horizon combination that is most likely to result in excess returns. Although the persistence results using a 3-year formation and holding period were stronger than those using 6-month periods in some cases, basing a strategy on a 3-year horizon would be risky because the result is likely to be highly sensitive to the starting point chosen.

To gain more insight into the 6-month period persistence observed, the slope coefficients produced from using formation and holding periods of 6 months are super- imposed on a graph of the 6-monthly returns of the JSE All Share Index. The 12-year regressions have been extended to 20 years to provide a longer history, but it must be borne in mind that the estimation error on the coefficients in the first 7 years is likely to be high because they are produced from only 7 data points.

Figure 15: The relationship between market returns and short-term persistence.



As can be seen in Figure 15, in most cases, high slope coefficients *follow* high market returns and performance reversals follow periods in which the return on the market is negative. This suggests that the short-term persistence may be caused by momentum in share returns. This would be consistent with the findings of Carhart (1997), who found that common factors in share returns explained persistence in mutual fund performances in the United States. Carhart concluded that past winners do well in future "not because fund managers successfully follow momentum strategies, but because some mutual funds just happen by chance to hold relatively large positions in last year's winning stocks"

Evidence of investor over-reaction on the JSE reported by Muller (1998) and evidence of the success of momentum strategies on the JSE reported by Fraser and Page (2000) indicate that momentum in share returns and persistence may be related. Further research is required in this area to determine whether or not funds did well in the formation period *because* they were holding the top performers on the JSE *and* continued to perform well in the holding period because they continued to hold these shares.

Figure 15 shows that the 6-month holding period strategy produces positive slope coefficients far more frequently than negative coefficients. The overall slope coefficient is significantly positive and persistence in the 1994 to 1999 period is particularly strong, with most of the coefficients being positive and many of them being significantly different from zero at the 5% level. Also, negative coefficients are always followed by positive coefficients indicating that the 6-month strategy effectively corrects the performance reversals. Two consecutive negative slope coefficients would indicate that the strategy shifts into funds that are only temporary out-performers and thus perform poorly in the period in which they are switched into.

The strong evidence of *some* persistence observable in the graph above together with the relatively low sensitivity of the results to the starting date makes a strategy using a 6-month formation period and a 6-month holding period the best choice. The analysis that follows will look at different strategies using consecutive 6-month periods. Strategies using holding periods longer than 6 months will not be compared as the preceding analysis shows the results are unlikely to be consistently superior.

5.5 Trading strategy test results

The 5-year terminal values (after costs) and the Sharpe ratios resulting from implementing the trading strategies are reported in Appendix IV. Table 7 summarises the overall results and shows how the averages have changed over time. Note that although the period studied spans 20 years, there are only 15 years (180 months) of 5-year terminal values. The first terminal value covers the period of returns from January 1980 to December 1984 and the last terminal value is results from the returns of the period January 1995 to December 1999.

The results provide very strong evidence of short-term persistence. The degree of persistence is sufficient to earn returns in excess of the average fund return after all trading costs have been taken into account.

An investor that followed the strategy of switching to the top fund every 6 months would have realised an annual compound return (after costs) of 22.3% on average over any 15-year period in the 20-year period ended December 1999. This can be compared to the return of 16.2% p.a. earned by an investor following the strategy of switching to the worst performing fund every 6 months. Switching to the top fund would have turned R100 into R2 048 over 15 years, while switching to the worst fund would have resulted in a terminal value of only R 951 on average. Holding all unit trusts would have returned an average of R1 723, while the JSE ALSI would have returned only R1 213 after taking notional costs into account.

Table 7: Average annual compound returns (after transaction costs) and standard deviations for a 5-year holding period between 1980 and 1999 earned by a variety of trading strategies.

Trading strategy	1985 - 1999				1985 - 1989		1990 - 1994		1995 - 1999	
	Rank	Return	Std dev	Sharpe	Rank	Return	Rank	Return	Rank	Return
Perfect hindsight - best case	1	34.5%	5.1%	0.2948	1	33.6%	1	34.7%	1	35.3%
Switch to top fund	2	22.3%	5.0%	0.1321	7	23.0%	2	22.4%	2	21.7%
Hold winners (>5%)	3	21.9%	5.0%	0.1236	9	22.9%	3	22.0%	3	20.9%
Hold all winners	4	21.3%	4.7%	0.1072	3	23.5%	4	22.0%	6	18.3%
Hold top quartile	5	21.1%	4.8%	0.1120	8	22.9%	6	21.6%	5	18.7%
Hold winners (>2%)	6	20.9%	4.8%	0.1109	10	22.4%	7	21.4%	4	19.0%
Hold all funds (Mean)	7	20.9%	4.7%	0.0873	4	23.5%	5	21.7%	8	17.6%
JSE All Share Index	8	20.3%	6.1%	0.0487	2	25.7%	9	20.0%	10	15.1%
Hold second quartile	9	20.2%	4.8%	0.0996	5	23.2%	8	21.3%	9	16.2%
Switch to 2nd best fund	10	19.6%	5.0%	0.0969	11	21.9%	11	19.4%	7	17.7%
Hold all losers	11	18.5%	4.8%	0.0639	12	21.1%	10	19.4%	11	15.1%
Simulated ALSI tracker fund	12	18.1%	5.8%	0.0236	6	23.2%	16	17.9%	17	13.2%
Hold third quartile	13	17.8%	4.9%	0.0647	14	20.4%	14	18.3%	13	14.8%
Hold bottom quartile	14	17.5%	4.8%	0.0542	15	19.9%	12	18.8%	15	13.9%
Hold losers (< -2%)	15	17.4%	4.8%	0.0529	16	19.6%	13	18.5%	14	14.1%
Switch to 2nd worst fund	16	17.2%	5.1%	0.0509	13	20.7%	15	18.3%	19	12.6%
Switch to worst fund	17	16.2%	5.1%	0.0378	18	18.3%	17	16.8%	16	13.5%
Hold losers (< -5%)	18	16.0%	5.1%	0.0335	17	18.5%	18	16.7%	18	12.7%
3 month NCDs (RFR proxy)	19	16.0%	0.3%	0.0000	19	16.5%	19	16.4%	12	15.0%
Perfect hindsight - worst case	20	5.1%	5.0%	-0.1351	20	9.8%	20	4.7%	20	0.9%

Note: Details of the trading strategies presented in this table are described in section 4.9. The returns reported in the above table are the average *annual* compound returns realised by each strategy, whereas the reported standard deviation is the standard deviation of *monthly* returns. The reported Sharpe average is the average of the Sharpe Ratios, which are calculated as the 5-year geometric mean of the monthly portfolio returns in excess of the mean risk-free rate divided by the standard deviation of monthly returns over 60 months.

In the 1985 to 1989 period, persistence amongst winners was very weak. The "switch to the top fund" strategy returned slightly less than the average return on all unit trusts, indicating that performance reversals occurred fairly often. Nevertheless, despite the poor performance of this strategy in the 1980's, it still did far better that the "switch to the worst fund" strategy. Following a strategy of switching to the worst fund resulted in a 5-year return that was less than the average return for 178 out of the 180 periods tested.

The results strongly support the results of the regression analysis that some persistence does exist. More specifically, the very top funds continue to do well over short holding periods and the very poorly performing funds tend stay bad performers. The results suggest that by following the "buy the top fund" strategy, an investor can, on average, earn a return of 1.4% p.a. in excess of the average return for all unit trusts *after* covering all the costs of trading in the funds.

This result is based on the average return figures and is by no means guaranteed. The unlucky investor who started following the "buy the top fund" strategy in November 1980 would have received a return of 18% p.a. compared to the average unit trust return of 21% p.a. over 15 years. On the other hand, the lucky investor who started investing in March 1982 would have earned almost 26% p.a. for 15 years compared to the unit trust average return of 23% p.a. The risk relating to the "buy the top fund" strategy and selected other strategies relative to the risk of the "buy all unit trusts" strategy is clearly illustrated in Figure 16, where the upper x-axis represents the *starting month* of the 5-year terminal value and the lower x-axis represents the *last month* in the 5-year period.

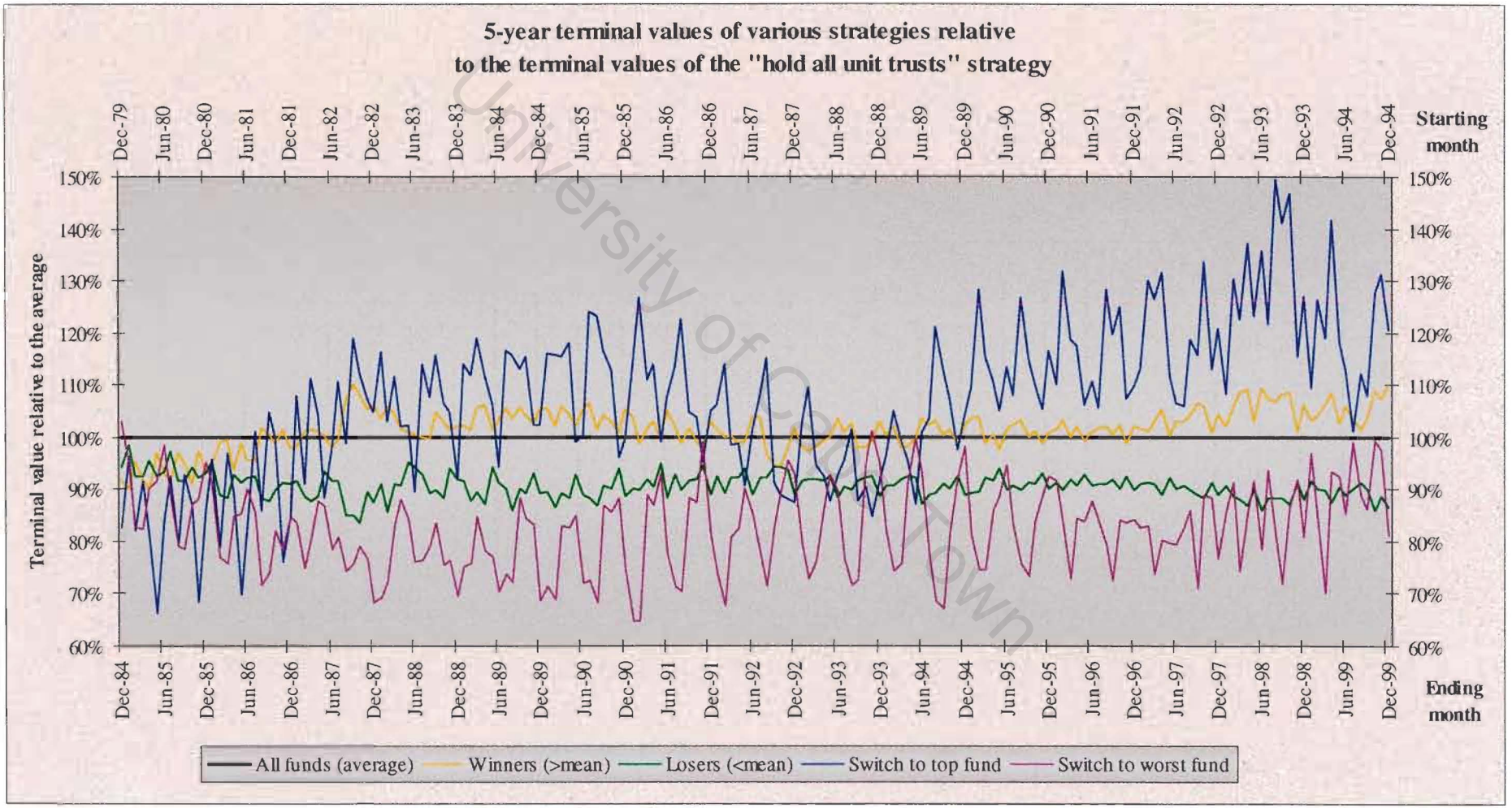
By graphing the strategies relative to the "all unit trusts" average, the fluctuations caused by the market are essentially eliminated. The remaining volatility represents the volatility of excess returns. Here we see that there is in fact a substantial difference in the volatility of the "buy the top fund" and "buy the worst fund" strategies relative to the other strategies that hold more funds.

The jaggedness of the graphs representing the "buy the top fund" and "buy the worst fund" strategies are caused by the fact the graphs represent relative 5-year returns of 6 different portfolios of funds, each of which are reconstituted every 6 months. For example, when

switching to the top fund over the last 6 months occurs in January and July the "top" fund held by the portfolio could quite conceivably differ from the "top" fund held by a similar portfolio that switches in February and August each year. Therefore, if two such portfolios hold different unit trust funds over a period of 5 years, they are likely to end up with significantly different terminal values. Thus, the graph represents all the possibilities that could have been experienced by different investors when employing a certain strategy. The jaggedness of the graph does not mean that a single investor employing such a strategy would experience wild fluctuations in returns from one month to the next.

Despite its volatility, the "buy the top fund" strategy beats the average unit trust return most of the time and the "buy the worst fund" strategy under-performs the average most of the time. Consistent with the results from the contingency table analysis and the regression analysis persistence is strongest in the 1995 to 1999 period. However, for the 5 years ending between 1985 and 1987 and between 1991 and 1994 there appears to be very little persistence.

Figure 16: The volatility of 5-year terminal values from selected strategies.



5.6 Analysing risk

Looking at Table 7, the standard deviation of monthly returns do not differ much across portfolios. The strategies that hold only a few portfolios at a time have slightly higher standard deviations than the more diverse portfolios, as would be expected. However, the small differences indicates that most funds are almost fully diversified and holding more funds does not result in a major reduction in portfolio volatility. The low portfolio standard deviation relative to that of the JSE All Share Index is indicative of the cash holdings in the funds, which reduces fund volatility relative to the index by reducing exposure to equities. The simulated ALSI tracker fund has a lower standard deviation as a result of its 5% cash holding, but it is still more volatile than the unit trust portfolios. This suggests that unit trusts perhaps have cash holdings greater than 5% on average. The funds are also likely to be less heavily weighted in risky resource shares than the ALSI and will therefore be less volatile.

Using the Sharpe ratio to risk-adjust the returns does not have any significant effect on the overall rankings of the trading portfolios. This suggests that the top performing portfolios do not take on risk that is not compensated for. However, the Sharpe ratios should be used with caution for two reasons:

- Firstly, the ratios have been calculated over a period of 60 months, which may be too short a period to obtain a reliable estimate of the risk premium and standard deviation of returns over time. As can be seen from Appendix IV, many of the 5-year Sharpe ratios are negative. This is counter-intuitive in terms of modern portfolio theory, which dictates that the market portfolio of risky assets should earn a return premium over the risk-free rate. The negative ratios are an indication that the period analysed is too short

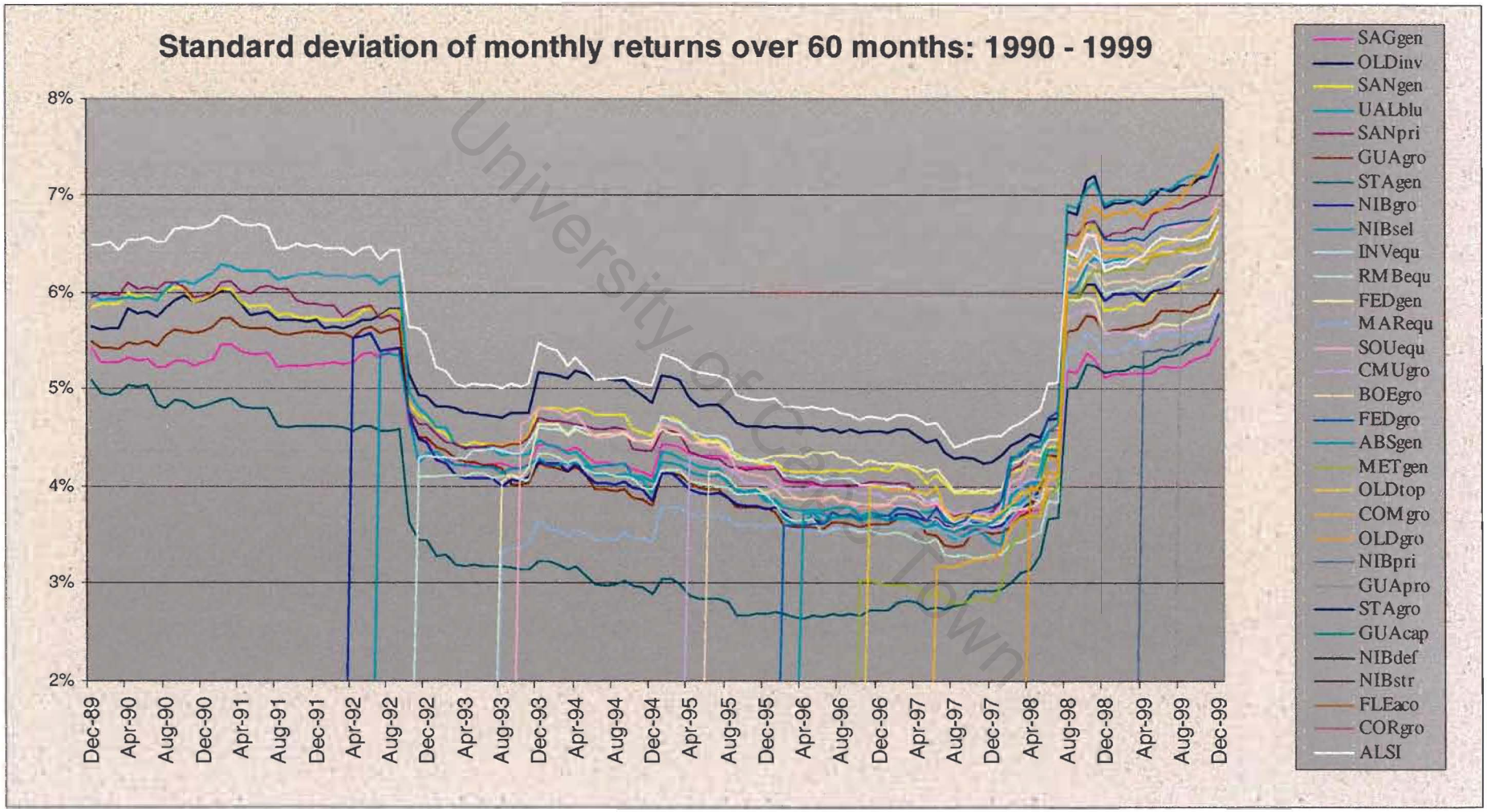
to obtain an accurate estimate of the risk-return relationship or that the portfolio's are not fully diversified and in fact take on risk that is not compensated for.

- Secondly, the Sharpe ratio assumes that the standard deviation of returns is constant over time. As can be seen from Figure 17, the standard deviation of returns over 60 months of individual funds has not been constant over the last 10 years. This likely to lead to a large degree of estimation risk in the standard deviation used in the Sharpe ratio.

It is interesting to note the following additional observations from Figure 17:

- The standard deviation of monthly returns over 5-years falls significantly for all funds in October 1992, exactly 5 years after the share market crashed in October 1987. This indicates that most of the historic volatility over 5 years occurred in one month. In August 1998, the month of the most significant share market crash since 1987, the 5-year standard deviation of monthly returns jumped dramatically for all funds, surpassing the 1987 levels of volatility. This graph shows that a history of at least 12 years of returns would be required to obtain a standard deviation that remained fairly constant over time.
- The JSE ALSI had a higher standard deviation than all funds until August 1998. Due to the non-equity holdings of funds contributing towards reduced volatility, this trend should continue in future unless the requirement that a fund must hold at least 5% of its portfolio in cash is scrapped from the Unit Trust Control Act.
- The standard deviation of funds relative to other funds changes only slowly over time. This suggests that funds tend maintain a consistent risk profile for prolonged periods. For example, the Standard Bank General Fund appears to have been a consistently conservative general equity fund.

Figure 17: The time-varying standard deviation of unit trust fund returns for the period 1990-1999.



6 CONCLUSION AND RECOMMENDATIONS

6.1 Summary of hypothesis test results

The null hypothesis of there being no relationship between a fund's ranking in the holding period and its ranking in the formation period (Hypothesis 1) is rejected for 6-month holding periods where the formation period is 6 – 12 months. Although the regression analysis showed that past performance had very little explanatory power in explaining future performance and in some periods there was no relationship between rankings in one period and the next, significant short-term persistence is observable, particularly in the 1995 to 1999 period. This result holds regardless of the ending date chosen for the analysis.

The results of tests with longer holding periods were less conclusive. Although strong persistence was evident over certain periods, the results were found to be very sensitive to variations in the ending date of the selected sample period.

Hypothesis 2 could not be rejected. The runs tests provided no evidence that individual funds were persistent out-performers or under-performers. A few funds did exhibit non-random behaviour, but it would have been impossible to identify these funds in advance.

Hypothesis 3 was rejected as it was shown that following a trading strategy of buying the fund that ranked top over the last 6-month period and holding it for 6 months, produced returns (after costs) that would beat the average return of all unit trust funds over a 5-year period most of the time. If this strategy were applied in the 1990's it would have given any investor a 5-year return that exceeded the average unit trust return by between 1% and 49%, regardless of the initial investment date. The results obtained from applying this

strategy in the 1980's are less conclusive, but they still support the contention that following a strategy of buying past winners is likely to lead to superior returns.

Of equal importance is the observation that following a strategy of buying the poorest performing fund over the past 6 months provided a 5-year return that was below the average return more than 95% of the time over the 20-year period studied.

The most significant results of this research can be summarised as follows:

- The results of persistence studies are highly sensitive to the holding period length, the time period studied and the ending date of the analysis. The formation period length also has an effect on the degree of persistence found, but is less significant.
- The longer the holding period and the formation period, the more sensitive the results of persistence studies are to the beginning and ending dates of the period being studied.
- Regardless of the ending date selected, persistence of winning funds and losing funds is evident where holding periods and formation periods of 6 months are used. Persistence is particularly evident during the 1995 to 1999 period. However, even in this period, the relationship between past and future performance rankings is weak. There are often periods where rankings from one period to the next appear random and occasional periods when rankings reverse.
- The disparate results obtained from prior research on persistence of unit trust performance in South Africa, can be explained partly by the application of different methodologies, but more importantly by the selection of different sample periods. Because the degree of observed persistence is weak and the results of persistence studies are highly dependent of the sample period and holding periods selected, the

researcher should not expect the results obtained from different periods to be consistent.

- Individual unit trust funds do not perform consistently for any length of time. This suggests that the observed persistence arises from short-term persistence amongst different funds.
- Although the persistence relationship is not strong it seems sufficient to enable an investor to profit from trading in unit trust funds, even when taking costs into account. On average, a strategy of switching to the top fund over the past 6 months and holding it for six months yielded a return of 1.4% p.a. above the average unit trust return after taking all transaction costs into account.

6.2 Recommendations for further research

Evidence of short-term persistence and the existence of a trading strategy that purports to deliver excess returns with a high degree of consistency using only past information, suggests that the market is weak-form inefficient. This conclusion is consistent with the success of momentum strategies on the JSE reported by Fraser and Page (2000) and the evidence of investor over-reaction on the JSE reported by Muller (1998).

Unless the management of unit trust funds frequently changes hands, the fact that individual unit trust funds do not exhibit persistent performance means that the persistence observed in this study is unlikely to be attributable to manager skill. It seems more plausible that the persistence is related to price momentum in the underlying shares in the unit trust portfolios. This theory needs to be tested empirically with the aim of answering the following questions:

- Does share momentum explain persistence of performance in unit trust funds?

- Does the portfolio turnover have any power in explaining persistence? If price momentum does cause short-term persistence, it is possible that funds exhibit strong persistence in periods when portfolio turnover is high.
- If share momentum does influence persistence, what makes some funds persistent winners and others persistent losers?

Another factor that could cause persistence is the effect on relative returns of non-equity holdings in a portfolio. For example, during a prolonged bear market, a fund that holds a higher proportion of cash than other general equity funds is likely to out-perform its rivals consistently due to reduced exposure to the declining equity market. If changes in relative rankings can be linked to changes in equity exposures, then research is required into the causes of fluctuating liquidity. Possible reasons for increased cash (or non-equity) holdings are:

- Recent investments or imminent withdrawals by unit holders. This could be tracked by comparing *changes* in fund size to liquidity levels.
- Lack of investment opportunities as perceived by the portfolio manager.
- Deliberate selling of equities to reduce exposure to the market.

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APPENDIX I

Contingency table results

This appendix reports the results of the contingency table tests described in section 4.6. Using adjacent evaluation periods of different lengths, funds are classified as *winners* if they earn a return equal to or in excess of the mean return of all funds and *losers* if the return less than the mean. The winners and losers are recorded in contingency tables, which show the number of funds that were winners in both periods (WW), losers in both periods (LL), winners then losers (WL) and losers then winners (LW). The resulting cell counts are then compared to the counts that would be expected if returns were random. The cell count differences are evaluated for statistical significance using a chi-square test.

Contents

Period length (months)	Starting month	Ending month	Number of periods	Sample size (n)	Run number
Results based on raw returns					
6	Dec-79	Dec-99	40	640	1
6	Oct-79	Oct-99	40	623	2
6	Aug-79	Aug-99	40	616	3
6	Jul-79	Jul-99	40	608	4
12	Dec-79	Dec-99	20	294	5
12	Sep-79	Sep-99	20	286	6
12	Jun-79	Jun-99	20	280	7
12	Mar-79	Mar-99	20	273	8
24	Dec-79	Dec-99	10	128	9
24	Jun-79	Jun-99	10	122	10
24	Dec-78	Dec-98	10	117	11
24	Jun-80	Jun-98	10	104	12
36	Dec-81	Dec-99	6	70	13
36	Jun-81	Jun-99	6	66	14
36	Dec-80	Dec-98	6	63	15
36	Jun-80	Jun-98	6	62	16
Results based on Sharpe ratios					
36	Dec-81	Dec-99	6	70	17
36	Jun-81	Jun-99	6	66	18
36	Dec-80	Dec-98	6	63	19
36	Jun-80	Jun-98	6	62	20

Winners and losers using raw returns with formation and holding periods of 6 MONTHS

TEST PARAMETERS [run number]	1	2	3	4
Formation period length (in months)	6	6	6	6
Holding period length (in months)	6	6	6	6
No. of consecutive evaluation periods	40	40	40	40
Roll forward period (in months)	6	6	6	6
Last month in test period	Dec-99	Oct-99	Aug-99	Jul-99
SUMMARY STATISTICS				
Start month	Dec-79	Oct-79	Aug-79	Jul-79
Period covered (years)	20	20	20	20
Sample size (no. of evaluations)	640	623	616	608
No. of funds at beginning of first holding period	7	7	7	7
No. of funds at beginning of last holding period	47	47	47	47

CONTINGENCY TABLE RESULTS

Actual	Holding Winner	Holding Loser	Total	Holding Winner	Holding Loser	Total	Holding Winner	Holding Loser	Total	Holding Winner	Holding Loser	Total
Formation Winner	182	127	309	176	128	304	170	122	292	158	131	289
Formation Loser	136	195	331	129	190	319	130	194	324	139	180	319
Total	318	322	640	305	318	623	300	316	616	297	311	608
Expected	Holding Winner	Holding Loser	Total	Holding Winner	Holding Loser	Total	Holding Winner	Holding Loser	Total	Holding Winner	Holding Loser	Total
Formation Winner	154	155	309	149	155	304	142	150	292	141	148	289
Formation Loser	164	167	331	156	163	319	158	166	324	156	163	319
Total	318	322	640	305	318	623	300	316	616	297	311	608
Chi-sq	Holding Winner	Holding Loser	Total	Holding Winner	Holding Loser	Total	Holding Winner	Holding Loser	Total	Holding Winner	Holding Loser	Total
Formation Winner	5.28	5.21	10.49	4.96	4.76	9.72	5.43	5.16	10.59	2.01	1.92	3.92
Formation Loser	4.93	4.87	9.79	4.73	4.53	9.26	4.90	4.65	9.54	1.82	1.74	3.55
Total	10.20	10.08	**20.28**	9.69	9.29	**18.98**	10.33	9.80	**20.13**	3.82	3.65	**7.47**

Tests for independence

p-value (chi-squared test)	0.0000	0.0000	0.0000	0.0063
Cross Product Ratio (Odds Ratio)	2.0548	2.0252	2.0794	1.5619
Log-Odds	0.7202	0.7057	0.7321	0.4459
CPR Z-statistic (log odds/std error)	4.4792	4.3341	4.4615	2.7281
Normal probability value (CPR Z statistic)	1.0000	1.0000	1.0000	0.9968
Percentage of persistence	58.91%	58.75%	59.09%	55.59%

Winners and losers using raw returns with formation and holding periods of 1 YEAR

TEST PARAMETERS [run number]	5	6	7	8
Formation period length (in months)	12	12	12	12
Holding period length (in months)	12	12	12	12
No. of consecutive evaluation periods	20	20	20	20
Roll forward period (in months)	12	12	12	12
Last month in test period	Dec-99	Sep-99	Jun-99	Mar-99
SUMMARY STATISTICS				
Start month	Dec-79	Sep-79	Jun-79	Mar-79
Period covered (years)	20	20	20	20
Sample size (no. of evaluations)	294	286	280	273
No. of funds at beginning of first holding period	7	7	7	7
No. of funds at beginning of last holding period	47	43	37	37

CONTINGENCY TABLE RESULTS

Actual	Holding Winner	Holding Loser	Total	Holding Winner	Holding Loser	Total	Holding Winner	Holding Loser	Total	Holding Winner	Holding Loser	Total
Formation Winner	75	67	142	79	65	144	68	67	135	73	57	130
Formation Loser	69	83	152	64	78	142	64	81	145	53	90	143
Total	144	150	294	143	143	286	132	148	280	126	147	273
Expected												
Formation Winner	70	72	142	72	72	144	64	71	135	60	70	130
Formation Loser	74	78	152	71	71	142	68	77	145	66	77	143
Total	144	150	294	143	143	286	132	148	280	126	147	273
Chi-sq												
Formation Winner	0.43	0.41	0.84	0.68	0.68	1.36	0.30	0.27	0.56	2.82	2.41	5.23
Formation Loser	0.40	0.38	0.78	0.69	0.69	1.38	0.28	0.25	0.53	2.56	2.19	4.76
Total	0.83	0.79	**1.62**	1.37	1.37	**2.74**	0.58	0.51	**1.09**	5.38	4.61	**9.99**
Tests for independence												
p-value (chi-squared test)			0.2033			0.0978			0.2965			0.0016
Cross Product Ratio (Odds Ratio)			1.3465			1.4813			1.2845			2.1748
Log-Odds			0.2975			0.3929			0.2504			0.7769
CPR Z-statistic (log odds/std error)			1.2710			1.6531			1.0432			3.1400
Normal probability value (CPR Z statistic)			0.8981			0.9508			0.8516			0.9992
Percentage of persistence			53.74%			54.90%			53.21%			59.71%

Winners and losers using raw returns with formation and holding periods of 2 YEARS

TEST PARAMETERS [run number]	**9**	**10**	**11**	**12**
Formation period length (in months)	24	24	24	24
Holding period length (in months)	24	24	24	24
No. of consecutive evaluation periods	10	10	10	9
Roll forward period (in months)	24	24	24	24
Last month in test period	Dec-99	Jun-99	Dec-98	Jun-98
SUMMARY STATISTICS				
Start month	Dec-79	Jun-79	Dec-78	Jun-80
Period covered (years)	20	20	20	18
Sample size (no. of evaluations)	128	122	117	104
No. of funds at beginning of first holding period	7	7	7	7
No. of funds at beginning of last holding period	34	31	30	30
CONTINGENCY TABLE RESULTS				
Actual	Holding Winner / Holding Loser / Total	Holding Winner / Holding Loser / Total	Holding Winner / Holding Loser / Total	Holding Winner / Holding Loser / Total
Formation Winner	36 / 29 / 65	33 / 23 / 56	31 / 26 / 57	29 / 22 / 51
Formation Loser	29 / 34 / 63	22 / 44 / 66	25 / 35 / 60	21 / 32 / 53
Total	65 / 63 / 128	55 / 67 / 122	56 / 61 / 117	50 / 54 / 104
Expected	Holding Winner / Holding Loser / Total	Holding Winner / Holding Loser / Total	Holding Winner / Holding Loser / Total	Holding Winner / Holding Loser / Total
Formation Winner	33 / 32 / 65	25 / 31 / 56	27 / 30 / 57	25 / 26 / 51
Formation Loser	32 / 31 / 63	30 / 36 / 66	29 / 31 / 60	25 / 28 / 53
Total	65 / 63 / 128	55 / 67 / 122	56 / 61 / 117	50 / 54 / 104
Chi-sq	Holding Winner / Holding Loser / Total	Holding Winner / Holding Loser / Total	Holding Winner / Holding Loser / Total	Holding Winner / Holding Loser / Total
Formation Winner	0.27 / 0.28 / 0.55	2.38 / 1.96 / 4.34	0.51 / 0.47 / 0.97	0.82 / 0.76 / 1.58
Formation Loser	0.28 / 0.29 / 0.57	2.02 / 1.66 / 3.68	0.48 / 0.44 / 0.92	0.79 / 0.73 / 1.52
Total	0.55 / 0.57 / **1.12**	4.40 / 3.61 / **8.02**	0.99 / 0.91 / **1.90**	1.61 / 1.49 / **3.09**
Tests for independence				
p-value (chi-squared test)	0.2900	0.0046	0.1686	0.0786
Cross Product Ratio (Odds Ratio)	1.4554	2.8696	1.6692	2.0087
Log-Odds	0.3753	1.0542	0.5124	0.6975
CPR Z-statistic (log odds/std error)	1.0566	2.7978	1.3728	1.7502
Normal probability value (CPR Z statistic)	0.8547	0.9974	0.9151	0.9600
Percentage of persistence	54.69%	63.11%	56.41%	58.65%

Winners and losers using raw returns with formation and holding periods of 3 YEARS

TEST PARAMETERS [run number]	13	14	15	16
Formation period length (in months)	36	36	36	36
Holding period length (in months)	36	36	36	36
No. of consecutive evaluation periods	6	6	6	6
Roll forward period (in months)	36	36	36	36
Last month in test period	Dec-99	Jun-99	Dec-98	Jun-98
SUMMARY STATISTICS				
Start month	Dec-81	Jun-81	Dec-80	Jun-80
Period covered (years)	18	18	18	18
Sample size (no. of evaluations)	70	66	63	62
No. of funds at beginning of first holding period	7	7	7	7
No. of funds at beginning of last holding period	30	30	26	25
CONTINGENCY TABLE RESULTS				

Actual

	Holding Winner	Holding Loser	Total	Holding Winner	Holding Loser	Total	Holding Winner	Holding Loser	Total	Holding Winner	Holding Loser	Total
Formation Winner	22	15	37	17	14	31	16	14	30	18	11	29
Formation Loser	13	20	33	13	22	35	14	19	33	11	22	33
Total	35	35	70	30	36	66	30	33	63	29	33	62

Expected

	Holding Winner	Holding Loser	Total	Holding Winner	Holding Loser	Total	Holding Winner	Holding Loser	Total	Holding Winner	Holding Loser	Total
Formation Winner	19	19	37	14	17	31	14	16	30	14	15	29
Formation Loser	17	17	33	16	19	35	16	17	33	15	18	33
Total	35	35	70	30	36	66	30	33	63	29	33	62

Chi-sq

	Holding Winner	Holding Loser	Total	Holding Winner	Holding Loser	Total	Holding Winner	Holding Loser	Total	Holding Winner	Holding Loser	Total
Formation Winner	0.66	0.66	1.32	0.60	0.50	1.10	0.21	0.19	0.39	1.45	1.27	2.72
Formation Loser	0.74	0.74	1.48	0.53	0.44	0.98	0.19	0.17	0.36	1.27	1.12	2.39
Total	1.40	1.40	2.81	1.13	0.94	2.08	0.39	0.36	0.75	2.72	2.39	5.12

Tests for independence				
p-value (chi-squared test)	0.0937	0.1496	0.3866	0.0237
Cross Product Ratio (Odds Ratio)	2.2564	2.0549	1.5510	3.2727
Log-Odds	0.8138	0.7202	0.4389	1.1856
CPR Z-statistic (log odds/std error)	1.6644	1.4330	0.8641	2.2294
Normal probability value (CPR Z statistic)	0.9520	0.9241	0.8062	0.9871
Percentage of persistence	60.00%	59.09%	55.56%	64.52%

Winners and losers using Sharpe Ratios with formation and holding periods of 3 YEARS

TEST PARAMETERS [run number]	17	18	19	20
Formation period length (in months)	36	36	36	36
Holding period length (in months)	36	36	36	36
No. of consecutive evaluation periods	6	6	6	6
Roll forward period (in months)	36	36	36	36
Last month in test period	Dec-99	Jun-99	Dec-98	Jun-98
SUMMARY STATISTICS				
Start month	Dec-81	Jun-81	Dec-80	Jun-80
Period covered (years)	18	18	18	18
Sample size (no. of evaluations)	70	66	63	62
No. of funds at beginning of first holding period	7	7	7	7
No. of funds at beginning of last holding period	30	30	26	25
CONTINGENCY TABLE RESULTS				
Actual	Holding Winner / Holding Loser / Total	Holding Winner / Holding Loser / Total	Holding Winner / Holding Loser / Total	Holding Winner / Holding Loser / Total
Formation Winner	24 / 12 / 36	24 / 8 / 32	21 / 10 / 31	21 / 11 / 32
Formation Loser	13 / 21 / 34	13 / 21 / 34	12 / 20 / 32	10 / 20 / 30
Total	37 / 33 / 70	37 / 29 / 66	33 / 30 / 63	31 / 31 / 62
Expected	- / - / Total	- / - / Total	- / - / Total	- / - / Total
Formation Winner	19 / 17 / 36	18 / 14 / 32	16 / 15 / 31	16 / 16 / 32
Formation Loser	18 / 16 / 34	19 / 15 / 34	17 / 15 / 32	15 / 15 / 30
Total	37 / 33 / 70	37 / 29 / 66	33 / 30 / 63	31 / 31 / 62
Chi-sq	- / - / Total	- / - / Total	- / - / Total	- / - / Total
Formation Winner	1.30 / 1.46 / 2.76	2.05 / 2.61 / 4.66	1.40 / 1.54 / 2.93	1.56 / 1.56 / 3.13
Formation Loser	1.38 / 1.54 / 2.92	1.93 / 2.46 / 4.39	1.35 / 1.49 / 2.84	1.67 / 1.67 / 3.33
Total	2.67 / 3.00 / 5.67	3.97 / 5.07 / 9.05	2.75 / 3.02 / 5.77	3.23 / 3.23 / 6.46
Tests for independence				
p-value (chi-squared test)	0.0172	0.0026	0.0163	0.0110
Cross Product Ratio (Odds Ratio)	3.2308	4.8462	3.5000	3.8182
Log-Odds	1.1727	1.5782	1.2528	1.3398
CPR Z-statistic (log odds/std error)	2.3476	2.9245	2.3635	2.4942
Normal probability value (CPR Z statistic)	0.9906	0.9983	0.9909	0.9937
Percentage of persistence	64.29%	68.18%	65.08%	66.13%

APPENDIX II

Regression test results

This appendix reports the results of the regressions of holding period percentile rankings on formation period percentile rankings as described in section 4.7. For each of the 16 combinations of formation period and holding period lengths there are 36 sets of regression tests resulting in $16 \times 36 = 576$ sets of regression tests in total. Each of these sets of regression tests span 12 years and contain 144/h two-period Ordinary Least Squares (OLS) regression lines, where h is the holding period length in months. Each of the 36 sets of tests differs from one another only by the ending month of the analysis, which ranges from January 1997 to December 1999 (i.e. 36 different ending months).

Contents

Formation period (months)	Holding period (months)	No. of adjacent periods	Beginning date of *first* of 36 formation periods	Beginning date of *first* of 36 holding periods	Ending date of *last* of 36 holding periods	Schedule
6	6	24	01-Aug-84	01-Feb-85	31-Dec-99	1
12	6	24	01-Feb-84	01-Feb-85	31-Dec-99	2
24	6	24	01-Feb-83	01-Feb-85	31-Dec-99	3
36	6	24	01-Feb-82	01-Feb-85	31-Dec-99	4
6	12	12	01-Aug-84	01-Feb-85	31-Dec-99	5
12	12	12	01-Feb-84	01-Feb-85	31-Dec-99	6
24	12	12	01-Feb-83	01-Feb-85	31-Dec-99	7
36	12	12	01-Feb-82	01-Feb-85	31-Dec-99	8
6	24	6	01-Aug-84	01-Feb-85	31-Dec-99	9
12	24	6	01-Feb-84	01-Feb-85	31-Dec-99	10
24	24	6	01-Feb-83	01-Feb-85	31-Dec-99	11
36	24	6	01-Feb-82	01-Feb-85	31-Dec-99	12
6	36	4	01-Aug-84	01-Feb-85	31-Dec-99	13
12	36	4	01-Feb-84	01-Feb-85	31-Dec-99	14
24	36	4	01-Feb-83	01-Feb-85	31-Dec-99	15
36	36	4	01-Feb-82	01-Feb-85	31-Dec-99	16

Schedule 1

Formation period (months)	Holding period (months)	No. of adjacent periods (n)	Last month in test period	Total points plotted	Overall slope coefficient	Standard deviation of slopes	t-value	p-value	R-Squared	% of positive slopes	% of negative slopes	Significant positive slopes (5% level)	Significant negative slopes (5% level)	Range of overall slopes
6	6	24	Jan-97	370	0.1690	0.3561	3.2888	0.0011	0.0286	75.0%	25.0%	8.3%	4.2%	
6	6	24	Feb-97	372	0.2392	0.2888	4.7381	0.0000	0.0572	87.5%	12.5%	8.3%	0.0%	
6	6	24	Mar-97	377	0.2136	0.3295	4.2333	0.0000	0.0456	75.0%	25.0%	8.3%	0.0%	Median
6	6	24	Apr-97	377	0.2115	0.3376	4.1899	0.0000	0.0447	66.7%	33.3%	16.7%	0.0%	
6	6	24	May-97	385	0.1899	0.3111	3.7845	0.0002	0.0360	79.2%	20.8%	16.7%	0.0%	
6	6	24	Jun-97	389	0.2629	0.3035	5.3603	0.0000	0.0691	91.7%	8.3%	16.7%	0.0%	
6	6	24	Jul-97	393	0.1696	0.3542	3.4028	0.0007	0.0288	75.0%	25.0%	8.3%	4.2%	
6	6	24	Aug-97	395	0.2472	0.2884	5.0576	0.0000	0.0611	87.5%	12.5%	12.5%	0.0%	
6	6	24	Sep-97	400	0.2231	0.3302	4.5653	0.0000	0.0498	75.0%	25.0%	12.5%	0.0%	
6	6	24	Oct-97	400	0.2145	0.3360	4.3812	0.0000	0.0460	66.7%	33.3%	16.7%	0.0%	
6	6	24	Nov-97	408	0.1990	0.2948	4.0906	0.0001	0.0396	79.2%	20.8%	20.8%	0.0%	
6	6	24	Dec-97	412	0.2776	0.3068	5.8516	0.0000	0.0771	91.7%	8.3%	20.8%	0.0%	Best
6	6	24	Jan-98	416	0.1883	0.3580	3.9009	0.0001	0.0355	75.0%	25.0%	12.5%	4.2%	
6	6	24	Feb-98	418	0.2603	0.2798	5.4979	0.0000	0.0677	87.5%	12.5%	16.7%	0.0%	
6	6	24	Mar-98	423	0.2237	0.3120	4.7089	0.0000	0.0500	75.0%	25.0%	16.7%	0.0%	
6	6	24	Apr-98	423	0.2288	0.3392	4.8216	0.0000	0.0523	66.7%	33.3%	20.8%	0.0%	
6	6	24	May-98	431	0.2062	0.2953	4.3636	0.0000	0.0425	79.2%	20.8%	20.8%	0.0%	
6	6	24	Jun-98	436	0.2700	0.3059	5.8407	0.0000	0.0729	91.7%	8.3%	20.8%	0.0%	
6	6	24	Jul-98	440	0.1981	0.3520	4.2293	0.0000	0.0392	75.0%	25.0%	16.7%	4.2%	
6	6	24	Aug-98	443	0.2565	0.2737	5.5728	0.0000	0.0658	87.5%	12.5%	16.7%	0.0%	
6	6	24	Sep-98	448	0.2146	0.2952	4.6410	0.0000	0.0461	75.0%	25.0%	16.7%	0.0%	
6	6	24	Oct-98	448	0.2063	0.3177	4.4536	0.0000	0.0426	66.7%	33.3%	16.7%	0.0%	
6	6	24	Nov-98	456	0.1526	0.2841	3.2909	0.0011	0.0233	75.0%	25.0%	16.7%	4.2%	
6	6	24	Dec-98	463	0.2186	0.3161	4.8095	0.0000	0.0478	87.5%	12.5%	20.8%	4.2%	
6	6	24	Jan-99	467	0.1428	0.3656	3.1111	0.0020	0.0204	70.8%	29.2%	16.7%	8.3%	Worst
6	6	24	Feb-99	471	0.2199	0.2891	4.8826	0.0000	0.0484	87.5%	12.5%	16.7%	4.2%	
6	6	24	Mar-99	477	0.1859	0.3041	4.1242	0.0000	0.0346	75.0%	25.0%	16.7%	0.0%	
6	6	24	Apr-99	477	0.1999	0.3146	4.4455	0.0000	0.0399	70.8%	29.2%	16.7%	0.0%	
6	6	24	May-99	485	0.1773	0.2876	3.9591	0.0001	0.0314	79.2%	20.8%	20.8%	4.2%	
6	6	24	Jun-99	492	0.2381	0.3197	5.4275	0.0000	0.0567	87.5%	12.5%	25.0%	4.2%	
6	6	24	Jul-99	496	0.1754	0.3784	3.9594	0.0001	0.0308	70.8%	29.2%	20.8%	8.3%	
6	6	24	Aug-99	504	0.2201	0.2744	5.0556	0.0000	0.0484	87.5%	12.5%	20.8%	4.2%	
6	6	24	Sep-99	512	0.1708	0.2984	3.9142	0.0001	0.0292	75.0%	25.0%	16.7%	0.0%	
6	6	24	Oct-99	511	0.2097	0.2879	4.8383	0.0000	0.0440	70.8%	29.2%	16.7%	0.0%	
6	6	24	Nov-99	523	0.2080	0.2934	4.8547	0.0000	0.0433	79.2%	20.8%	25.0%	4.2%	
6	6	24	Dec-99	528	0.2614	0.3245	6.2121	0.0000	0.0684	87.5%	12.5%	29.2%	4.2%	

Schedule 2

Formation period (months)	Holding period (months)	No. of adjacent periods (n)	Last month in test period	Total points plotted	Overall slope coefficient	Standard deviation of slopes	t-value	p-value	R-Squared	% of positive slopes	% of negative slopes	Significant positive slopes (5% level)	Significant negative slopes (5% level)	Range of overall slopes
12	6	24	Jan-97	349	0.1738	0.4000	3.2884	0.0011	0.0302	66.7%	33.3%	16.7%	8.3%	
12	6	24	Feb-97	350	0.2078	0.3363	3.9638	0.0001	0.0432	75.0%	25.0%	12.5%	4.2%	Median
12	6	24	Mar-97	355	0.2194	0.3269	4.2251	0.0000	0.0481	70.8%	29.2%	16.7%	0.0%	
12	6	24	Apr-97	355	0.2167	0.3355	4.1714	0.0000	0.0470	62.5%	37.5%	20.8%	0.0%	
12	6	24	May-97	362	0.2303	0.3303	4.4901	0.0000	0.0530	75.0%	25.0%	16.7%	0.0%	
12	6	24	Jun-97	366	0.2039	0.3882	3.9729	0.0001	0.0416	75.0%	25.0%	20.8%	4.2%	
12	6	24	Jul-97	370	0.1682	0.3982	3.2725	0.0012	0.0283	70.8%	29.2%	16.7%	8.3%	
12	6	24	Aug-97	372	0.1952	0.3334	3.8290	0.0002	0.0381	75.0%	25.0%	12.5%	4.2%	
12	6	24	Sep-97	377	0.2312	0.3285	4.6026	0.0000	0.0535	70.8%	29.2%	20.8%	0.0%	
12	6	24	Oct-97	377	0.2279	0.3286	4.5322	0.0000	0.0519	62.5%	37.5%	25.0%	0.0%	
12	6	24	Nov-97	385	0.2411	0.3074	4.8610	0.0000	0.0581	75.0%	25.0%	16.7%	0.0%	
12	6	24	Dec-97	389	0.2233	0.3882	4.5073	0.0000	0.0499	75.0%	25.0%	25.0%	4.2%	
12	6	24	Jan-98	393	0.1924	0.4022	3.8769	0.0001	0.0370	70.8%	29.2%	20.8%	8.3%	
12	6	24	Feb-98	395	0.2198	0.3361	4.4670	0.0000	0.0483	75.0%	25.0%	16.7%	4.2%	
12	6	24	Mar-98	400	0.2364	0.3071	4.8536	0.0000	0.0559	70.8%	29.2%	20.8%	0.0%	
12	6	24	Apr-98	400	0.2299	0.3222	4.7117	0.0000	0.0528	62.5%	37.5%	25.0%	0.0%	
12	6	24	May-98	408	0.2452	0.3074	5.0951	0.0000	0.0601	75.0%	25.0%	16.7%	0.0%	Best
12	6	24	Jun-98	412	0.2110	0.3723	4.3712	0.0000	0.0445	75.0%	25.0%	25.0%	4.2%	
12	6	24	Jul-98	416	0.1889	0.4002	3.9138	0.0001	0.0357	70.8%	29.2%	20.8%	8.3%	
12	6	24	Aug-98	418	0.2150	0.3246	4.4898	0.0000	0.0462	75.0%	25.0%	16.7%	4.2%	
12	6	24	Sep-98	423	0.2234	0.3024	4.7021	0.0000	0.0499	70.8%	29.2%	20.8%	0.0%	
12	6	24	Oct-98	423	0.2144	0.3183	4.5042	0.0000	0.0460	62.5%	37.5%	25.0%	0.0%	
12	6	24	Nov-98	431	0.1931	0.3254	4.0756	0.0001	0.0373	70.8%	29.2%	16.7%	4.2%	
12	6	24	Dec-98	436	0.1598	0.3979	3.3720	0.0008	0.0255	70.8%	29.2%	25.0%	8.3%	
12	6	24	Jan-99	439	0.1349	0.4261	2.8467	0.0046	0.0182	66.7%	33.3%	20.8%	12.5%	
12	6	24	Feb-99	442	0.1662	0.3554	3.5362	0.0004	0.0276	70.8%	29.2%	16.7%	8.3%	
12	6	24	Mar-99	447	0.2051	0.2947	4.4200	0.0000	0.0421	70.8%	29.2%	20.8%	0.0%	
12	6	24	Apr-99	447	0.1962	0.3217	4.2204	0.0000	0.0385	62.5%	37.5%	25.0%	0.0%	
12	6	24	May-99	455	0.1836	0.3249	3.9764	0.0001	0.0337	70.8%	29.2%	16.7%	4.2%	
12	6	24	Jun-99	462	0.1490	0.3961	3.2324	0.0013	0.0222	70.8%	29.2%	25.0%	8.3%	
12	6	24	Jul-99	466	0.1344	0.4217	2.9215	0.0037	0.0181	70.8%	29.2%	20.8%	12.5%	Worst
12	6	24	Aug-99	470	0.1731	0.3541	3.8025	0.0002	0.0300	75.0%	25.0%	16.7%	8.3%	
12	6	24	Sep-99	476	0.2084	0.2946	4.6381	0.0000	0.0434	70.8%	29.2%	20.8%	0.0%	
12	6	24	Oct-99	475	0.2097	0.3039	4.6648	0.0000	0.0440	62.5%	37.5%	25.0%	0.0%	
12	6	24	Nov-99	483	0.2013	0.3243	4.5072	0.0000	0.0405	70.8%	29.2%	20.8%	4.2%	
12	6	24	Dec-99	488	0.1611	0.3923	3.5990	0.0004	0.0260	70.8%	29.2%	29.2%	8.3%	

Schedule 3

Formation period (months)	Holding period (months)	No. of adjacent periods (n)	Last month in test period	Total points plotted	Overall slope coefficient	Standard deviation of slopes	t-value	p-value	R-Squared	% of positive slopes	% of negative slopes	Significant positive slopes (5% level)	Significant negative slopes (5% level)	Range of overall slopes
24	6	24	Jan-97	314	0.1490	0.3954	2.6618	0.0082	0.0222	70.8%	29.2%	12.5%	0.0%	Median
24	6	24	Feb-97	315	0.1058	0.3638	1.8817	0.0608	0.0112	50.0%	50.0%	16.7%	0.0%	
24	6	24	Mar-97	319	0.1401	0.3058	2.5198	0.0122	0.0196	62.5%	37.5%	4.2%	0.0%	
24	6	24	Apr-97	319	0.1335	0.3221	2.3978	0.0171	0.0178	62.5%	37.5%	12.5%	0.0%	
24	6	24	May-97	326	0.1708	0.3010	3.1208	0.0020	0.0292	62.5%	37.5%	4.2%	0.0%	
24	6	24	Jun-97	329	0.1390	0.3786	2.5386	0.0116	0.0193	62.5%	37.5%	12.5%	0.0%	
24	6	24	Jul-97	331	0.1350	0.3835	2.4721	0.0139	0.0182	70.8%	29.2%	12.5%	0.0%	
24	6	24	Aug-97	332	0.1002	0.3322	1.8289	0.0683	0.0100	50.0%	50.0%	12.5%	0.0%	
24	6	24	Sep-97	337	0.1562	0.3079	2.8950	0.0040	0.0244	62.5%	37.5%	8.3%	0.0%	
24	6	24	Oct-97	337	0.1536	0.3248	2.8456	0.0047	0.0236	62.5%	37.5%	16.7%	0.0%	
24	6	24	Nov-97	344	0.1848	0.2917	3.4765	0.0006	0.0341	62.5%	37.5%	8.3%	0.0%	
24	6	24	Dec-97	347	0.1535	0.3717	2.8845	0.0042	0.0235	62.5%	37.5%	16.7%	0.0%	
24	6	24	Jan-98	349	0.1624	0.3942	3.0653	0.0023	0.0264	70.8%	29.2%	16.7%	0.0%	
24	6	24	Feb-98	350	0.1232	0.3407	2.3168	0.0211	0.0152	50.0%	50.0%	16.7%	0.0%	
24	6	24	Mar-98	355	0.1649	0.3046	3.1414	0.0018	0.0272	62.5%	37.5%	8.3%	0.0%	
24	6	24	Apr-98	355	0.1571	0.3253	2.9879	0.0030	0.0247	62.5%	37.5%	16.7%	0.0%	
24	6	24	May-98	362	0.1853	0.2906	3.5788	0.0004	0.0344	62.5%	37.5%	8.3%	0.0%	Best
24	6	24	Jun-98	366	0.1503	0.3656	2.9004	0.0040	0.0226	62.5%	37.5%	16.7%	0.0%	
24	6	24	Jul-98	370	0.1720	0.3958	3.3498	0.0009	0.0296	70.8%	29.2%	16.7%	0.0%	
24	6	24	Aug-98	372	0.1297	0.3392	2.5169	0.0123	0.0168	50.0%	50.0%	16.7%	0.0%	
24	6	24	Sep-98	377	0.1633	0.3041	3.2058	0.0015	0.0267	62.5%	37.5%	8.3%	0.0%	
24	6	24	Oct-98	377	0.1573	0.3249	3.0849	0.0022	0.0247	62.5%	37.5%	16.7%	0.0%	
24	6	24	Nov-98	385	0.1488	0.2919	2.9441	0.0034	0.0221	58.3%	41.7%	8.3%	0.0%	
24	6	24	Dec-98	389	0.1154	0.3714	2.2847	0.0229	0.0133	58.3%	41.7%	16.7%	0.0%	
24	6	24	Jan-99	392	0.1308	0.4106	2.6058	0.0095	0.0171	66.7%	33.3%	16.7%	4.2%	
24	6	24	Feb-99	394	0.0965	0.3520	1.9192	0.0557	0.0093	50.0%	50.0%	16.7%	4.2%	
24	6	24	Mar-99	399	0.1664	0.2857	3.3621	0.0008	0.0277	66.7%	33.3%	8.3%	0.0%	
24	6	24	Apr-99	399	0.1560	0.3110	3.1476	0.0018	0.0243	62.5%	37.5%	16.7%	0.0%	
24	6	24	May-99	407	0.1428	0.2783	2.9029	0.0039	0.0204	58.3%	41.7%	8.3%	0.0%	
24	6	24	Jun-99	411	0.1029	0.3652	2.0930	0.0370	0.0106	58.3%	41.7%	16.7%	0.0%	
24	6	24	Jul-99	414	0.1275	0.3912	2.6091	0.0094	0.0163	66.7%	33.3%	16.7%	4.2%	
24	6	24	Aug-99	416	0.0901	0.3377	1.8417	0.0662	0.0081	50.0%	50.0%	16.7%	4.2%	Worst
24	6	24	Sep-99	421	0.1572	0.2676	3.2592	0.0012	0.0247	66.7%	33.3%	8.3%	0.0%	
24	6	24	Oct-99	420	0.1487	0.3100	3.0752	0.0022	0.0221	62.5%	37.5%	16.7%	0.0%	
24	6	24	Nov-99	428	0.1513	0.2674	3.1598	0.0017	0.0229	62.5%	37.5%	8.3%	0.0%	
24	6	24	Dec-99	431	0.1154	0.3665	2.4057	0.0166	0.0133	62.5%	37.5%	16.7%	0.0%	

Schedule 4

Formation period (months)	Holding period (months)	No. of adjacent periods (n)	Last month in test period	Total points plotted	Overall slope coefficient	Standard deviation of slopes	t-value	p-value	R-Squared	% of positive slopes	% of negative slopes	Significant positive slopes (5% level)	Significant negative slopes (5% level)	Range of overall slopes
36	6	24	Jan-97	283	0.1397	0.3735	2.3657	0.0187	0.0195	58.3%	41.7%	4.2%	4.2%	
36	6	24	Feb-97	284	0.0948	0.3937	1.5994	0.1109	0.0090	62.5%	37.5%	8.3%	0.0%	
36	6	24	Mar-97	287	0.1382	0.4055	2.3554	0.0192	0.0191	66.7%	33.3%	8.3%	0.0%	
36	6	24	Apr-97	287	0.1148	0.3889	1.9513	0.0520	0.0132	50.0%	50.0%	8.3%	0.0%	
36	6	24	May-97	293	0.1233	0.3864	2.1193	0.0349	0.0152	58.3%	41.7%	8.3%	0.0%	
36	6	24	Jun-97	296	0.1190	0.3982	2.0549	0.0408	0.0142	54.2%	45.8%	8.3%	4.2%	
36	6	24	Jul-97	298	0.1258	0.3540	2.1822	0.0299	0.0158	58.3%	41.7%	4.2%	4.2%	Median
36	6	24	Aug-97	299	0.0954	0.3613	1.6517	0.0997	0.0091	62.5%	37.5%	4.2%	0.0%	
36	6	24	Sep-97	302	0.1465	0.3908	2.5651	0.0108	0.0215	66.7%	33.3%	12.5%	0.0%	
36	6	24	Oct-97	302	0.1233	0.3724	2.1512	0.0323	0.0152	50.0%	50.0%	12.5%	0.0%	
36	6	24	Nov-97	309	0.1330	0.3663	2.3505	0.0194	0.0177	58.3%	41.7%	8.3%	0.0%	
36	6	24	Dec-97	312	0.1346	0.3921	2.3923	0.0173	0.0181	54.2%	45.8%	12.5%	4.2%	
36	6	24	Jan-98	314	0.1543	0.3654	2.7589	0.0061	0.0238	58.3%	41.7%	8.3%	4.2%	
36	6	24	Feb-98	315	0.1079	0.3469	1.9199	0.0558	0.0116	62.5%	37.5%	8.3%	0.0%	
36	6	24	Mar-98	319	0.1517	0.3768	2.7331	0.0066	0.0230	66.7%	33.3%	16.7%	0.0%	
36	6	24	Apr-98	319	0.1175	0.3619	2.1073	0.0359	0.0138	50.0%	50.0%	12.5%	0.0%	
36	6	24	May-98	326	0.1314	0.3599	2.3850	0.0177	0.0173	58.3%	41.7%	8.3%	0.0%	
36	6	24	Jun-98	329	0.1236	0.3796	2.2532	0.0249	0.0153	54.2%	45.8%	12.5%	4.2%	
36	6	24	Jul-98	331	0.1550	0.3641	2.8467	0.0047	0.0240	58.3%	41.7%	8.3%	4.2%	
36	6	24	Aug-98	332	0.1129	0.3470	2.0645	0.0397	0.0128	62.5%	37.5%	8.3%	0.0%	
36	6	24	Sep-98	337	0.1529	0.3765	2.8321	0.0049	0.0234	66.7%	33.3%	16.7%	0.0%	
36	6	24	Oct-98	337	0.1228	0.3605	2.2644	0.0242	0.0151	50.0%	50.0%	12.5%	0.0%	
36	6	24	Nov-98	344	0.0940	0.3559	1.7457	0.0818	0.0088	54.2%	45.8%	8.3%	0.0%	
36	6	24	Dec-98	347	0.0826	0.3817	1.5390	0.1247	0.0068	50.0%	50.0%	12.5%	4.2%	
36	6	24	Jan-99	348	0.1124	0.3793	2.1033	0.0362	0.0126	54.2%	45.8%	8.3%	8.3%	
36	6	24	Feb-99	349	0.0897	0.3538	1.6772	0.0944	0.0080	62.5%	37.5%	8.3%	0.0%	
36	6	24	Mar-99	354	0.1623	0.3666	3.0867	0.0022	0.0264	70.8%	29.2%	16.7%	0.0%	Best
36	6	24	Apr-99	354	0.1139	0.3563	2.1512	0.0321	0.0130	50.0%	50.0%	12.5%	0.0%	
36	6	24	May-99	361	0.0992	0.3457	1.8893	0.0597	0.0098	58.3%	41.7%	8.3%	0.0%	
36	6	24	Jun-99	365	0.0768	0.3750	1.4682	0.1429	0.0059	50.0%	50.0%	12.5%	4.2%	Worst
36	6	24	Jul-99	368	0.1078	0.3716	2.0749	0.0387	0.0116	54.2%	45.8%	8.3%	8.3%	
36	6	24	Aug-99	370	0.0808	0.3465	1.5544	0.1209	0.0065	62.5%	37.5%	8.3%	0.0%	
36	6	24	Sep-99	375	0.1535	0.3530	3.0004	0.0029	0.0236	70.8%	29.2%	16.7%	0.0%	
36	6	24	Oct-99	374	0.1122	0.3519	2.1781	0.0300	0.0126	50.0%	50.0%	12.5%	0.0%	
36	6	24	Nov-99	382	0.1162	0.3037	2.2799	0.0232	0.0135	62.5%	37.5%	8.3%	0.0%	
36	6	24	Dec-99	384	0.0966	0.3611	1.8962	0.0587	0.0093	54.2%	45.8%	12.5%	4.2%	

Schedule 5

Formation period (months)	Holding period (months)	No. of adjacent periods (n)	Last month in test period	Total points plotted	Overall slope coefficient	Standard deviation of slopes	t-value	p-value	R-Squared	% of positive slopes	% of negative slopes	Significant positive slopes (5% level)	Significant negative slopes (5% level)	Range of overall slopes
6	12	12	Jan-97	179	0.2307	0.3890	3.1546	0.0019	0.0532	66.7%	33.3%	25.0%	0.0%	
6	12	12	Feb-97	180	0.2732	0.3251	3.7896	0.0002	0.0747	75.0%	25.0%	25.0%	0.0%	
6	12	12	Mar-97	183	0.2498	0.2675	3.4713	0.0006	0.0624	66.7%	33.3%	16.7%	0.0%	
6	12	12	Apr-97	183	0.2860	0.2319	4.0149	0.0001	0.0818	91.7%	8.3%	16.7%	0.0%	
6	12	12	May-97	185	0.2069	0.2801	2.8614	0.0047	0.0428	75.0%	25.0%	16.7%	0.0%	
6	12	12	Jun-97	189	0.2318	0.2652	3.2591	0.0013	0.0537	75.0%	25.0%	16.7%	0.0%	
6	12	12	Jul-97	191	0.1180	0.2681	1.6332	0.1041	0.0139	83.3%	16.7%	0.0%	0.0%	
6	12	12	Aug-97	192	0.1331	0.3185	1.8509	0.0657	0.0177	58.3%	41.7%	8.3%	0.0%	
6	12	12	Sep-97	194	0.1191	0.3909	1.6626	0.0980	0.0142	66.7%	33.3%	0.0%	0.0%	
6	12	12	Oct-97	194	0.1327	0.3461	1.8545	0.0652	0.0176	58.3%	41.7%	16.7%	0.0%	
6	12	12	Nov-97	200	0.1845	0.3078	2.6421	0.0089	0.0341	75.0%	25.0%	16.7%	0.0%	
6	12	12	Dec-97	200	0.2174	0.4319	3.1334	0.0020	0.0472	66.7%	33.3%	33.3%	16.7%	
6	12	12	Jan-98	202	0.2478	0.3902	3.6167	0.0004	0.0614	66.7%	33.3%	33.3%	0.0%	
6	12	12	Feb-98	203	0.3031	0.3316	4.5088	0.0000	0.0919	75.0%	25.0%	33.3%	0.0%	Best
6	12	12	Mar-98	206	0.2630	0.2604	3.8942	0.0001	0.0692	66.7%	33.3%	25.0%	0.0%	
6	12	12	Apr-98	206	0.2497	0.2044	3.6829	0.0003	0.0623	91.7%	8.3%	16.7%	0.0%	
6	12	12	May-98	208	0.1883	0.2051	2.7512	0.0065	0.0354	75.0%	25.0%	8.3%	0.0%	
6	12	12	Jun-98	212	0.2242	0.2339	3.3337	0.0010	0.0503	75.0%	25.0%	16.7%	0.0%	
6	12	12	Jul-98	214	0.1144	0.2680	1.6763	0.0952	0.0131	83.3%	16.7%	0.0%	0.0%	
6	12	12	Aug-98	215	0.1203	0.2764	1.7691	0.0783	0.0145	58.3%	41.7%	8.3%	0.0%	
6	12	12	Sep-98	217	0.0995	0.3562	1.4666	0.1439	0.0099	66.7%	33.3%	0.0%	0.0%	
6	12	12	Oct-98	217	0.1482	0.3473	2.1979	0.0290	0.0220	66.7%	33.3%	16.7%	0.0%	
6	12	12	Nov-98	223	0.1721	0.3081	2.5974	0.0100	0.0296	75.0%	25.0%	16.7%	0.0%	
6	12	12	Dec-98	224	0.1954	0.4321	2.9683	0.0033	0.0382	66.7%	33.3%	33.3%	16.7%	
6	12	12	Jan-99	226	0.2220	0.3786	3.4072	0.0008	0.0493	66.7%	33.3%	33.3%	0.0%	
6	12	12	Feb-99	228	0.2797	0.3289	4.3803	0.0000	0.0783	75.0%	25.0%	33.3%	0.0%	
6	12	12	Mar-99	231	0.2674	0.2452	4.1988	0.0000	0.0715	75.0%	25.0%	25.0%	0.0%	
6	12	12	Apr-99	231	0.2008	0.2132	3.1013	0.0022	0.0403	83.3%	16.7%	16.7%	0.0%	Median
6	12	12	May-99	233	0.1026	0.2755	1.5670	0.1185	0.0105	66.7%	33.3%	8.3%	8.3%	
6	12	12	Jun-99	239	0.1539	0.2796	2.3973	0.0173	0.0237	66.7%	33.3%	16.7%	8.3%	
6	12	12	Jul-99	241	0.0433	0.3061	0.6697	0.5037	0.0019	75.0%	25.0%	0.0%	8.3%	Worst
6	12	12	Aug-99	243	0.0997	0.2593	1.5552	0.1212	0.0099	58.3%	41.7%	8.3%	0.0%	
6	12	12	Sep-99	246	0.1072	0.3542	1.6839	0.0935	0.0115	75.0%	25.0%	0.0%	0.0%	
6	12	12	Oct-99	246	0.1607	0.3492	2.5428	0.0116	0.0258	66.7%	33.3%	16.7%	0.0%	
6	12	12	Nov-99	252	0.2228	0.3288	3.6141	0.0004	0.0497	75.0%	25.0%	25.0%	0.0%	
6	12	12	Dec-99	253	0.2215	0.4353	3.5984	0.0004	0.0491	66.7%	33.3%	41.7%	16.7%	

Schedule 6

Formation period (months)	Holding period (months)	No. of adjacent periods (n)	Last month in test period	Total points plotted	Overall slope coefficient	Standard deviation of slopes	t-value	p-value	R-Squared	% of positive slopes	% of negative slopes	Significant positive slopes (5% level)	Significant negative slopes (5% level)	Range of overall slopes
12	12	12	Jan-97	170	0.1361	0.3761	1.7812	0.0767	0.0185	75.0%	25.0%	8.3%	8.3%	
12	12	12	Feb-97	170	0.1809	0.3689	2.3840	0.0182	0.0327	66.7%	33.3%	8.3%	0.0%	
12	12	12	Mar-97	172	0.2238	0.3380	2.9937	0.0032	0.0501	58.3%	41.7%	25.0%	0.0%	
12	12	12	Apr-97	172	0.2456	0.3311	3.3036	0.0012	0.0603	75.0%	25.0%	16.7%	0.0%	Best
12	12	12	May-97	177	0.2265	0.2724	3.0765	0.0024	0.0513	75.0%	25.0%	16.7%	0.0%	
12	12	12	Jun-97	177	0.1849	0.3439	2.4889	0.0137	0.0342	50.0%	50.0%	25.0%	8.3%	
12	12	12	Jul-97	179	0.2228	0.2954	3.0405	0.0027	0.0496	66.7%	33.3%	16.7%	0.0%	
12	12	12	Aug-97	180	0.2281	0.2610	3.1252	0.0021	0.0520	75.0%	25.0%	8.3%	0.0%	
12	12	12	Sep-97	183	0.1414	0.3452	1.9223	0.0561	0.0200	75.0%	25.0%	8.3%	0.0%	
12	12	12	Oct-97	183	0.1563	0.3434	2.1293	0.0346	0.0244	66.7%	33.3%	8.3%	0.0%	
12	12	12	Nov-97	185	0.1699	0.3311	2.3328	0.0207	0.0289	75.0%	25.0%	8.3%	0.0%	
12	12	12	Dec-97	189	0.1601	0.4017	2.2186	0.0277	0.0256	75.0%	25.0%	8.3%	0.0%	
12	12	12	Jan-98	191	0.1485	0.3724	2.0651	0.0403	0.0221	75.0%	25.0%	8.3%	8.3%	
12	12	12	Feb-98	192	0.1671	0.3649	2.3364	0.0205	0.0279	66.7%	33.3%	8.3%	0.0%	
12	12	12	Mar-98	194	0.2382	0.3369	3.3978	0.0008	0.0567	58.3%	41.7%	33.3%	0.0%	
12	12	12	Apr-98	194	0.2372	0.3076	3.3828	0.0009	0.0562	75.0%	25.0%	16.7%	0.0%	
12	12	12	May-98	200	0.2301	0.2558	3.3265	0.0010	0.0529	75.0%	25.0%	16.7%	0.0%	
12	12	12	Jun-98	200	0.2055	0.3414	2.9540	0.0035	0.0422	50.0%	50.0%	33.3%	8.3%	
12	12	12	Jul-98	202	0.2392	0.2963	3.4833	0.0006	0.0572	66.7%	33.3%	25.0%	0.0%	
12	12	12	Aug-98	203	0.2436	0.2493	3.5607	0.0005	0.0593	75.0%	25.0%	16.7%	0.0%	
12	12	12	Sep-98	206	0.1479	0.3044	2.1355	0.0339	0.0219	75.0%	25.0%	8.3%	0.0%	
12	12	12	Oct-98	206	0.1642	0.3390	2.3781	0.0183	0.0270	66.7%	33.3%	8.3%	0.0%	
12	12	12	Nov-98	208	0.1673	0.3311	2.4362	0.0157	0.0280	75.0%	25.0%	8.3%	0.0%	Median
12	12	12	Dec-98	212	0.1367	0.3873	2.0004	0.0467	0.0187	75.0%	25.0%	8.3%	0.0%	
12	12	12	Jan-99	214	0.1296	0.3683	1.9034	0.0583	0.0168	75.0%	25.0%	8.3%	8.3%	
12	12	12	Feb-99	215	0.1555	0.3603	2.2971	0.0226	0.0242	66.7%	33.3%	8.3%	0.0%	
12	12	12	Mar-99	217	0.2395	0.3221	3.6170	0.0004	0.0574	66.7%	33.3%	33.3%	0.0%	
12	12	12	Apr-99	217	0.2109	0.3032	3.1631	0.0018	0.0445	75.0%	25.0%	16.7%	0.0%	
12	12	12	May-99	223	0.1512	0.3092	2.2745	0.0239	0.0229	75.0%	25.0%	16.7%	8.3%	
12	12	12	Jun-99	224	0.1182	0.3872	1.7739	0.0774	0.0140	50.0%	50.0%	33.3%	16.7%	
12	12	12	Jul-99	225	0.1530	0.3544	2.3123	0.0217	0.0234	66.7%	33.3%	25.0%	8.3%	
12	12	12	Aug-99	227	0.1718	0.2908	2.6158	0.0095	0.0295	75.0%	25.0%	16.7%	8.3%	
12	12	12	Sep-99	230	0.1135	0.2964	1.7245	0.0860	0.0129	75.0%	25.0%	8.3%	0.0%	Worst
12	12	12	Oct-99	230	0.1281	0.3466	1.9498	0.0524	0.0164	58.3%	41.7%	8.3%	0.0%	
12	12	12	Nov-99	232	0.1647	0.3292	2.5327	0.0120	0.0271	75.0%	25.0%	8.3%	0.0%	
12	12	12	Dec-99	238	0.1186	0.3884	1.8344	0.0678	0.0141	66.7%	33.3%	8.3%	0.0%	

Schedule 7

Formation period (months)	Holding period (months)	No. of adjacent periods (n)	Last month in test period	Total points plotted	Overall slope coefficient	Standard deviation of slopes	t-value	p-value	R-Squared	% of positive slopes	% of negative slopes	Significant positive slopes (5% level)	Significant negative slopes (5% level)	Range of overall slopes
24	12	12	Jan-97	153	0.0777	0.3950	0.9577	0.3397	0.0060	58.3%	41.7%	8.3%	0.0%	
24	12	12	Feb-97	153	0.0356	0.2989	0.4376	0.6623	0.0013	50.0%	50.0%	0.0%	0.0%	Worst
24	12	12	Mar-97	154	0.0803	0.3553	0.9936	0.3220	0.0065	41.7%	58.3%	8.3%	0.0%	
24	12	12	Apr-97	154	0.1368	0.3161	1.7021	0.0908	0.0187	50.0%	50.0%	0.0%	0.0%	
24	12	12	May-97	159	0.1964	0.3095	2.5096	0.0131	0.0386	66.7%	33.3%	8.3%	0.0%	
24	12	12	Jun-97	159	0.1665	0.3284	2.1153	0.0360	0.0277	58.3%	41.7%	0.0%	0.0%	
24	12	12	Jul-97	161	0.1913	0.2901	2.4571	0.0151	0.0366	75.0%	25.0%	0.0%	0.0%	
24	12	12	Aug-97	162	0.1150	0.2954	1.4637	0.1452	0.0132	66.7%	33.3%	8.3%	0.0%	
24	12	12	Sep-97	165	0.0878	0.2692	1.1249	0.2623	0.0077	50.0%	50.0%	0.0%	0.0%	
24	12	12	Oct-97	165	0.0711	0.2864	0.9095	0.3644	0.0050	58.3%	41.7%	0.0%	0.0%	
24	12	12	Nov-97	167	0.1038	0.2587	1.3402	0.1820	0.0108	50.0%	50.0%	8.3%	0.0%	
24	12	12	Dec-97	170	0.0709	0.3563	0.9207	0.3585	0.0050	50.0%	50.0%	8.3%	0.0%	
24	12	12	Jan-98	170	0.0795	0.3459	1.0336	0.3028	0.0063	58.3%	41.7%	8.3%	0.0%	
24	12	12	Feb-98	170	0.0410	0.2771	0.5318	0.5956	0.0017	50.0%	50.0%	0.0%	0.0%	
24	12	12	Mar-98	172	0.1099	0.3585	1.4412	0.1514	0.0121	41.7%	58.3%	8.3%	0.0%	Median
24	12	12	Apr-98	172	0.1457	0.2859	1.9196	0.0566	0.0212	50.0%	50.0%	0.0%	0.0%	
24	12	12	May-98	177	0.1915	0.2839	2.5808	0.0107	0.0367	66.7%	33.3%	8.3%	0.0%	
24	12	12	Jun-98	177	0.1817	0.3192	2.4444	0.0155	0.0330	58.3%	41.7%	8.3%	0.0%	
24	12	12	Jul-98	179	0.2015	0.2818	2.7372	0.0068	0.0406	75.0%	25.0%	0.0%	0.0%	Best
24	12	12	Aug-98	180	0.1349	0.2967	1.8164	0.0710	0.0182	66.7%	33.3%	8.3%	0.0%	
24	12	12	Sep-98	183	0.0962	0.2588	1.3009	0.1949	0.0093	50.0%	50.0%	0.0%	0.0%	
24	12	12	Oct-98	183	0.0946	0.2946	1.2783	0.2028	0.0089	58.3%	41.7%	0.0%	0.0%	
24	12	12	Nov-98	185	0.1197	0.2638	1.6303	0.1048	0.0143	50.0%	50.0%	8.3%	0.0%	
24	12	12	Dec-98	189	0.0801	0.3579	1.0985	0.2734	0.0064	50.0%	50.0%	8.3%	0.0%	
24	12	12	Jan-99	191	0.1028	0.3527	1.4205	0.1571	0.0106	58.3%	41.7%	8.3%	0.0%	
24	12	12	Feb-99	192	0.0714	0.2870	0.9863	0.3252	0.0051	50.0%	50.0%	0.0%	0.0%	
24	12	12	Mar-99	194	0.1628	0.3176	2.2870	0.0233	0.0265	50.0%	50.0%	8.3%	0.0%	
24	12	12	Apr-99	194	0.1592	0.2302	2.2348	0.0266	0.0254	58.3%	41.7%	0.0%	0.0%	
24	12	12	May-99	200	0.1470	0.2860	2.0918	0.0377	0.0216	66.7%	33.3%	8.3%	0.0%	
24	12	12	Jun-99	200	0.1206	0.3393	1.7099	0.0889	0.0146	58.3%	41.7%	8.3%	0.0%	
24	12	12	Jul-99	201	0.1382	0.3110	1.9686	0.0504	0.0191	75.0%	25.0%	0.0%	0.0%	
24	12	12	Aug-99	202	0.0919	0.2963	1.3046	0.1935	0.0084	66.7%	33.3%	8.3%	0.0%	
24	12	12	Sep-99	205	0.0758	0.2395	1.0835	0.2799	0.0058	50.0%	50.0%	0.0%	0.0%	
24	12	12	Oct-99	205	0.0774	0.2728	1.1058	0.2701	0.0060	58.3%	41.7%	0.0%	0.0%	
24	12	12	Nov-99	207	0.1142	0.2295	1.6460	0.1013	0.0130	50.0%	50.0%	8.3%	0.0%	
24	12	12	Dec-99	211	0.0599	0.3519	0.8670	0.3869	0.0036	50.0%	50.0%	8.3%	0.0%	

Schedule 8

Formation period (months)	Holding period (months)	No. of adjacent periods (n)	Last month in test period	Total points plotted	Overall slope coefficient	Standard deviation of slopes	t-value	p-value	R-Squared	% of positive slopes	% of negative slopes	Significant positive slopes (5% level)	Significant negative slopes (5% level)	Range of overall slopes
36	12	12	Jan-97	138	0.0645	0.4192	0.7533	0.4526	0.0042	50.0%	50.0%	8.3%	0.0%	
36	12	12	Feb-97	138	0.0483	0.4352	0.5641	0.5736	0.0023	58.3%	41.7%	0.0%	0.0%	
36	12	12	Mar-97	139	0.1167	0.4861	1.3748	0.1714	0.0136	58.3%	41.7%	25.0%	0.0%	
36	12	12	Apr-97	139	0.1249	0.4790	1.4733	0.1430	0.0156	58.3%	41.7%	16.7%	8.3%	
36	12	12	May-97	143	0.1354	0.3650	1.6225	0.1069	0.0183	50.0%	50.0%	16.7%	0.0%	
36	12	12	Jun-97	143	0.2015	0.3313	2.4424	0.0158	0.0406	66.7%	33.3%	8.3%	0.0%	
36	12	12	Jul-97	145	0.2040	0.3260	2.4914	0.0139	0.0416	75.0%	25.0%	8.3%	0.0%	
36	12	12	Aug-97	146	0.1578	0.3862	1.9179	0.0571	0.0249	66.7%	33.3%	8.3%	0.0%	
36	12	12	Sep-97	148	0.0835	0.3057	1.0126	0.3129	0.0070	50.0%	50.0%	0.0%	0.0%	
36	12	12	Oct-97	148	0.0364	0.4052	0.4403	0.6604	0.0013	50.0%	50.0%	0.0%	8.3%	
36	12	12	Nov-97	150	0.0594	0.4001	0.7243	0.4700	0.0035	58.3%	41.7%	0.0%	0.0%	
36	12	12	Dec-97	153	0.0531	0.4495	0.6539	0.5141	0.0028	58.3%	41.7%	8.3%	8.3%	
36	12	12	Jan-98	153	0.0782	0.3867	0.9645	0.3364	0.0061	50.0%	50.0%	8.3%	0.0%	
36	12	12	Feb-98	153	0.0803	0.4196	0.9897	0.3239	0.0064	58.3%	41.7%	8.3%	0.0%	
36	12	12	Mar-98	154	0.1347	0.4508	1.6759	0.0958	0.0181	58.3%	41.7%	25.0%	0.0%	
36	12	12	Apr-98	154	0.1315	0.4318	1.6352	0.1041	0.0173	58.3%	41.7%	16.7%	8.3%	
36	12	12	May-98	159	0.1311	0.3033	1.6564	0.0996	0.0172	50.0%	50.0%	8.3%	0.0%	
36	12	12	Jun-98	159	0.2108	0.3045	2.7022	0.0076	0.0444	66.7%	33.3%	16.7%	0.0%	
36	12	12	Jul-98	161	0.2155	0.3264	2.7828	0.0060	0.0464	75.0%	25.0%	8.3%	0.0%	Best
36	12	12	Aug-98	162	0.1507	0.3535	1.9284	0.0556	0.0227	66.7%	33.3%	8.3%	0.0%	
36	12	12	Sep-98	165	0.0760	0.2669	0.9725	0.3322	0.0058	50.0%	50.0%	0.0%	0.0%	
36	12	12	Oct-98	165	0.0390	0.3948	0.4980	0.6192	0.0015	50.0%	50.0%	0.0%	8.3%	
36	12	12	Nov-98	167	0.0622	0.3981	0.8009	0.4243	0.0039	58.3%	41.7%	0.0%	0.0%	
36	12	12	Dec-98	170	0.0434	0.4423	0.5624	0.5746	0.0019	58.3%	41.7%	8.3%	8.3%	
36	12	12	Jan-99	170	0.0799	0.3850	1.0390	0.3003	0.0064	50.0%	50.0%	8.3%	0.0%	
36	12	12	Feb-99	170	0.1040	0.4250	1.3549	0.1773	0.0108	58.3%	41.7%	8.3%	0.0%	Median
36	12	12	Mar-99	172	0.1866	0.4147	2.4760	0.0143	0.0348	66.7%	33.3%	25.0%	0.0%	
36	12	12	Apr-99	172	0.1476	0.4078	1.9461	0.0533	0.0218	66.7%	33.3%	16.7%	8.3%	
36	12	12	May-99	177	0.0971	0.3010	1.2911	0.1984	0.0094	50.0%	50.0%	8.3%	0.0%	
36	12	12	Jun-99	177	0.1403	0.3411	1.8741	0.0626	0.0197	66.7%	33.3%	16.7%	8.3%	
36	12	12	Jul-99	178	0.1534	0.3583	2.0601	0.0409	0.0235	66.7%	33.3%	8.3%	0.0%	
36	12	12	Aug-99	179	0.1176	0.3467	1.5751	0.1170	0.0138	66.7%	33.3%	8.3%	0.0%	
36	12	12	Sep-99	182	0.0631	0.2566	0.8488	0.3971	0.0040	50.0%	50.0%	0.0%	0.0%	
36	12	12	Oct-99	182	0.0232	0.3828	0.3107	0.7564	0.0005	50.0%	50.0%	0.0%	8.3%	Worst
36	12	12	Nov-99	184	0.0722	0.3792	0.9762	0.3303	0.0052	58.3%	41.7%	0.0%	0.0%	
36	12	12	Dec-99	188	0.0333	0.4371	0.4543	0.6501	0.0011	58.3%	41.7%	8.3%	8.3%	

Schedule 9

Formation period (months)	Holding period (months)	No. of adjacent periods (n)	Last month in test period	Total points plotted	Overall slope coefficient	Standard deviation of slopes	t-value	p-value	R-Squared	% of positive slopes	% of negative slopes	Significant positive slopes (5% level)	Significant negative slopes (5% level)	Range of overall slopes
6	24	6	Jan-97	85	0.2708	0.2270	2.5633	0.0122	0.0734	83.3%	16.7%	16.7%	0.0%	
6	24	6	Feb-97	85	0.3209	0.1736	3.0863	0.0028	0.1029	100.0%	0.0%	16.7%	0.0%	
6	24	6	Mar-97	88	0.1928	0.3284	1.8226	0.0718	0.0372	66.7%	33.3%	0.0%	0.0%	Median
6	24	6	Apr-97	88	0.1999	0.3813	1.8915	0.0619	0.0399	66.7%	33.3%	16.7%	0.0%	
6	24	6	May-97	89	0.2247	0.3644	2.1511	0.0342	0.0505	66.7%	33.3%	16.7%	0.0%	
6	24	6	Jun-97	89	0.0470	0.4152	0.4389	0.6618	0.0022	66.7%	33.3%	0.0%	0.0%	
6	24	6	Jul-97	89	(0.1487)	0.2606	(1.4022)	0.1644	0.0221	16.7%	83.3%	0.0%	0.0%	Worst
6	24	6	Aug-97	89	(0.0330)	0.2982	(0.3079)	0.7589	0.0011	66.7%	33.3%	0.0%	0.0%	
6	24	6	Sep-97	91	(0.0617)	0.3177	(0.5831)	0.5613	0.0038	33.3%	66.7%	0.0%	0.0%	
6	24	6	Oct-97	91	0.0250	0.4591	0.2357	0.8142	0.0006	33.3%	66.7%	16.7%	16.7%	
6	24	6	Nov-97	94	(0.0032)	0.4681	(0.0308)	0.9755	0.0000	33.3%	66.7%	16.7%	16.7%	
6	24	6	Dec-97	94	0.1408	0.4974	1.3645	0.1758	0.0198	33.3%	66.7%	16.7%	0.0%	
6	24	6	Jan-98	94	0.1892	0.4302	1.8486	0.0677	0.0358	33.3%	66.7%	33.3%	0.0%	
6	24	6	Feb-98	95	0.2138	0.4464	2.1107	0.0375	0.0457	66.7%	33.3%	16.7%	0.0%	
6	24	6	Mar-98	95	0.2210	0.3059	2.1848	0.0314	0.0488	66.7%	33.3%	33.3%	0.0%	
6	24	6	Apr-98	95	0.2311	0.2397	2.2902	0.0243	0.0534	83.3%	16.7%	16.7%	0.0%	
6	24	6	May-98	96	0.1338	0.2268	1.3094	0.1936	0.0179	66.7%	33.3%	0.0%	0.0%	
6	24	6	Jun-98	100	0.3015	0.2046	3.1301	0.0023	0.0909	100.0%	0.0%	0.0%	0.0%	
6	24	6	Jul-98	102	0.2151	0.2934	2.2028	0.0299	0.0463	100.0%	0.0%	16.7%	0.0%	
6	24	6	Aug-98	103	0.0330	0.3220	0.3316	0.7409	0.0011	66.7%	33.3%	16.7%	0.0%	
6	24	6	Sep-98	103	0.1627	0.3266	1.6576	0.1005	0.0265	83.3%	16.7%	16.7%	0.0%	
6	24	6	Oct-98	103	0.2381	0.3930	2.4642	0.0154	0.0567	83.3%	16.7%	33.3%	0.0%	
6	24	6	Nov-98	106	0.3302	0.3635	3.5679	0.0005	0.1091	83.3%	16.7%	16.7%	0.0%	
6	24	6	Dec-98	106	0.3522	0.3508	3.8373	0.0002	0.1240	83.3%	16.7%	50.0%	0.0%	
6	24	6	Jan-99	108	0.3574	0.2550	3.9398	0.0001	0.1277	83.3%	16.7%	33.3%	0.0%	
6	24	6	Feb-99	108	0.3914	0.1888	4.3788	0.0000	0.1532	100.0%	0.0%	33.3%	0.0%	Best
6	24	6	Mar-99	111	0.2571	0.3340	2.7773	0.0065	0.0661	66.7%	33.3%	16.7%	0.0%	
6	24	6	Apr-99	111	0.2302	0.3891	2.4693	0.0151	0.0530	66.7%	33.3%	16.7%	0.0%	
6	24	6	May-99	112	0.2585	0.3709	2.8065	0.0059	0.0668	66.7%	33.3%	33.3%	0.0%	
6	24	6	Jun-99	112	0.0687	0.4043	0.7227	0.4714	0.0047	66.7%	33.3%	0.0%	0.0%	
6	24	6	Jul-99	112	(0.1129)	0.2692	(1.1917)	0.2359	0.0127	16.7%	83.3%	0.0%	0.0%	
6	24	6	Aug-99	112	(0.0256)	0.2889	(0.2684)	0.7889	0.0007	66.7%	33.3%	0.0%	0.0%	
6	24	6	Sep-99	114	0.0029	0.3014	0.0307	0.9755	0.0000	50.0%	50.0%	0.0%	0.0%	
6	24	6	Oct-99	114	0.0525	0.4460	0.5560	0.5793	0.0028	50.0%	50.0%	16.7%	16.7%	
6	24	6	Nov-99	117	0.0147	0.4292	0.1580	0.8747	0.0002	33.3%	66.7%	16.7%	16.7%	
6	24	6	Dec-99	118	0.1131	0.4668	1.2260	0.2227	0.0128	33.3%	66.7%	16.7%	0.0%	

Schedule 10

Formation period (months)	Holding period (months)	No. of adjacent periods (n)	Last month in test period	Total points plotted	Overall slope coefficient	Standard deviation of slopes	t-value	p-value	R-Squared	% of positive slopes	% of negative slopes	Significant positive slopes (5% level)	Significant negative slopes (5% level)	Range of overall slopes
12	24	6	Jan-97	81	0.2058	0.2678	1.8688	0.0654	0.0423	83.3%	16.7%	0.0%	0.0%	
12	24	6	Feb-97	81	0.2559	0.2989	2.3526	0.0211	0.0655	83.3%	16.7%	0.0%	0.0%	
12	24	6	Mar-97	81	0.2264	0.2243	2.0655	0.0422	0.0512	83.3%	16.7%	0.0%	0.0%	
12	24	6	Apr-97	81	0.2582	0.1582	2.3759	0.0199	0.0667	100.0%	0.0%	16.7%	0.0%	
12	24	6	May-97	83	0.2782	0.2422	2.6065	0.0109	0.0774	83.3%	16.7%	16.7%	0.0%	
12	24	6	Jun-97	83	0.1164	0.3461	1.0545	0.2948	0.0135	33.3%	66.7%	16.7%	0.0%	
12	24	6	Jul-97	85	0.1397	0.3493	1.2856	0.2021	0.0195	33.3%	66.7%	16.7%	0.0%	
12	24	6	Aug-97	85	0.1082	0.4157	0.9919	0.3241	0.0117	33.3%	66.7%	16.7%	0.0%	
12	24	6	Sep-97	88	0.0387	0.4409	0.3589	0.7205	0.0015	33.3%	66.7%	16.7%	0.0%	Worst
12	24	6	Oct-97	88	0.0755	0.5902	0.7019	0.4847	0.0057	50.0%	50.0%	16.7%	16.7%	
12	24	6	Nov-97	89	0.1222	0.5160	1.1487	0.2538	0.0149	50.0%	50.0%	16.7%	0.0%	
12	24	6	Dec-97	89	0.1019	0.4881	0.9553	0.3421	0.0104	33.3%	66.7%	16.7%	0.0%	
12	24	6	Jan-98	89	0.1003	0.4466	0.9406	0.3495	0.0101	33.3%	66.7%	33.3%	0.0%	
12	24	6	Feb-98	89	0.0846	0.4462	0.7923	0.4303	0.0072	66.7%	33.3%	16.7%	0.0%	
12	24	6	Mar-98	91	0.1621	0.4129	1.5495	0.1248	0.0263	50.0%	50.0%	16.7%	0.0%	
12	24	6	Apr-98	91	0.1403	0.3679	1.3365	0.1848	0.0197	50.0%	50.0%	16.7%	0.0%	
12	24	6	May-98	94	0.1202	0.0337	1.1615	0.2485	0.0145	100.0%	0.0%	0.0%	0.0%	
12	24	6	Jun-98	94	0.1630	0.1154	1.5845	0.1165	0.0266	100.0%	0.0%	0.0%	0.0%	
12	24	6	Jul-98	94	0.1771	0.1951	1.7257	0.0878	0.0314	66.7%	33.3%	0.0%	0.0%	
12	24	6	Aug-98	95	0.1186	0.0975	1.1517	0.2524	0.0141	83.3%	16.7%	0.0%	0.0%	
12	24	6	Sep-98	95	0.1936	0.2534	1.9029	0.0601	0.0375	83.3%	16.7%	0.0%	0.0%	
12	24	6	Oct-98	95	0.1979	0.3476	1.9474	0.0545	0.0392	83.3%	16.7%	16.7%	0.0%	
12	24	6	Nov-98	96	0.2262	0.3232	2.2516	0.0267	0.0512	83.3%	16.7%	0.0%	0.0%	
12	24	6	Dec-98	100	0.2118	0.2854	2.1452	0.0344	0.0449	83.3%	16.7%	0.0%	0.0%	
12	24	6	Jan-99	102	0.2315	0.2685	2.3795	0.0192	0.0536	83.3%	16.7%	0.0%	0.0%	
12	24	6	Feb-99	103	0.2361	0.3022	2.4423	0.0163	0.0558	83.3%	16.7%	0.0%	0.0%	
12	24	6	Mar-99	103	0.2511	0.1699	2.6075	0.0105	0.0631	83.3%	16.7%	16.7%	0.0%	
12	24	6	Apr-99	103	0.2950	0.1696	3.1026	0.0025	0.0870	100.0%	0.0%	33.3%	0.0%	
12	24	6	May-99	106	0.3556	0.2681	3.8802	0.0002	0.1265	83.3%	16.7%	33.3%	0.0%	Best
12	24	6	Jun-99	106	0.2232	0.3878	2.3349	0.0215	0.0498	50.0%	50.0%	33.3%	0.0%	
12	24	6	Jul-99	108	0.2205	0.3703	2.3272	0.0219	0.0486	50.0%	50.0%	33.3%	0.0%	
12	24	6	Aug-99	108	0.1678	0.4242	1.7523	0.0826	0.0282	50.0%	50.0%	16.7%	0.0%	Median
12	24	6	Sep-99	111	0.1460	0.4274	1.5406	0.1263	0.0213	50.0%	50.0%	16.7%	0.0%	
12	24	6	Oct-99	111	0.1280	0.5752	1.3477	0.1806	0.0164	66.7%	33.3%	16.7%	16.7%	
12	24	6	Nov-99	112	0.1424	0.4572	1.5090	0.1342	0.0203	66.7%	33.3%	16.7%	0.0%	
12	24	6	Dec-99	112	0.0900	0.4855	0.9480	0.3452	0.0081	33.3%	66.7%	16.7%	0.0%	

Schedule 11

Formation period (months)	Holding period (months)	No. of adjacent periods (n)	Last month in test period	Total points plotted	Overall slope coefficient	Standard deviation of slopes	t-value	p-value	R-Squared	% of positive slopes	% of negative slopes	Significant positive slopes (5% level)	Significant negative slopes (5% level)	Range of overall slopes
24	24	6	Jan-97	72	0.1438	0.4362	1.2155	0.2282	0.0207	66.7%	33.3%	0.0%	0.0%	
24	24	6	Feb-97	72	0.0675	0.4085	0.5657	0.5734	0.0046	50.0%	50.0%	0.0%	0.0%	
24	24	6	Mar-97	73	0.2363	0.3636	2.0494	0.0441	0.0559	83.3%	16.7%	16.7%	0.0%	
24	24	6	Apr-97	73	0.2580	0.3535	2.2497	0.0276	0.0665	66.7%	33.3%	16.7%	0.0%	
24	24	6	May-97	76	0.3519	0.3004	3.2340	0.0018	0.1238	83.3%	16.7%	33.3%	0.0%	Best
24	24	6	Jun-97	76	0.2214	0.2710	1.9528	0.0546	0.0490	83.3%	16.7%	16.7%	0.0%	
24	24	6	Jul-97	76	0.1911	0.4074	1.6750	0.0982	0.0365	66.7%	33.3%	16.7%	0.0%	
24	24	6	Aug-97	77	0.0389	0.4538	0.3374	0.7368	0.0015	50.0%	50.0%	16.7%	0.0%	
24	24	6	Sep-97	77	(0.0668)	0.4557	(0.5799)	0.5637	0.0045	33.3%	66.7%	16.7%	16.7%	
24	24	6	Oct-97	77	(0.0893)	0.5430	(0.7765)	0.4399	0.0080	33.3%	66.7%	16.7%	33.3%	Worst
24	24	6	Nov-97	78	(0.0006)	0.4991	(0.0056)	0.9955	0.0000	50.0%	50.0%	16.7%	16.7%	
24	24	6	Dec-97	81	0.0119	0.5253	0.1062	0.9157	0.0001	33.3%	66.7%	16.7%	0.0%	
24	24	6	Jan-98	81	0.0364	0.5049	0.3234	0.7473	0.0013	33.3%	66.7%	16.7%	0.0%	
24	24	6	Feb-98	81	0.1005	0.4256	0.8982	0.3718	0.0101	33.3%	66.7%	16.7%	0.0%	
24	24	6	Mar-98	81	0.0949	0.4208	0.8473	0.3994	0.0090	50.0%	50.0%	16.7%	0.0%	
24	24	6	Apr-98	81	0.0458	0.4042	0.4073	0.6849	0.0021	33.3%	66.7%	16.7%	0.0%	
24	24	6	May-98	83	0.0380	0.2778	0.3422	0.7331	0.0014	33.3%	66.7%	16.7%	0.0%	
24	24	6	Jun-98	83	0.1086	0.2387	0.9836	0.3282	0.0118	66.7%	33.3%	16.7%	0.0%	Median
24	24	6	Jul-98	85	0.1368	0.2014	1.2585	0.2117	0.0187	83.3%	16.7%	0.0%	0.0%	
24	24	6	Aug-98	85	0.0250	0.2193	0.2281	0.8202	0.0006	16.7%	83.3%	0.0%	0.0%	
24	24	6	Sep-98	88	0.1398	0.2148	1.3094	0.1939	0.0195	66.7%	33.3%	0.0%	0.0%	
24	24	6	Oct-98	88	0.1616	0.2541	1.5185	0.1326	0.0261	66.7%	33.3%	0.0%	0.0%	
24	24	6	Nov-98	89	0.1213	0.2734	1.1398	0.2575	0.0147	50.0%	50.0%	0.0%	0.0%	
24	24	6	Dec-98	89	0.1134	0.3442	1.0644	0.2901	0.0129	66.7%	33.3%	0.0%	0.0%	
24	24	6	Jan-99	89	0.1071	0.3655	1.0048	0.3178	0.0115	66.7%	33.3%	0.0%	0.0%	
24	24	6	Feb-99	89	0.0748	0.3752	0.6996	0.4861	0.0056	50.0%	50.0%	0.0%	0.0%	
24	24	6	Mar-99	91	0.2659	0.3627	2.6025	0.0108	0.0707	83.3%	16.7%	33.3%	0.0%	
24	24	6	Apr-99	91	0.2661	0.3511	2.6042	0.0108	0.0708	66.7%	33.3%	16.7%	0.0%	
24	24	6	May-99	94	0.3457	0.3001	3.5332	0.0006	0.1195	83.3%	16.7%	33.3%	0.0%	
24	24	6	Jun-99	94	0.2548	0.2742	2.5270	0.0132	0.0649	83.3%	16.7%	16.7%	0.0%	
24	24	6	Jul-99	94	0.2215	0.4112	2.1786	0.0319	0.0491	66.7%	33.3%	16.7%	0.0%	
24	24	6	Aug-99	95	0.1440	0.4576	1.4034	0.1638	0.0207	66.7%	33.3%	16.7%	0.0%	
24	24	6	Sep-99	95	0.0926	0.3548	0.8969	0.3721	0.0086	50.0%	50.0%	16.7%	0.0%	
24	24	6	Oct-99	95	0.0503	0.5083	0.4860	0.6281	0.0025	50.0%	50.0%	16.7%	16.7%	
24	24	6	Nov-99	96	0.1077	0.4460	1.0505	0.2962	0.0116	66.7%	33.3%	16.7%	16.7%	
24	24	6	Dec-99	100	0.0845	0.4717	0.8399	0.4030	0.0071	50.0%	50.0%	16.7%	0.0%	

Schedule 12

Formation period (months)	Holding period (months)	No. of adjacent periods (n)	Last month in test period	Total points plotted	Overall slope coefficient	Standard deviation of slopes	t-value	p-value	R-Squared	% of positive slopes	% of negative slopes	Significant positive slopes (5% level)	Significant negative slopes (5% level)	Range of overall slopes
36	24	6	Jan-97	66	0.1144	0.4072	0.9214	0.3603	0.0131	50.0%	50.0%	0.0%	0.0%	
36	24	6	Feb-97	66	0.0206	0.5044	0.1646	0.8698	0.0004	50.0%	50.0%	0.0%	0.0%	
36	24	6	Mar-97	66	0.2459	0.3995	2.0294	0.0466	0.0605	83.3%	16.7%	16.7%	0.0%	
36	24	6	Apr-97	66	0.2718	0.3555	2.2595	0.0273	0.0739	83.3%	16.7%	16.7%	0.0%	
36	24	6	May-97	67	0.2641	0.3466	2.2080	0.0308	0.0698	66.7%	33.3%	16.7%	0.0%	
36	24	6	Jun-97	67	0.2972	0.2743	2.5098	0.0146	0.0883	83.3%	16.7%	0.0%	0.0%	
36	24	6	Jul-97	69	0.3012	0.3849	2.5858	0.0119	0.0907	66.7%	33.3%	16.7%	0.0%	
36	24	6	Aug-97	69	0.2242	0.4521	1.8830	0.0640	0.0503	83.3%	16.7%	0.0%	0.0%	
36	24	6	Sep-97	71	0.0769	0.3734	0.6403	0.5241	0.0059	50.0%	50.0%	0.0%	0.0%	
36	24	6	Oct-97	71	(0.0037)	0.3830	(0.0306)	0.9757	0.0000	33.3%	66.7%	0.0%	0.0%	Worst
36	24	6	Nov-97	72	0.0791	0.4989	0.6640	0.5089	0.0063	50.0%	50.0%	16.7%	0.0%	
36	24	6	Dec-97	72	0.0622	0.5020	0.5215	0.6037	0.0039	50.0%	50.0%	16.7%	0.0%	
36	24	6	Jan-98	72	0.0631	0.5279	0.5288	0.5986	0.0040	50.0%	50.0%	33.3%	0.0%	
36	24	6	Feb-98	72	0.0796	0.4903	0.6678	0.5065	0.0063	50.0%	50.0%	16.7%	0.0%	
36	24	6	Mar-98	73	0.0639	0.6379	0.5397	0.5911	0.0041	50.0%	50.0%	33.3%	33.3%	
36	24	6	Apr-98	73	0.0315	0.5778	0.2656	0.7913	0.0010	50.0%	50.0%	16.7%	16.7%	
36	24	6	May-98	76	0.1037	0.3270	0.8968	0.3727	0.0108	66.7%	33.3%	16.7%	0.0%	
36	24	6	Jun-98	76	0.1643	0.2606	1.4328	0.1561	0.0270	83.3%	16.7%	16.7%	0.0%	
36	24	6	Jul-98	76	0.1504	0.3449	1.3088	0.1947	0.0226	83.3%	16.7%	16.7%	0.0%	
36	24	6	Aug-98	77	0.0479	0.3070	0.4149	0.6794	0.0023	50.0%	50.0%	16.7%	0.0%	
36	24	6	Sep-98	77	0.1173	0.2855	1.0227	0.3097	0.0138	83.3%	16.7%	0.0%	0.0%	
36	24	6	Oct-98	77	0.1334	0.3134	1.1655	0.2475	0.0178	50.0%	50.0%	0.0%	0.0%	
36	24	6	Nov-98	78	0.0818	0.2781	0.7154	0.4766	0.0067	66.7%	33.3%	0.0%	0.0%	
36	24	6	Dec-98	81	0.0638	0.3556	0.5682	0.5715	0.0041	50.0%	50.0%	0.0%	0.0%	
36	24	6	Jan-99	81	0.1195	0.3637	1.0696	0.2880	0.0143	50.0%	50.0%	0.0%	0.0%	
36	24	6	Feb-99	81	0.0397	0.4279	0.3532	0.7249	0.0016	50.0%	50.0%	0.0%	0.0%	
36	24	6	Mar-99	81	0.2496	0.3710	2.2911	0.0246	0.0623	83.3%	16.7%	16.7%	0.0%	
36	24	6	Apr-99	81	0.2903	0.3555	2.6968	0.0086	0.0843	83.3%	16.7%	16.7%	0.0%	
36	24	6	May-99	83	0.3095	0.3530	2.9295	0.0044	0.0958	66.7%	33.3%	33.3%	0.0%	
36	24	6	Jun-99	83	0.3376	0.2624	3.2277	0.0018	0.1140	83.3%	16.7%	0.0%	0.0%	
36	24	6	Jul-99	85	0.3661	0.3567	3.5844	0.0006	0.1340	83.3%	16.7%	33.3%	0.0%	Best
36	24	6	Aug-99	85	0.2820	0.4601	2.6783	0.0089	0.0795	83.3%	16.7%	0.0%	0.0%	
36	24	6	Sep-99	88	0.2050	0.2274	1.9420	0.0554	0.0420	66.7%	33.3%	0.0%	0.0%	
36	24	6	Oct-99	88	0.0957	0.3264	0.8919	0.3749	0.0092	50.0%	50.0%	0.0%	0.0%	
36	24	6	Nov-99	89	0.1528	0.4191	1.4419	0.1529	0.0233	66.7%	33.3%	16.7%	0.0%	
36	24	6	Dec-99	89	0.1286	0.4416	1.2094	0.2298	0.0165	66.7%	33.3%	16.7%	0.0%	Median

Schedule 13

Formation period (months)	Holding period (months)	No. of adjacent periods (n)	Last month in test period	Total points plotted	Overall slope coefficient	Standard deviation of slopes	t-value	p-value	R-Squared	% of positive slopes	% of negative slopes	Significant positive slopes (5% level)	Significant negative slopes (5% level)	Range of overall slopes
6	36	4	Jan-97	53	0.0777	0.3470	0.5563	0.5805	0.0060	50.0%	50.0%	0.0%	0.0%	
6	36	4	Feb-97	54	(0.0739)	0.3746	(0.5341)	0.5955	0.0055	50.0%	50.0%	0.0%	25.0%	
6	36	4	Mar-97	54	0.2231	0.2575	1.6504	0.1049	0.0498	75.0%	25.0%	0.0%	0.0%	
6	36	4	Apr-97	54	0.1947	0.1416	1.4313	0.1583	0.0379	100.0%	0.0%	0.0%	0.0%	
6	36	4	May-97	54	0.1172	0.1329	0.8509	0.3987	0.0137	75.0%	25.0%	0.0%	0.0%	
6	36	4	Jun-97	56	0.2955	0.1378	2.2733	0.0270	0.0873	100.0%	0.0%	0.0%	0.0%	
6	36	4	Jul-97	56	0.2320	0.2728	1.7526	0.0854	0.0538	75.0%	25.0%	0.0%	0.0%	
6	36	4	Aug-97	56	0.1966	0.2756	1.4735	0.1464	0.0387	50.0%	50.0%	0.0%	0.0%	
6	36	4	Sep-97	57	0.0655	0.1770	0.4868	0.6283	0.0043	75.0%	25.0%	0.0%	0.0%	
6	36	4	Oct-97	57	0.1756	0.2136	1.3230	0.1913	0.0308	50.0%	50.0%	0.0%	0.0%	
6	36	4	Nov-97	59	0.2344	0.1536	1.8206	0.0739	0.0550	100.0%	0.0%	0.0%	0.0%	
6	36	4	Dec-97	59	0.2752	0.2202	2.1609	0.0349	0.0757	100.0%	0.0%	0.0%	0.0%	
6	36	4	Jan-98	59	0.3264	0.3607	2.6068	0.0116	0.1065	75.0%	25.0%	25.0%	0.0%	
6	36	4	Feb-98	59	0.4384	0.2495	3.6826	0.0005	0.1922	100.0%	0.0%	25.0%	0.0%	Best
6	36	4	Mar-98	62	0.1338	0.4375	1.0458	0.2998	0.0179	50.0%	50.0%	25.0%	0.0%	
6	36	4	Apr-98	62	(0.0375)	0.5682	(0.2909)	0.7721	0.0014	50.0%	50.0%	0.0%	0.0%	
6	36	4	May-98	64	0.1191	0.4903	0.9446	0.3485	0.0142	50.0%	50.0%	0.0%	0.0%	
6	36	4	Jun-98	65	0.1391	0.5069	1.1146	0.2693	0.0193	75.0%	25.0%	0.0%	0.0%	Median
6	36	4	Jul-98	65	(0.0143)	0.4980	(0.1135)	0.9100	0.0002	50.0%	50.0%	25.0%	0.0%	
6	36	4	Aug-98	65	(0.1115)	0.3034	(0.8909)	0.3764	0.0124	25.0%	75.0%	0.0%	0.0%	Worst
6	36	4	Sep-98	66	0.1548	0.3740	1.2537	0.2145	0.0240	75.0%	25.0%	25.0%	0.0%	
6	36	4	Oct-98	66	0.0990	0.4245	0.7960	0.4290	0.0098	75.0%	25.0%	0.0%	0.0%	
6	36	4	Nov-98	66	0.0600	0.4644	0.4808	0.6323	0.0036	50.0%	50.0%	0.0%	0.0%	
6	36	4	Dec-98	66	0.1364	0.5156	1.1011	0.2750	0.0186	50.0%	50.0%	50.0%	0.0%	
6	36	4	Jan-99	67	0.1935	0.3532	1.5903	0.1166	0.0375	50.0%	50.0%	25.0%	0.0%	
6	36	4	Feb-99	67	0.3420	0.1756	2.9338	0.0046	0.1169	100.0%	0.0%	25.0%	0.0%	
6	36	4	Mar-99	67	0.1439	0.3717	1.1727	0.2452	0.0207	50.0%	50.0%	25.0%	0.0%	
6	36	4	Apr-99	67	0.1862	0.3896	1.5280	0.1314	0.0347	75.0%	25.0%	25.0%	0.0%	
6	36	4	May-99	67	0.0966	0.3597	0.7826	0.4367	0.0093	50.0%	50.0%	25.0%	0.0%	
6	36	4	Jun-99	68	0.0745	0.3777	0.6073	0.5457	0.0056	75.0%	25.0%	0.0%	0.0%	
6	36	4	Jul-99	70	(0.0342)	0.3893	(0.2821)	0.7787	0.0012	50.0%	50.0%	0.0%	0.0%	
6	36	4	Aug-99	71	(0.0648)	0.3172	(0.5397)	0.5912	0.0042	50.0%	50.0%	0.0%	0.0%	
6	36	4	Sep-99	71	0.0306	0.3255	0.2544	0.7999	0.0009	50.0%	50.0%	0.0%	0.0%	
6	36	4	Oct-99	71	0.0894	0.4847	0.7460	0.4582	0.0080	50.0%	50.0%	25.0%	0.0%	
6	36	4	Nov-99	75	0.2009	0.3558	1.7518	0.0840	0.0403	50.0%	50.0%	25.0%	0.0%	
6	36	4	Dec-99	75	0.1912	0.3333	1.6641	0.1004	0.0365	75.0%	25.0%	25.0%	0.0%	

Schedule 14

Formation period (months)	Holding period (months)	No. of adjacent periods (n)	Last month in test period	Total points plotted	Overall slope coefficient	Standard deviation of slopes	t-value	p-value	R-Squared	% of positive slopes	% of negative slopes	Significant positive slopes (5% level)	Significant negative slopes (5% level)	Range of overall slopes
12	36	4	Jan-97	49	0.0127	0.5279	0.0872	0.9309	0.0002	50.0%	50.0%	0.0%	25.0%	
12	36	4	Feb-97	49	(0.1095)	0.5118	(0.7554)	0.4538	0.0120	50.0%	50.0%	0.0%	25.0%	Worst
12	36	4	Mar-97	49	0.0805	0.4320	0.5535	0.5826	0.0065	50.0%	50.0%	0.0%	0.0%	
12	36	4	Apr-97	49	(0.0411)	0.3309	(0.2823)	0.7789	0.0017	25.0%	75.0%	0.0%	0.0%	
12	36	4	May-97	52	0.0536	0.2170	0.3794	0.7060	0.0029	50.0%	50.0%	0.0%	0.0%	
12	36	4	Jun-97	52	0.1283	0.2643	0.9144	0.3649	0.0164	75.0%	25.0%	0.0%	0.0%	
12	36	4	Jul-97	53	0.1847	0.2831	1.3420	0.1855	0.0341	75.0%	25.0%	0.0%	0.0%	
12	36	4	Aug-97	54	0.1002	0.2451	0.7260	0.4711	0.0100	50.0%	50.0%	0.0%	0.0%	
12	36	4	Sep-97	54	0.1513	0.1803	1.1039	0.2747	0.0229	75.0%	25.0%	0.0%	0.0%	
12	36	4	Oct-97	54	0.1940	0.1692	1.4262	0.1598	0.0376	75.0%	25.0%	0.0%	0.0%	
12	36	4	Nov-97	54	0.2218	0.1522	1.6405	0.1069	0.0492	100.0%	0.0%	0.0%	0.0%	
12	36	4	Dec-97	56	0.3307	0.0478	2.5752	0.0128	0.1094	100.0%	0.0%	0.0%	0.0%	
12	36	4	Jan-98	56	0.2851	0.1538	2.1858	0.0332	0.0813	100.0%	0.0%	25.0%	0.0%	
12	36	4	Feb-98	56	0.3775	0.1536	2.9956	0.0041	0.1425	100.0%	0.0%	25.0%	0.0%	
12	36	4	Mar-98	57	0.2470	0.3239	1.8902	0.0640	0.0610	75.0%	25.0%	25.0%	0.0%	
12	36	4	Apr-98	57	0.2566	0.3954	1.9687	0.0540	0.0658	50.0%	50.0%	25.0%	0.0%	
12	36	4	May-98	59	0.4225	0.2080	3.5192	0.0009	0.1785	100.0%	0.0%	25.0%	0.0%	Best
12	36	4	Jun-98	59	0.2580	0.3180	2.0158	0.0485	0.0665	50.0%	50.0%	25.0%	0.0%	
12	36	4	Jul-98	59	0.1915	0.3477	1.4729	0.1463	0.0367	50.0%	50.0%	25.0%	0.0%	
12	36	4	Aug-98	59	0.2165	0.3995	1.6741	0.0996	0.0469	50.0%	50.0%	25.0%	0.0%	
12	36	4	Sep-98	62	0.1154	0.4798	0.9001	0.3717	0.0133	50.0%	50.0%	0.0%	0.0%	
12	36	4	Oct-98	62	0.0620	0.5948	0.4815	0.6319	0.0038	50.0%	50.0%	25.0%	0.0%	
12	36	4	Nov-98	64	0.0567	0.5995	0.4469	0.6565	0.0032	50.0%	50.0%	50.0%	0.0%	
12	36	4	Dec-98	65	0.1378	0.5648	1.1045	0.2736	0.0190	50.0%	50.0%	50.0%	0.0%	
12	36	4	Jan-99	65	0.1247	0.4868	0.9974	0.3224	0.0155	50.0%	50.0%	25.0%	0.0%	
12	36	4	Feb-99	65	0.2447	0.4133	2.0031	0.0495	0.0599	75.0%	25.0%	50.0%	0.0%	
12	36	4	Mar-99	66	0.1543	0.2142	1.2497	0.2160	0.0238	50.0%	50.0%	0.0%	0.0%	
12	36	4	Apr-99	66	0.1366	0.1192	1.1032	0.2741	0.0187	75.0%	25.0%	0.0%	0.0%	
12	36	4	May-99	66	0.0865	0.1822	0.6950	0.4896	0.0075	50.0%	50.0%	0.0%	0.0%	
12	36	4	Jun-99	66	0.1145	0.2823	0.9222	0.3599	0.0131	50.0%	50.0%	0.0%	0.0%	
12	36	4	Jul-99	67	0.1576	0.3318	1.2871	0.2026	0.0249	50.0%	50.0%	0.0%	0.0%	
12	36	4	Aug-99	67	0.1798	0.3647	1.4735	0.1454	0.0323	75.0%	25.0%	0.0%	0.0%	
12	36	4	Sep-99	67	0.1254	0.3443	1.0194	0.3118	0.0157	75.0%	25.0%	0.0%	0.0%	
12	36	4	Oct-99	67	0.0897	0.5153	0.7258	0.4705	0.0080	50.0%	50.0%	0.0%	25.0%	
12	36	4	Nov-99	67	0.1402	0.4993	1.1414	0.2579	0.0196	50.0%	50.0%	0.0%	0.0%	Median
12	36	4	Dec-99	68	0.0343	0.4803	0.2784	0.7815	0.0012	50.0%	50.0%	0.0%	0.0%	

Schedule 15

Formation period (months)	Holding period (months)	No. of adjacent periods (n)	Last month in test period	Total points plotted	Overall slope coefficient	Standard deviation of slopes	t-value	p-value	R-Squared	% of positive slopes	% of negative slopes	Significant positive slopes (5% level)	Significant negative slopes (5% level)	Range of overall slopes
24	36	4	Jan-97	48	(0.1300)	0.4196	(0.8896)	0.3783	0.0169	50.0%	50.0%	0.0%	25.0%	
24	36	4	Feb-97	48	(0.1588)	0.2979	(1.0908)	0.2810	0.0252	25.0%	75.0%	0.0%	0.0%	
24	36	4	Mar-97	48	(0.0996)	0.2947	(0.6788)	0.5006	0.0099	50.0%	50.0%	0.0%	0.0%	
24	36	4	Apr-97	48	(0.1656)	0.3218	(1.1388)	0.2607	0.0274	50.0%	50.0%	0.0%	25.0%	
24	36	4	May-97	48	(0.0815)	0.3192	(0.5548)	0.5817	0.0066	50.0%	50.0%	0.0%	0.0%	
24	36	4	Jun-97	48	(0.0217)	0.2477	(0.1475)	0.8833	0.0005	75.0%	25.0%	0.0%	0.0%	
24	36	4	Jul-97	49	0.0653	0.3743	0.4486	0.6558	0.0043	75.0%	25.0%	0.0%	0.0%	
24	36	4	Aug-97	49	(0.2139)	0.3004	(1.5014)	0.1399	0.0458	25.0%	75.0%	0.0%	0.0%	Worst
24	36	4	Sep-97	49	(0.0108)	0.2171	(0.0742)	0.9412	0.0001	25.0%	75.0%	0.0%	0.0%	
24	36	4	Oct-97	49	0.0093	0.1995	0.0637	0.9495	0.0001	25.0%	75.0%	0.0%	0.0%	
24	36	4	Nov-97	49	0.0083	0.2813	0.0567	0.9550	0.0001	50.0%	50.0%	0.0%	0.0%	
24	36	4	Dec-97	49	0.0523	0.2739	0.3593	0.7210	0.0027	50.0%	50.0%	0.0%	0.0%	
24	36	4	Jan-98	49	0.0732	0.3719	0.5029	0.6174	0.0054	50.0%	50.0%	25.0%	0.0%	
24	36	4	Feb-98	49	0.1536	0.2324	1.0656	0.2920	0.0236	50.0%	50.0%	0.0%	0.0%	
24	36	4	Mar-98	49	0.1372	0.3025	0.9496	0.3472	0.0188	50.0%	50.0%	25.0%	0.0%	Median
24	36	4	Apr-98	49	0.1188	0.5089	0.8205	0.4161	0.0141	50.0%	50.0%	25.0%	0.0%	
24	36	4	May-98	52	0.3928	0.2740	3.0206	0.0040	0.1543	100.0%	0.0%	25.0%	0.0%	
24	36	4	Jun-98	52	0.4007	0.1692	3.0927	0.0032	0.1606	100.0%	0.0%	25.0%	0.0%	Best
24	36	4	Jul-98	53	0.3266	0.2940	2.4680	0.0170	0.1067	75.0%	25.0%	25.0%	0.0%	
24	36	4	Aug-98	54	0.2872	0.2470	2.1622	0.0352	0.0825	100.0%	0.0%	25.0%	0.0%	
24	36	4	Sep-98	54	0.2520	0.2751	1.8776	0.0661	0.0635	100.0%	0.0%	0.0%	0.0%	
24	36	4	Oct-98	54	0.1888	0.4674	1.3865	0.1715	0.0357	50.0%	50.0%	25.0%	0.0%	
24	36	4	Nov-98	54	0.1245	0.6127	0.9046	0.3698	0.0155	50.0%	50.0%	25.0%	0.0%	
24	36	4	Dec-98	56	0.2074	0.5657	1.5577	0.1251	0.0430	75.0%	25.0%	50.0%	0.0%	
24	36	4	Jan-99	56	0.3149	0.4622	2.4385	0.0181	0.0992	75.0%	25.0%	50.0%	0.0%	
24	36	4	Feb-99	56	0.3140	0.4493	2.4303	0.0184	0.0986	75.0%	25.0%	50.0%	0.0%	
24	36	4	Mar-99	57	0.2726	0.4716	2.1011	0.0402	0.0743	75.0%	25.0%	50.0%	0.0%	
24	36	4	Apr-99	57	0.2637	0.3969	2.0272	0.0475	0.0695	75.0%	25.0%	50.0%	0.0%	
24	36	4	May-99	59	0.2779	0.3525	2.1844	0.0331	0.0772	75.0%	25.0%	0.0%	0.0%	
24	36	4	Jun-99	59	0.1822	0.3423	1.3989	0.1673	0.0332	50.0%	50.0%	0.0%	0.0%	
24	36	4	Jul-99	59	0.1964	0.2287	1.5120	0.1360	0.0386	75.0%	25.0%	0.0%	0.0%	
24	36	4	Aug-99	59	0.2029	0.2286	1.5645	0.1232	0.0412	75.0%	25.0%	25.0%	0.0%	
24	36	4	Sep-99	62	0.1344	0.2227	1.0506	0.2977	0.0181	75.0%	25.0%	0.0%	0.0%	
24	36	4	Oct-99	62	0.0544	0.3945	0.4221	0.6745	0.0030	75.0%	25.0%	0.0%	0.0%	
24	36	4	Nov-99	64	0.1377	0.2480	1.0947	0.2779	0.0190	50.0%	50.0%	0.0%	0.0%	
24	36	4	Dec-99	65	0.0618	0.3351	0.4917	0.6247	0.0038	50.0%	50.0%	0.0%	0.0%	

Schedule 16

Formation period (months)	Holding period (months)	No. of adjacent periods (n)	Last month in test period	Total points plotted	Overall slope coefficient	Standard deviation of slopes	t-value	p-value	R-Squared	% of positive slopes	% of negative slopes	Significant positive slopes (5% level)	Significant negative slopes (5% level)	Range of overall slopes
36	36	4	Jan-97	41	0.0153	0.2544	0.0958	0.9241	0.0002	25.0%	75.0%	0.0%	0.0%	
36	36	4	Feb-97	41	0.0679	0.1735	0.4252	0.6730	0.0046	50.0%	50.0%	0.0%	0.0%	
36	36	4	Mar-97	42	0.1913	0.2062	1.2324	0.2250	0.0366	75.0%	25.0%	0.0%	0.0%	
36	36	4	Apr-97	42	0.1045	0.2002	0.6648	0.5100	0.0109	50.0%	50.0%	0.0%	0.0%	
36	36	4	May-97	43	0.0406	0.1720	0.2601	0.7961	0.0016	50.0%	50.0%	0.0%	0.0%	
36	36	4	Jun-97	43	0.1219	0.1862	0.7866	0.4360	0.0149	50.0%	50.0%	0.0%	0.0%	Median
36	36	4	Jul-97	43	0.2195	0.2502	1.4407	0.1573	0.0482	75.0%	25.0%	0.0%	0.0%	
36	36	4	Aug-97	43	0.0835	0.1708	0.5365	0.5945	0.0070	50.0%	50.0%	0.0%	0.0%	
36	36	4	Sep-97	45	0.0980	0.2245	0.6458	0.5218	0.0096	75.0%	25.0%	0.0%	0.0%	
36	36	4	Oct-97	45	0.0307	0.3541	0.2015	0.8412	0.0009	50.0%	50.0%	0.0%	0.0%	
36	36	4	Nov-97	47	(0.0060)	0.2999	(0.0404)	0.9679	0.0000	75.0%	25.0%	0.0%	0.0%	
36	36	4	Dec-97	48	(0.0397)	0.3569	(0.2695)	0.7887	0.0016	50.0%	50.0%	0.0%	25.0%	Worst
36	36	4	Jan-98	48	0.0862	0.3486	0.5870	0.5601	0.0074	75.0%	25.0%	0.0%	0.0%	
36	36	4	Feb-98	48	0.0901	0.3576	0.6137	0.5424	0.0081	75.0%	25.0%	0.0%	0.0%	
36	36	4	Mar-98	48	0.0807	0.4035	0.5491	0.5856	0.0065	75.0%	25.0%	25.0%	0.0%	
36	36	4	Apr-98	48	0.1021	0.5458	0.6964	0.4897	0.0104	50.0%	50.0%	25.0%	0.0%	
36	36	4	May-98	48	0.1742	0.3742	1.2001	0.2362	0.0304	75.0%	25.0%	0.0%	0.0%	
36	36	4	Jun-98	48	0.2045	0.3533	1.4171	0.1632	0.0418	50.0%	50.0%	0.0%	0.0%	
36	36	4	Jul-98	49	0.1057	0.4998	0.7289	0.4697	0.0112	50.0%	50.0%	0.0%	0.0%	
36	36	4	Aug-98	49	0.1419	0.2349	0.9826	0.3308	0.0201	50.0%	50.0%	0.0%	0.0%	
36	36	4	Sep-98	49	0.1069	0.3494	0.7370	0.4648	0.0114	50.0%	50.0%	0.0%	0.0%	
36	36	4	Oct-98	49	0.1145	0.4082	0.7901	0.4334	0.0131	50.0%	50.0%	0.0%	0.0%	
36	36	4	Nov-98	49	0.1122	0.5431	0.7738	0.4429	0.0126	50.0%	50.0%	25.0%	0.0%	
36	36	4	Dec-98	49	0.1140	0.6129	0.7868	0.4354	0.0130	50.0%	50.0%	25.0%	0.0%	
36	36	4	Jan-99	49	0.2482	0.5713	1.7563	0.0856	0.0616	50.0%	50.0%	25.0%	0.0%	
36	36	4	Feb-99	49	0.2111	0.5517	1.4807	0.1454	0.0446	50.0%	50.0%	25.0%	0.0%	
36	36	4	Mar-99	49	0.2893	0.4236	2.0720	0.0438	0.0837	75.0%	25.0%	25.0%	0.0%	
36	36	4	Apr-99	49	0.2505	0.4480	1.7738	0.0826	0.0627	50.0%	50.0%	25.0%	0.0%	
36	36	4	May-99	52	0.3852	0.2909	2.9511	0.0048	0.1483	100.0%	0.0%	25.0%	0.0%	
36	36	4	Jun-99	52	0.4512	0.1954	3.5746	0.0008	0.2035	100.0%	0.0%	25.0%	0.0%	Best
36	36	4	Jul-99	53	0.4511	0.1496	3.6099	0.0007	0.2035	100.0%	0.0%	0.0%	0.0%	
36	36	4	Aug-99	54	0.3642	0.2884	2.8198	0.0068	0.1326	75.0%	25.0%	25.0%	0.0%	
36	36	4	Sep-99	54	0.2853	0.0607	2.1464	0.0365	0.0814	100.0%	0.0%	0.0%	0.0%	
36	36	4	Oct-99	54	0.1668	0.2528	1.2198	0.2281	0.0278	75.0%	25.0%	0.0%	0.0%	
36	36	4	Nov-99	54	0.2649	0.0744	1.9809	0.0529	0.0702	100.0%	0.0%	0.0%	0.0%	
36	36	4	Dec-99	56	0.2410	0.1803	1.8251	0.0735	0.0581	100.0%	0.0%	0.0%	0.0%	

APPENDIX III

Runs test critical values

For the one-sample runs test and various values of n_1 and n_2, any value of r that is equal to or smaller than the lower limit or equal to or larger than the upper limit, is significant at the 5% level.

Lower limits

	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
2											2	2	2	2	2	2	2	2	2
3					2	2	2	2	2	2	2	2	2	3	3	3	3	3	3
4				2	2	2	3	3	3	3	3	3	3	3	4	4	4	4	4
5			2	2	3	3	3	3	3	4	4	4	4	4	4	4	5	5	5
6		2	2	3	3	3	3	4	4	4	4	5	5	5	5	5	5	6	6
7		2	2	3	3	3	4	4	5	5	5	5	5	6	6	6	6	6	6
8		2	3	3	3	4	4	5	5	5	6	6	6	6	6	7	7	7	7
9		2	3	3	4	4	5	5	5	6	6	6	7	7	7	7	8	8	8
10		2	3	3	4	5	5	5	6	6	7	7	7	7	8	8	8	8	9
11		2	3	4	4	5	5	6	6	7	7	7	8	8	8	9	9	9	9
12	2	2	3	4	4	5	6	6	7	7	7	8	8	8	9	9	9	10	10
13	2	2	3	4	5	5	6	6	7	7	8	8	9	9	9	10	10	10	10
14	2	2	3	4	5	5	6	7	7	8	8	9	9	9	10	10	10	11	11
15	2	3	3	4	5	6	6	7	7	8	8	9	9	10	10	11	11	11	12
16	2	3	4	4	5	6	6	7	8	8	9	9	10	10	11	11	11	12	12
17	2	3	4	4	5	6	7	7	8	9	9	10	10	11	11	11	12	12	13
18	2	3	4	5	5	6	7	8	8	9	9	10	10	11	11	12	12	13	13
19	2	3	4	5	6	6	7	8	8	9	10	10	11	11	12	12	13	13	13
20	2	3	4	5	6	6	7	8	9	9	10	10	11	12	12	13	13	13	14

Upper limits

	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
2																			
3																			
4				9	9														
5			9	10	10	11	11												
6			9	10	11	12	12	13	13	13	13								
7				11	12	13	13	14	14	14	14	15	15	15					
8				11	12	13	14	14	15	15	16	16	16	16	17	17	17	17	17
9					13	14	14	15	16	16	16	17	17	18	18	18	18	18	18
10					13	14	15	16	16	17	17	18	18	18	19	19	19	20	20
11					13	14	15	16	17	17	18	19	19	19	20	20	20	21	21
12					13	14	16	16	17	18	19	19	20	20	21	21	21	22	22
13						15	16	17	18	19	19	20	20	21	21	22	22	23	23
14						15	16	17	18	19	20	20	21	22	22	23	23	23	24
15						15	16	18	18	19	20	21	22	22	23	23	24	24	25
16							17	18	19	20	21	21	22	23	23	24	25	25	25
17							17	18	19	20	21	22	23	23	24	25	25	26	26
18							17	18	19	20	21	22	23	24	25	25	26	26	27
19							17	18	20	21	22	23	23	24	25	26	26	27	27
20							17	18	20	21	22	23	24	25	25	26	27	27	28

Source: Siegel (1956): "Non-parametric statistics for the behavioural sciences", p. 252.

APPENDIX IV

Trading strategy results

The first set of five tables in this appendix reports the terminal value of R100 after 5 years when invested in each of the trading strategies outline in section 4.9. Starting on 1 January 1980, R100 is invested in each strategy. At the end of 5 years, the value of each investment is reported as the *terminal value*. The starting (investment) date is then rolled forward one month and the R100 investment is again tracked for a 5-year period. This process is repeated $12 \times 15 = 180$ times, each time rolling the starting point forward by one month. This results in 180 reported 5-year terminal values for the each strategy. The first terminal value is reported for the 5-year period ending on the 31 December 1984. The last terminal value reported is for the 5-year period ending 31 December 1999 (i.e. 180 months later).

The second set of tables report the 5-year Sharpe ratios for each investment strategy. The Sharpe ratio is calculated from the monthly returns generated by a portfolio following a particular strategy. The ratio is the excess of the portfolio's 5-year geometric average monthly return over the monthly risk-free rate (approximated by the monthly NCD rate) divided by the portfolio's standard deviation of monthly returns over 60 months.

Date at end of 5-year period	All funds (average)	Winners (>mean)	Winners (>2%)	Winners (>5%)	Losers (<mean)	Losers (< -2%)	Losers (< -5%)	Top Fund Switching	Bottom Fund Switching	Second Best	Second Worst	Quartile 1	Quartile 2	Quartile 3	Quartile 4	Hindsight best case	Hindsight worst case	3 month NCDs	ALSI after costs
31 Dec 1999	170.66	187.65	191.28	205.89	147.61	142.49	129.54	205.89	138.32	199.14	141.08	198.99	160.32	138.95	141.56	406.89	64.63	214.43	153.96
30 Nov 1999	154.30	165.60	171.89	183.95	136.91	129.98	122.11	202.54	150.30	202.69	106.97	165.91	153.45	129.02	129.26	403.11	57.91	214.58	139.41
31 Oct 1999	146.18	159.15	159.41	168.04	125.82	126.75	134.27	186.53	145.03	120.64	135.98	159.98	146.05	117.88	123.38	385.49	56.84	214.58	133.07
30 Sep 1999	140.05	144.85	148.71	142.53	126.24	120.37	115.39	151.03	120.72	137.02	105.68	145.63	138.52	116.22	122.28	318.98	59.82	214.47	128.80
31 Aug 1999	144.53	146.54	161.90	166.38	132.03	121.56	119.93	162.17	128.48	142.82	104.42	160.58	130.51	125.81	121.94	355.34	54.33	214.19	126.88
31 Jul 1999	158.09	163.51	173.34	191.74	142.67	132.82	148.17	159.67	156.36	191.47	129.17	176.00	145.47	139.83	128.79	389.31	58.91	213.79	133.55
30 Jun 1999	167.08	176.83	181.40	196.20	148.77	142.51	127.85	188.22	142.42	192.59	150.28	188.35	153.38	140.77	140.66	377.64	66.50	213.22	138.45
31 May 1999	156.74	160.84	169.85	183.20	141.59	135.96	129.84	185.23	145.12	200.48	120.13	164.28	148.07	136.18	136.45	364.49	66.26	212.53	128.09
30 Apr 1999	171.84	186.50	190.02	199.48	150.14	150.90	152.67	243.25	160.52	142.61	153.53	188.20	165.24	142.69	146.07	434.40	73.09	211.70	139.69
31 Mar 1999	177.37	188.31	194.52	192.99	159.06	147.14	137.83	210.93	124.22	160.56	125.19	192.66	173.54	153.22	145.73	380.16	79.81	210.71	137.00
28 Feb 1999	169.75	176.79	195.48	216.68	153.08	137.98	126.81	214.50	144.23	176.98	114.26	192.11	152.58	150.69	138.41	416.64	67.40	209.54	129.65
31 Jan 1999	169.33	174.76	181.56	210.54	155.11	140.24	153.77	185.53	164.09	199.72	125.60	182.55	157.44	151.86	140.30	423.42	65.45	208.21	129.46
31 Dec 1998	157.42	167.06	176.29	199.39	138.61	137.28	122.21	200.05	127.08	183.57	156.08	178.75	144.65	130.08	134.94	363.60	63.55	206.79	118.23
30 Nov 1998	178.02	180.09	189.99	204.96	162.58	157.66	147.78	205.65	163.71	214.28	127.63	183.31	167.06	156.08	157.41	424.26	71.18	205.30	142.40
31 Oct 1998	196.21	213.30	227.67	244.78	170.89	171.02	165.23	288.17	169.72	159.89	176.43	218.28	185.81	166.55	163.67	513.80	85.20	203.68	156.18
30 Sep 1998	178.61	193.28	205.77	221.85	157.67	146.71	142.21	251.75	128.65	163.54	127.54	196.37	178.04	151.58	144.76	415.88	82.79	202.06	142.47
31 Aug 1998	172.43	184.24	204.87	242.84	152.27	137.34	127.05	257.60	140.58	175.34	117.26	201.83	156.70	149.19	137.91	422.22	75.79	200.52	129.14
31 Jul 1998	249.70	267.95	276.68	321.02	220.38	199.34	228.05	304.21	233.81	295.47	164.38	275.28	244.57	221.04	197.89	557.90	109.83	199.47	174.45
30 Jun 1998	241.37	264.07	277.81	317.84	207.39	204.95	188.39	327.54	189.12	272.36	225.36	277.61	231.96	198.77	198.50	522.03	106.32	198.85	172.48
31 May 1998	271.26	279.40	295.99	329.67	244.04	235.36	222.46	333.74	248.20	327.62	184.22	292.95	253.15	239.67	233.05	577.58	120.43	198.60	197.16
30 Apr 1998	292.31	318.77	341.65	362.03	253.45	252.46	248.01	400.70	249.78	255.25	249.89	322.21	287.43	241.96	248.16	651.21	134.32	198.34	226.11
31 Mar 1998	273.85	297.13	308.76	326.13	240.93	229.52	221.76	335.76	203.86	264.54	205.55	299.26	267.91	236.44	226.96	536.82	134.42	197.99	218.70
28 Feb 1998	260.85	276.60	301.73	359.35	231.45	214.84	208.26	339.62	238.31	285.29	190.50	296.84	239.83	225.76	216.22	530.54	121.24	197.55	213.67
31 Jan 1998	236.24	241.31	241.55	269.12	214.26	202.52	189.20	255.63	202.19	237.23	186.23	239.27	224.98	212.49	205.01	486.92	117.09	197.08	197.30
31 Dec 1997	232.76	243.25	251.56	277.63	206.89	201.39	173.90	281.32	178.26	244.55	191.55	245.32	224.01	204.69	195.56	457.77	115.12	196.58	196.94
30 Nov 1997	246.02	248.40	251.38	280.42	224.70	215.65	209.25	277.87	217.51	288.14	189.86	253.53	226.66	222.86	214.24	487.69	118.14	196.10	204.80
31 Oct 1997	259.51	274.96	293.27	297.03	229.35	226.01	226.09	346.48	230.42	223.53	213.39	276.18	248.52	223.76	220.65	521.03	127.17	195.64	224.78
30 Sep 1997	261.71	279.00	280.03	294.37	232.64	213.96	206.66	302.81	185.74	247.17	209.31	273.64	258.58	236.05	213.63	498.25	131.70	195.23	228.32
31 Aug 1997	277.62	288.71	303.19	362.00	249.19	229.09	212.38	329.77	238.58	299.23	219.22	298.98	261.30	245.65	231.78	555.21	129.43	194.90	238.27
31 Jul 1997	269.55	277.03	275.81	300.37	244.47	234.25	206.83	285.42	223.02	254.76	253.36	268.00	264.07	238.44	238.92	556.79	130.26	194.62	225.10
30 Jun 1997	252.81	260.48	252.97	275.21	227.72	218.64	196.59	269.47	201.02	274.58	204.13	265.84	239.32	229.89	212.37	500.34	120.78	194.41	210.40
31 May 1997	234.54	234.93	243.34	262.69	215.89	210.25	194.26	261.48	186.83	265.50	193.60	245.00	210.16	214.08	206.46	447.09	112.14	194.24	195.82
30 Apr 1997	249.37	262.73	281.76	285.75	222.02	219.58	196.22	328.18	199.97	235.01	192.07	264.86	234.29	221.07	211.09	474.07	120.01	194.15	214.03
31 Mar 1997	240.64	247.49	250.65	272.26	219.07	202.63	188.96	304.61	177.34	218.21	205.75	242.55	232.07	224.73	199.21	451.80	119.96	194.10	207.67
28 Feb 1997	237.53	240.37	248.25	306.36	217.13	201.80	189.99	309.04	197.37	241.87	194.35	246.82	220.31	217.58	203.24	464.05	114.16	194.05	206.61
31 Jan 1997	227.45	231.49	233.53	257.11	206.78	202.49	179.82	256.99	187.75	212.57	225.64	225.52	214.60	198.39	208.49	445.08	114.45	193.99	193.36

Date at end of 5-year period	All funds (average)	Winners (>mean)	Winners (>2%)	Winners (>5%)	Losers (<mean)	Losers (< -2%)	Losers (< -5%)	Top Fund Switching	Bottom Fund Switching	Second Best	Second Worst	Quartile 1	Quartile 2	Quartile 3	Quartile 4	Hindsight best case	Hindsight worst case	3 month NCDs	ALSI after costs
31 Dec 1996	233.67	238.59	231.00	255.18	210.04	200.71	192.18	256.44	196.51	248.72	188.65	242.09	220.12	213.15	196.38	417.77	117.75	193.96	201.76
30 Nov 1996	232.97	230.24	236.01	251.09	215.53	214.69	199.13	250.38	194.96	263.74	191.38	238.26	206.17	212.04	211.04	406.99	113.48	194.05	197.94
31 Oct 1996	237.99	243.75	260.72	264.91	214.41	210.29	196.70	297.55	200.47	227.20	182.40	244.82	221.04	216.94	202.05	422.81	121.00	194.21	206.29
30 Sep 1996	248.85	250.32	249.97	271.62	228.34	207.88	192.21	297.92	180.39	232.10	204.67	244.26	240.02	237.49	205.59	445.60	125.55	194.41	217.18
31 Aug 1996	237.52	242.08	247.17	299.78	216.09	200.40	181.64	304.74	188.70	221.31	188.56	240.71	227.98	220.02	199.41	464.18	117.25	194.63	208.56
31 Jul 1996	232.60	236.27	235.00	243.92	211.66	206.87	184.19	245.48	195.88	219.16	223.97	224.59	223.67	207.48	212.23	437.81	117.63	194.80	198.28
30 Jun 1996	252.82	255.61	246.29	267.97	229.35	220.93	215.50	280.06	221.92	275.87	210.03	258.57	240.67	229.59	217.04	427.82	127.44	194.99	217.16
31 May 1996	259.82	258.24	266.23	271.22	240.69	240.36	222.66	276.26	217.99	277.31	201.05	268.76	230.54	236.68	236.27	434.08	127.24	195.26	228.14
30 Apr 1996	268.93	274.39	285.89	287.49	243.61	240.91	226.66	316.24	227.42	239.78	206.88	274.84	249.79	247.25	230.72	470.69	135.29	195.68	239.44
31 Mar 1996	273.46	272.89	275.41	292.85	251.66	230.91	212.38	324.72	199.32	239.13	215.18	270.21	262.44	261.21	228.27	489.25	134.98	196.21	244.30
29 Feb 1996	286.05	295.04	301.54	368.92	257.28	242.63	224.45	376.80	239.41	274.35	226.82	296.14	274.65	258.74	242.35	558.00	142.48	196.76	249.27
31 Jan 1996	318.68	323.19	322.89	342.54	291.28	286.41	254.71	350.89	292.20	286.90	284.17	317.07	299.22	284.08	292.04	604.38	157.70	197.34	279.05
31 Dec 1995	284.15	286.65	285.74	314.51	256.20	250.84	255.06	331.16	262.66	313.76	241.68	296.45	265.84	258.33	242.31	482.48	141.85	197.96	239.97
30 Nov 1995	288.78	285.25	293.71	298.75	268.90	266.38	261.44	304.30	255.95	297.34	223.68	297.72	257.67	264.69	261.65	485.99	145.71	198.60	240.98
31 Oct 1995	281.00	283.88	295.33	281.15	256.01	253.74	234.48	309.26	235.26	242.52	225.15	281.85	259.90	254.83	246.66	490.15	145.75	199.29	228.82
30 Sep 1995	266.36	266.14	269.15	276.17	243.51	225.81	208.63	306.23	195.80	245.14	214.33	262.04	262.43	250.04	223.02	478.25	135.97	200.00	218.22
31 Aug 1995	246.42	254.66	255.66	305.96	221.41	204.64	174.43	312.49	186.98	233.64	201.32	254.33	244.04	217.53	208.29	484.00	118.56	200.79	197.35
31 Jul 1995	229.68	234.95	235.60	241.93	208.23	201.02	166.17	247.83	191.43	217.12	209.97	233.05	215.02	210.52	204.27	428.86	109.77	201.61	184.70
30 Jun 1995	235.37	238.88	238.82	255.61	211.19	207.12	215.94	266.77	222.38	260.84	197.85	246.77	221.07	216.99	197.81	393.63	115.48	202.47	188.58
31 May 1995	233.55	227.96	237.35	236.58	219.60	217.52	211.54	245.44	207.11	251.07	179.72	240.71	210.56	209.91	213.76	393.85	112.81	203.39	184.16
30 Apr 1995	243.93	245.51	251.87	242.39	223.30	220.09	209.08	269.70	209.78	214.97	185.85	240.36	225.04	223.76	215.48	423.61	120.90	204.36	193.66
31 Mar 1995	222.93	219.95	221.68	227.63	205.74	192.66	177.04	257.32	166.32	198.07	183.69	217.30	215.95	204.87	191.79	398.61	110.35	205.42	174.94
28 Feb 1995	227.85	236.54	235.95	275.68	203.74	188.23	158.63	292.23	170.27	211.37	182.35	235.95	225.05	203.72	191.67	447.82	111.47	206.52	179.97
31 Jan 1995	224.77	232.79	225.38	244.36	200.66	193.11	158.51	245.96	182.51	204.22	206.80	227.98	215.38	205.94	194.64	422.94	109.40	207.69	171.25
31 Dec 1994	263.41	269.42	268.72	273.69	234.25	233.08	243.56	274.62	258.55	300.34	225.47	277.38	253.45	229.72	224.69	446.91	127.91	208.88	211.23
30 Nov 1994	275.30	271.22	283.41	262.02	254.98	254.99	251.74	268.30	253.15	280.16	209.00	281.77	256.47	239.57	250.43	472.50	124.10	210.04	215.81
31 Oct 1994	282.89	287.25	291.65	282.96	254.72	251.59	230.41	303.81	229.95	255.32	227.38	276.28	272.61	251.85	247.78	502.27	136.49	211.21	227.35
30 Sep 1994	266.90	267.26	265.59	273.25	242.80	222.39	196.97	301.00	179.23	248.41	240.17	266.18	257.95	241.90	225.91	490.30	127.25	212.39	220.47
31 Aug 1994	270.35	279.39	274.74	322.33	241.19	219.08	180.64	327.31	185.91	252.66	218.78	274.32	271.41	243.98	226.41	533.58	133.71	213.64	225.27
31 Jul 1994	272.44	278.83	265.83	289.51	241.97	229.92	188.35	282.23	210.40	250.93	230.92	270.54	262.07	249.99	239.45	497.04	135.52	214.92	227.40
30 Jun 1994	268.15	277.83	270.03	281.72	233.55	237.80	245.78	270.27	250.65	293.64	245.84	279.06	266.02	226.29	230.59	449.44	123.09	216.18	221.94
31 May 1994	288.63	287.33	294.43	259.40	265.95	267.67	276.39	251.16	287.61	287.72	222.31	291.31	281.66	234.82	269.92	479.38	124.41	217.44	242.25
30 Apr 1994	268.00	262.99	265.53	253.27	247.71	243.35	236.02	255.77	243.53	229.74	226.08	252.70	253.42	238.09	245.56	440.36	127.90	218.68	223.76
31 Mar 1994	257.65	252.31	252.95	247.37	236.65	221.62	202.44	255.40	195.17	247.84	242.21	251.47	248.51	228.48	228.69	428.29	131.06	219.90	212.07
28 Feb 1994	267.82	273.50	262.21	277.32	242.61	221.48	196.98	281.61	198.62	233.61	227.84	260.84	271.97	243.49	229.63	471.42	138.81	221.07	230.09
31 Jan 1994	274.17	274.47	260.98	271.30	248.84	237.18	201.51	264.48	225.10	249.43	240.59	272.00	256.85	261.13	241.50	451.41	136.28	222.23	238.98

Date at end of 5-year period	All funds (average)	Winners (>mean)	Winners (>2%)	Winners (>5%)	Losers (<mean)	Losers (< -2%)	Losers (< -5%)	Top Fund Switching	Bottom Fund Switching	Second Best	Second Worst	Quartile 1	Quartile 2	Quartile 3	Quartile 4	Hindsight best case	Hindsight worst case	3 month NCDs	ALSI after costs
31 Dec 1993	295.12	303.45	281.37	279.79	261.66	256.96	274.39	271.08	279.82	316.62	241.17	299.14	300.24	251.98	253.71	464.11	138.02	223.33	265.73
30 Nov 1993	273.33	271.86	274.16	239.07	252.74	254.54	265.32	231.48	276.10	264.22	221.10	270.15	272.55	221.42	256.10	415.95	129.21	224.23	231.39
31 Oct 1993	259.47	255.04	244.03	231.20	239.18	236.63	229.94	234.39	246.32	224.54	210.47	240.94	252.18	230.64	236.84	393.41	130.22	224.89	217.80
30 Sep 1993	263.51	257.85	252.15	220.82	241.48	223.72	195.60	231.45	190.77	254.07	235.19	256.72	258.47	232.73	233.58	403.61	137.48	225.34	223.21
31 Aug 1993	288.53	295.76	284.79	296.38	259.36	236.41	208.38	292.40	206.96	271.77	245.67	287.90	294.84	259.65	243.24	501.12	148.72	225.66	254.82
31 Jul 1993	284.30	286.54	273.08	283.10	257.35	246.85	203.45	271.76	217.77	271.99	236.91	286.33	265.60	270.38	249.32	473.52	141.14	225.90	251.64
30 Jun 1993	289.05	298.81	277.15	276.45	255.17	247.71	254.50	268.02	258.90	306.38	228.53	293.17	299.15	253.50	243.75	449.25	135.80	226.07	253.97
31 May 1993	293.59	293.65	291.38	256.00	271.29	270.13	271.86	257.95	272.41	293.13	250.51	287.65	302.38	241.25	272.16	451.16	131.81	226.18	260.48
30 Apr 1993	289.26	287.27	285.10	266.82	265.01	262.76	239.68	267.29	249.37	275.10	256.50	285.84	265.67	256.81	262.46	452.15	131.65	226.18	255.08
31 Mar 1993	281.38	276.55	261.43	253.81	258.26	236.78	217.09	266.03	214.00	243.69	236.98	274.97	281.14	253.98	244.36	448.44	134.01	226.07	233.82
28 Feb 1993	298.35	289.73	286.22	300.87	274.48	252.31	222.63	326.55	217.51	258.05	252.03	284.59	308.93	272.96	260.54	510.13	146.15	225.83	248.12
31 Jan 1993	296.85	291.61	276.32	309.55	272.14	264.28	229.01	305.88	235.73	257.67	256.27	288.21	282.58	280.32	265.73	474.99	140.64	225.45	241.95
31 Dec 1992	263.48	268.32	250.53	232.70	234.59	231.04	241.65	230.68	245.61	281.75	212.73	256.23	277.61	229.27	227.63	400.14	118.58	224.94	200.14
30 Nov 1992	247.49	242.35	234.29	216.01	232.04	234.63	235.57	217.66	236.05	228.64	220.36	229.06	259.55	204.20	234.18	377.81	108.09	224.37	186.07
31 Oct 1992	213.41	201.35	198.64	189.61	201.08	199.15	180.35	189.94	189.48	190.53	191.37	199.48	200.45	191.79	199.22	344.60	95.54	223.76	166.93
30 Sep 1992	172.10	162.65	155.26	149.86	162.31	155.00	140.16	157.07	142.01	147.72	157.97	162.53	172.00	143.51	164.01	274.59	82.85	223.09	137.04
31 Aug 1992	170.33	165.30	166.65	180.59	156.93	148.41	124.59	196.01	121.72	142.80	156.38	165.68	174.21	152.32	152.89	288.04	80.70	222.29	133.29
31 Jul 1992	188.39	195.51	184.09	206.58	173.55	166.93	141.79	204.13	145.95	158.36	154.92	189.12	175.40	180.29	168.34	289.08	85.80	221.38	148.20
30 Jun 1992	216.10	224.16	225.38	211.28	191.98	192.00	195.81	219.32	184.68	214.76	192.60	215.38	224.31	188.73	186.78	325.35	98.17	220.34	176.59
31 May 1992	218.59	216.63	207.51	191.42	205.66	205.83	207.86	198.38	196.80	199.21	198.03	203.98	232.87	175.25	206.95	333.67	96.28	219.20	180.05
30 Apr 1992	210.03	207.40	209.28	206.94	193.77	188.82	164.64	207.30	172.97	192.13	185.14	210.45	194.46	185.71	190.24	354.58	95.42	217.97	166.01
31 Mar 1992	229.41	230.07	215.31	208.82	211.37	199.32	182.75	225.81	185.16	195.39	200.39	228.56	228.31	180.60	210.77	370.59	114.77	216.69	184.39
29 Feb 1992	242.52	242.04	239.28	254.90	216.19	202.80	167.83	276.65	163.96	214.82	220.40	245.42	245.22	206.52	211.76	407.53	118.62	215.40	192.41
31 Jan 1992	250.33	253.69	238.45	269.14	231.87	219.62	177.96	265.95	185.48	209.49	219.26	248.76	229.52	238.91	223.35	397.51	114.66	214.10	189.92
31 Dec 1991	252.32	259.42	262.82	256.93	224.43	224.88	214.87	264.71	204.51	238.55	241.27	252.03	257.23	217.63	219.89	402.77	111.90	212.81	194.64
30 Nov 1991	256.61	251.19	243.48	237.14	242.70	246.01	268.34	243.94	254.06	219.21	222.71	239.34	266.67	200.34	248.31	424.84	113.59	211.53	198.43
31 Oct 1991	262.63	260.45	264.64	271.32	241.64	236.58	206.47	272.40	229.49	235.39	218.57	266.82	239.58	227.95	239.01	462.53	115.50	210.28	207.63
30 Sep 1991	244.47	248.72	232.31	238.10	224.24	213.08	213.19	256.29	216.00	200.31	197.40	247.65	238.13	192.98	224.80	410.95	118.09	209.08	192.67
31 Aug 1991	253.34	250.01	251.48	288.38	227.23	218.03	182.88	310.61	178.67	222.99	241.62	259.91	241.87	216.66	229.11	421.07	122.77	207.97	201.38
31 Jul 1991	287.69	293.84	292.15	331.01	266.83	251.57	202.00	325.95	204.95	237.13	251.41	291.42	266.04	276.94	253.49	471.08	132.93	206.94	240.35
30 Jun 1991	282.13	295.85	300.26	303.30	248.92	251.75	231.48	304.18	219.22	266.47	271.60	287.94	282.85	240.50	246.38	453.45	127.74	206.00	244.74
31 May 1991	274.33	273.13	261.79	258.51	260.14	260.04	270.04	271.78	255.67	232.92	246.73	257.34	283.34	218.96	258.86	459.53	118.45	205.17	243.78
30 Apr 1991	287.72	296.29	304.89	326.92	259.79	251.36	224.71	328.03	249.77	261.47	228.70	302.76	260.17	251.69	253.72	522.46	121.13	204.39	248.26
31 Mar 1991	261.01	265.89	246.79	272.54	239.79	225.68	229.20	289.66	232.22	210.79	220.43	267.82	251.78	204.91	239.28	441.79	125.74	203.60	220.00
28 Feb 1991	260.20	256.59	259.95	307.54	233.65	219.20	177.08	329.94	168.42	213.29	250.50	266.77	250.73	231.70	225.67	442.47	125.10	202.84	224.84
31 Jan 1991	249.01	258.15	256.40	289.65	224.35	211.72	171.41	285.22	161.60	199.83	227.98	249.89	236.44	241.18	213.64	408.89	117.16	202.10	205.23

Date at end of 5-year period	All funds (average)	Winners (>mean)	Winners (>2%)	Winners (>5%)	Losers (<mean)	Losers (< -2%)	Losers (< -5%)	Top Fund Switching	Bottom Fund Switching	Second Best	Second Worst	Quartile 1	Quartile 2	Quartile 3	Quartile 4	Hindsight best case	Hindsight worst case	3 month NCDs	ALSI after costs
31 Dec 1990	263.83	277.57	274.68	262.19	233.72	224.89	207.86	262.95	196.85	234.33	235.27	255.48	278.80	228.41	226.18	437.49	123.51	201.42	229.99
30 Nov 1990	253.00	254.94	235.25	231.17	237.86	234.53	236.38	243.04	223.80	212.56	218.50	230.39	278.41	200.12	230.51	431.45	113.45	200.85	223.61
31 Oct 1990	269.01	276.81	283.22	301.91	242.13	232.00	207.16	302.93	230.25	260.91	214.62	288.51	244.98	233.60	230.92	474.15	114.40	200.41	244.29
30 Sep 1990	269.67	280.79	257.89	295.89	244.67	231.79	231.02	314.48	234.07	220.83	223.91	287.40	254.42	214.38	241.72	459.88	128.70	200.17	256.92
31 Aug 1990	293.55	297.96	293.02	337.19	254.71	247.02	211.16	361.75	200.84	256.11	275.42	307.05	291.12	252.74	247.35	506.29	147.29	199.90	285.63
31 Jul 1990	324.20	345.14	345.06	408.19	286.77	276.34	249.40	401.94	235.13	260.03	274.74	330.24	309.07	307.51	278.86	536.51	155.23	199.77	324.22
30 Jun 1990	302.03	318.34	318.87	299.56	268.72	264.72	229.36	303.09	217.22	270.37	297.33	297.34	312.74	250.79	268.03	502.89	144.19	199.76	302.57
31 May 1990	311.06	317.78	301.36	294.85	288.70	277.15	278.92	307.64	264.08	257.04	276.75	289.94	338.29	261.11	275.04	526.28	147.22	200.05	311.87
30 Apr 1990	317.95	331.58	360.99	378.80	280.68	273.24	236.47	375.75	262.84	307.74	265.27	356.84	289.29	264.57	267.29	573.04	139.93	200.54	309.63
31 Mar 1990	354.39	375.58	346.93	392.43	316.60	286.43	285.59	409.11	293.77	288.20	296.87	373.79	351.52	276.17	307.50	616.29	174.49	201.09	348.39
28 Feb 1990	357.48	365.19	346.84	399.71	309.15	300.71	255.77	413.18	246.82	340.48	340.29	381.21	354.62	303.71	300.87	614.79	182.20	201.70	363.11
31 Jan 1990	372.01	393.26	402.15	438.62	332.91	319.01	279.68	431.91	265.33	323.78	323.90	379.79	352.28	353.13	321.04	607.22	181.05	202.23	372.51
31 Dec 1989	331.47	348.69	347.81	334.93	295.98	287.97	243.26	338.88	227.79	308.67	343.69	326.81	338.33	284.52	291.56	529.67	160.12	202.79	337.35
30 Nov 1989	301.82	309.81	293.02	295.87	280.55	262.94	265.44	308.70	250.80	255.82	270.62	283.52	319.58	262.54	264.98	492.76	153.32	203.41	308.33
31 Oct 1989	308.96	321.57	342.36	359.25	275.52	264.95	234.56	356.36	260.72	301.62	251.69	344.70	273.86	263.64	260.17	533.63	144.87	204.18	305.13
30 Sep 1989	330.98	349.24	313.86	358.78	297.79	274.20	283.72	374.04	291.85	266.23	263.89	337.26	335.64	261.40	287.34	547.06	177.76	204.85	321.58
31 Aug 1989	328.72	340.33	318.92	368.12	282.17	275.16	245.95	380.52	237.35	320.75	316.83	356.80	328.36	271.61	273.12	549.34	173.05	205.25	319.10
31 Jul 1989	333.90	352.24	368.71	395.73	301.29	287.45	259.70	389.67	246.38	289.15	319.61	343.39	314.07	293.76	292.26	533.21	161.49	205.39	325.80
30 Jun 1989	294.67	304.36	292.69	274.73	268.59	251.65	222.00	277.97	207.88	290.66	280.00	284.95	301.03	267.65	251.49	458.48	153.13	205.50	289.79
31 May 1989	268.79	272.48	259.63	273.85	253.41	226.31	218.85	285.72	206.79	236.45	235.03	255.18	283.43	246.52	227.44	424.67	145.43	205.67	261.89
30 Apr 1989	277.34	294.55	291.00	308.79	241.74	224.36	199.41	309.99	216.66	283.09	219.79	311.10	256.11	239.62	223.12	487.51	134.76	205.92	278.27
31 Mar 1989	268.76	284.16	263.61	306.66	240.90	217.45	223.79	319.70	227.66	212.24	210.90	278.31	268.93	217.02	227.93	443.63	144.91	206.23	274.54
28 Feb 1989	263.24	266.69	241.99	282.24	230.96	225.81	201.37	294.77	199.39	256.35	252.11	276.46	256.94	220.92	222.81	437.17	142.87	206.62	253.52
31 Jan 1989	274.50	280.50	294.49	317.35	251.49	244.12	217.98	312.50	206.79	225.11	269.24	269.42	260.89	236.32	249.68	435.07	139.82	206.98	264.18
31 Dec 1988	251.14	256.10	243.72	225.83	230.95	219.04	186.61	230.75	174.75	242.07	256.35	237.27	248.97	227.54	219.29	374.86	136.08	207.24	241.60
30 Nov 1988	254.75	258.56	240.74	255.92	239.76	210.61	206.22	267.02	194.85	220.68	223.83	240.45	267.76	238.22	211.75	395.51	142.22	207.44	250.71
31 Oct 1988	269.98	278.18	268.96	287.54	238.81	216.72	192.80	287.54	203.98	285.72	228.59	293.92	245.67	234.80	220.12	458.48	134.43	207.69	277.72
30 Sep 1988	237.54	248.55	226.51	267.44	213.65	188.66	198.29	274.64	198.29	188.28	194.50	238.25	237.69	194.62	200.67	385.76	131.65	207.98	234.18
31 Aug 1988	222.70	222.03	201.11	225.58	198.63	193.44	175.81	240.01	175.81	208.20	204.75	227.75	217.43	189.95	191.83	355.96	123.88	208.27	205.41
31 Jul 1988	237.23	237.26	249.26	270.61	220.44	212.89	184.29	270.61	181.54	182.11	248.61	226.83	222.76	204.75	218.69	373.79	119.89	208.36	220.80
30 Jun 1988	225.78	226.76	213.95	194.65	212.90	204.77	183.27	202.30	171.61	215.40	228.77	211.34	218.29	203.04	206.00	341.73	122.27	208.30	214.41
31 May 1988	219.88	221.60	205.12	215.68	209.35	189.90	196.09	225.03	185.28	176.40	191.27	204.87	230.59	195.68	190.86	342.36	130.16	208.17	206.33
30 Apr 1988	225.55	229.18	211.74	230.16	204.39	186.83	187.46	230.16	198.32	220.73	178.61	230.13	215.81	192.79	191.58	379.64	124.30	208.09	204.54
31 Mar 1988	246.49	257.07	245.82	267.99	224.52	200.43	205.55	275.21	205.55	222.14	216.38	250.24	236.10	197.13	215.31	379.18	152.63	208.15	232.91
29 Feb 1988	230.54	244.41	218.12	247.00	197.70	193.09	166.23	237.19	166.23	247.52	211.13	249.73	220.61	193.99	189.36	358.73	137.87	208.43	215.19
31 Jan 1988	229.25	237.55	258.41	266.50	208.54	191.92	161.15	266.50	158.75	202.50	242.63	236.93	208.75	194.54	203.25	349.51	129.16	209.11	191.64

Date at end of 5-year period	All funds (average)	Winners (>mean)	Winners (>2%)	Winners (>5%)	Losers (<mean)	Losers (< -2%)	Losers (< -5%)	Top Fund Switching	Bottom Fund Switching	Second Best	Second Worst	Quartile 1	Quartile 2	Quartile 3	Quartile 4	Hindsight best case	Hindsight worst case	3 month NCDs	ALSI after costs
31 Dec 1987	260.76	276.70	263.53	259.82	227.84	214.80	190.65	273.30	178.53	257.16	252.18	268.12	257.01	224.59	220.58	391.60	149.46	210.11	240.85
30 Nov 1987	280.00	294.43	283.18	297.46	251.02	224.29	227.10	300.27	214.59	254.64	232.85	282.39	289.55	248.14	226.80	431.86	166.19	211.30	284.63
31 Oct 1987	338.87	367.30	337.99	381.38	282.77	262.53	252.88	381.38	267.54	336.22	262.25	368.13	323.72	285.68	269.92	551.18	183.95	212.61	330.84
30 Sep 1987	434.19	477.62	466.32	503.31	369.70	331.50	343.63	516.86	329.60	424.10	351.31	473.86	428.37	361.89	347.59	630.74	262.89	214.04	441.05
31 Aug 1987	465.03	497.30	451.82	478.12	395.10	385.03	344.96	459.13	344.96	547.56	384.04	514.61	459.87	409.57	366.41	691.62	285.93	215.54	499.87
31 Jul 1987	486.61	484.79	520.10	538.39	446.12	434.59	399.13	538.39	393.19	426.52	427.10	488.60	464.84	420.53	426.94	727.21	267.47	217.03	563.08
30 Jun 1987	477.54	466.74	469.73	463.12	437.77	421.36	374.81	468.74	374.81	413.61	464.09	442.86	480.07	421.10	432.71	697.88	258.61	218.53	585.47
31 May 1987	463.36	464.95	429.73	413.63	432.40	393.79	402.65	409.00	402.65	432.32	391.63	427.49	479.60	431.73	399.17	705.20	256.88	220.07	543.12
30 Apr 1987	428.39	433.29	408.80	446.02	379.68	355.53	349.58	446.02	375.26	418.99	350.55	443.48	390.00	382.08	366.78	649.05	234.24	221.67	503.61
31 Mar 1987	410.96	416.68	405.98	457.39	359.94	334.52	343.48	457.39	329.46	366.31	358.35	412.54	400.83	358.64	349.27	580.97	242.19	223.21	479.70
28 Feb 1987	349.78	353.57	313.61	331.87	309.71	290.77	262.05	318.69	262.05	381.56	288.25	357.92	363.02	327.28	276.71	519.62	209.83	224.59	405.15
31 Jan 1987	332.15	325.91	346.23	358.41	303.76	288.50	281.87	358.41	277.67	290.44	273.25	328.97	316.51	302.64	283.74	478.31	178.71	225.77	379.05
31 Dec 1986	306.92	300.52	290.99	257.10	279.46	270.94	260.21	260.22	260.21	288.67	277.06	275.60	320.49	267.35	276.66	444.75	159.79	226.81	344.72
30 Nov 1986	307.10	311.86	280.49	236.66	280.56	253.68	240.74	234.01	240.74	317.62	273.72	279.02	330.68	287.53	257.15	446.32	163.44	227.73	345.17
31 Oct 1986	305.28	301.62	289.96	304.92	274.08	253.86	250.31	304.92	250.31	291.27	272.05	305.65	275.46	287.48	261.89	448.24	169.74	228.58	318.14
30 Sep 1986	311.78	313.23	301.16	326.24	273.06	251.73	240.55	326.24	230.73	275.66	304.99	302.03	315.73	254.93	268.97	434.48	187.18	229.51	321.20
31 Aug 1986	316.16	321.93	280.25	283.17	279.18	253.77	226.62	271.92	226.62	374.23	256.10	331.44	329.08	292.40	244.13	463.06	192.68	230.48	324.84
31 Jul 1986	303.86	290.24	296.96	307.40	281.06	269.10	264.09	307.40	260.16	269.77	258.23	295.38	290.31	258.65	266.98	422.09	162.26	231.29	308.53
30 Jun 1986	299.79	286.41	283.06	245.35	276.14	265.99	270.23	248.33	270.23	275.36	253.54	265.07	314.11	266.97	269.20	424.48	153.06	231.65	308.28
31 May 1986	274.28	271.20	235.12	198.39	250.66	229.10	233.98	191.94	233.98	279.93	233.25	237.19	301.38	254.65	235.85	384.25	146.95	231.52	259.17
30 Apr 1986	261.10	244.96	231.01	233.16	242.18	230.29	220.92	233.16	220.92	244.33	256.70	243.51	234.90	245.83	238.79	357.66	152.88	231.15	248.82
31 Mar 1986	279.77	277.64	264.12	271.57	247.30	228.61	221.41	271.57	212.37	248.27	266.34	260.04	283.10	235.61	242.79	366.02	168.91	230.66	271.02
28 Feb 1986	288.75	286.37	246.87	237.29	256.95	238.14	222.09	227.86	222.09	344.64	239.74	290.85	295.99	263.34	233.78	391.93	181.24	229.95	275.67
31 Jan 1986	288.12	271.68	273.99	275.68	274.02	263.72	262.80	275.68	262.80	256.84	248.31	271.29	272.87	246.48	261.65	375.97	157.05	228.91	280.85
31 Dec 1985	253.29	236.93	236.07	214.84	235.85	236.13	241.40	217.45	241.40	230.26	226.22	226.82	249.57	219.34	238.97	339.34	133.03	227.48	226.87
30 Nov 1985	241.14	234.20	205.11	170.47	222.15	206.10	212.27	164.93	212.27	248.35	209.52	207.08	252.11	228.09	212.90	323.35	129.93	225.74	211.85
31 Oct 1985	213.11	193.61	183.32	184.96	200.61	192.64	185.55	184.96	185.55	185.08	205.02	188.74	195.95	210.73	195.61	293.62	124.53	223.73	186.20
30 Sep 1985	225.07	214.27	205.50	209.14	205.94	185.64	184.18	209.14	176.66	187.63	223.61	198.36	231.87	185.76	202.92	286.44	139.82	221.46	186.24
31 Aug 1985	222.42	215.51	190.74	183.34	203.69	187.43	176.07	176.06	176.07	252.56	187.32	218.95	221.79	210.53	184.00	293.45	142.34	219.17	193.57
31 Jul 1985	226.16	207.46	208.43	209.27	219.65	210.03	201.37	209.27	201.37	193.38	200.91	204.06	221.30	193.09	205.91	294.36	127.41	216.73	190.02
30 Jun 1985	251.90	234.50	227.62	209.08	235.23	231.14	248.12	211.62	248.12	226.85	211.10	223.55	252.72	217.22	233.93	331.74	133.27	214.19	214.21
31 May 1985	263.30	255.01	218.32	180.11	243.54	231.45	241.03	174.26	241.03	278.69	231.73	225.63	269.51	240.83	238.63	340.68	141.84	211.37	233.89
30 Apr 1985	265.29	237.88	211.68	215.86	252.92	242.19	239.29	215.86	239.29	225.06	248.97	224.74	249.63	274.92	244.70	348.10	157.52	208.35	246.86
31 Mar 1985	246.37	226.19	221.59	225.52	228.21	210.96	211.62	225.52	202.98	205.67	243.26	215.64	244.14	206.19	225.50	307.14	155.70	205.24	234.13
28 Feb 1985	225.71	214.66	199.71	193.00	208.83	194.89	186.53	185.34	186.53	243.73	193.22	220.92	217.64	211.19	191.32	288.35	145.81	202.13	196.57
31 Jan 1985	240.18	216.19	223.25	231.62	236.47	232.55	228.00	231.62	228.00	197.06	209.04	218.09	226.72	206.76	223.47	314.63	133.97	199.12	217.67
31 Dec 1984	254.84	233.62	224.73	207.89	240.35	235.29	262.31	210.41	262.31	229.86	205.78	224.42	255.62	221.08	236.06	334.09	135.35	196.14	222.78

Date at end of 5-year period	All funds (average)	Winners (>mean)	Winners (>2%)	Winners (>5%)	Losers (<mean)	Losers (< -2%)	Losers (< -5%)	Top Fund Switching	Bottom Fund Switching	Second Best	Second Worst	Quartile 1	Quartile 2	Quartile 3	Quartile 4	Hindsight best case	Hindsight worst case	3 month NCDs	ALSI after costs
31 Dec 1999	-0.0569	-0.0187	-0.0098	0.0139	-0.0854	-0.0903	-0.1037	0.0166	-0.0863	0.0108	-0.0840	0.0015	-0.0506	-0.0891	-0.0902	0.2159	-0.2754	0.0000	-0.0865
30 Nov 1999	-0.0870	-0.0531	-0.0397	-0.0160	-0.1099	-0.1199	-0.1283	0.0145	-0.0695	0.0144	-0.1608	-0.0447	-0.0692	-0.1131	-0.1196	0.2476	-0.2867	0.0000	-0.1158
31 Oct 1999	-0.1028	-0.0636	-0.0581	-0.0388	-0.1355	-0.1274	-0.0994	-0.0090	-0.0852	-0.1210	-0.1088	-0.0559	-0.0794	-0.1481	-0.1283	0.2318	-0.3344	0.0000	-0.1288
30 Sep 1999	-0.1152	-0.0889	-0.0772	-0.0809	-0.1340	-0.1418	-0.1511	-0.0642	-0.1281	-0.0907	-0.1610	-0.0812	-0.0961	-0.1434	-0.1360	0.1685	-0.3225	0.0000	-0.1378
31 Aug 1999	-0.1065	-0.0846	-0.0549	-0.0432	-0.1224	-0.1359	-0.1352	-0.0459	-0.1068	-0.0772	-0.1661	-0.0555	-0.1107	-0.1218	-0.1344	0.1970	-0.3461	0.0000	-0.1413
31 Jul 1999	-0.0812	-0.0552	-0.0369	-0.0053	-0.0957	-0.1121	-0.0718	-0.0440	-0.0563	-0.0022	-0.1114	-0.0320	-0.0796	-0.0906	-0.1187	0.2067	-0.2806	0.0000	-0.1270
30 Jun 1999	-0.0651	-0.0347	-0.0232	0.0019	-0.0870	-0.0939	-0.1139	-0.0042	-0.0796	0.0040	-0.0677	-0.0123	-0.0626	-0.0898	-0.0954	0.2006	-0.2808	0.0000	-0.1163
31 May 1999	-0.0830	-0.0601	-0.0418	-0.0144	-0.1006	-0.1081	-0.1136	-0.0075	-0.0783	0.0144	-0.1288	-0.0461	-0.0778	-0.0996	-0.1062	0.2261	-0.2605	0.0000	-0.1380
30 Apr 1999	-0.0561	-0.0190	-0.0092	0.0081	-0.0867	-0.0778	-0.0646	0.0635	-0.0550	-0.0748	-0.0690	-0.0098	-0.0429	-0.0922	-0.0832	0.2878	-0.2743	0.0000	-0.1152
31 Mar 1999	-0.0454	-0.0147	-0.0020	0.0015	-0.0675	-0.0851	-0.0988	0.0297	-0.1192	-0.0425	-0.1104	-0.0034	-0.0301	-0.0653	-0.0852	0.2389	-0.2506	0.0000	-0.1203
28 Feb 1999	-0.0572	-0.0310	0.0008	0.0317	-0.0785	-0.0980	-0.1169	0.0331	-0.0751	-0.0139	-0.1396	-0.0031	-0.0629	-0.0687	-0.0971	0.2689	-0.2909	0.0000	-0.1355
31 Jan 1999	-0.0561	-0.0316	-0.0178	0.0283	-0.0692	-0.0932	-0.0573	0.0008	-0.0405	0.0153	-0.1178	-0.0152	-0.0526	-0.0628	-0.0925	0.2483	-0.2536	0.0000	-0.1342
31 Dec 1998	-0.0757	-0.0440	-0.0240	0.0160	-0.1020	-0.0992	-0.1226	0.0162	-0.1072	-0.0003	-0.0507	-0.0197	-0.0731	-0.1065	-0.1040	0.2084	-0.2942	0.0000	-0.1588
30 Nov 1998	-0.0368	-0.0196	-0.0016	0.0258	-0.0512	-0.0542	-0.0656	0.0265	-0.0335	0.0393	-0.1037	-0.0091	-0.0335	-0.0517	-0.0550	0.2700	-0.2352	0.0000	-0.0983
31 Oct 1998	-0.0065	0.0274	0.0491	0.0714	-0.0366	-0.0278	-0.0292	0.1189	-0.0236	-0.0328	-0.0114	0.0394	-0.0008	-0.0345	-0.0388	0.3415	-0.2222	0.0000	-0.0712
30 Sep 1998	-0.0319	0.0036	0.0247	0.0482	-0.0591	-0.0747	-0.0798	0.0836	-0.0998	-0.0242	-0.0954	0.0127	-0.0113	-0.0582	-0.0767	0.2740	-0.2312	0.0000	-0.0971
31 Aug 1998	-0.0397	-0.0075	0.0244	0.0689	-0.0678	-0.0876	-0.1055	0.0895	-0.0726	-0.0039	-0.1248	0.0214	-0.0442	-0.0594	-0.0864	0.2869	-0.2499	0.0000	-0.1211
31 Jul 1998	0.1005	0.1473	0.1697	0.2158	0.0635	0.0307	0.0977	0.2155	0.1099	0.2038	-0.0314	0.1675	0.1206	0.0771	0.0302	0.4636	-0.1985	0.0000	-0.0469
30 Jun 1998	0.0876	0.1414	0.1695	0.2187	0.0382	0.0429	0.0185	0.2527	0.0258	0.1832	0.0884	0.1674	0.1021	0.0352	0.0332	0.4008	-0.2053	0.0000	-0.0499
31 May 1998	0.1458	0.1834	0.2166	0.2843	0.1142	0.1046	0.0875	0.2772	0.1317	0.2744	0.0081	0.2155	0.1457	0.1192	0.1007	0.4714	-0.1697	0.0000	-0.0027
30 Apr 1998	0.1812	0.2425	0.2692	0.2993	0.1305	0.1412	0.1406	0.3494	0.1546	0.1617	0.1552	0.2520	0.2089	0.1231	0.1321	0.5204	-0.1333	0.0000	0.0493
31 Mar 1998	0.1565	0.2143	0.2380	0.2476	0.1115	0.0940	0.0900	0.2545	0.0556	0.1658	0.0704	0.2291	0.1724	0.1193	0.0938	0.4204	-0.1446	0.0000	0.0380
28 Feb 1998	0.1378	0.1816	0.2290	0.2809	0.0979	0.0757	0.0741	0.2660	0.1304	0.2051	0.0313	0.2223	0.1275	0.1048	0.0790	0.4401	-0.1929	0.0000	0.0302
31 Jan 1998	0.0982	0.1314	0.1428	0.1794	0.0680	0.0524	0.0334	0.1706	0.0619	0.1368	0.0291	0.1406	0.1110	0.0781	0.0597	0.5134	-0.2137	0.0000	0.0005
31 Dec 1997	0.0933	0.1353	0.1610	0.2053	0.0529	0.0513	-0.0105	0.2263	0.0097	0.1670	0.0391	0.1498	0.1083	0.0633	0.0389	0.4309	-0.2129	0.0000	0.0007
30 Nov 1997	0.1226	0.1541	0.1733	0.2512	0.0947	0.0826	0.0746	0.2470	0.0918	0.2735	0.0276	0.1783	0.1200	0.1047	0.0801	0.4828	-0.1967	0.0000	0.0171
31 Oct 1997	0.1509	0.2071	0.2355	0.2539	0.1035	0.1109	0.1157	0.3323	0.1284	0.1250	0.0920	0.2152	0.1717	0.1052	0.0974	0.4756	-0.1715	0.0000	0.0550
30 Sep 1997	0.1580	0.2145	0.2266	0.2345	0.1129	0.0770	0.0735	0.2562	0.0219	0.1691	0.0940	0.2210	0.1806	0.1348	0.0792	0.4297	-0.1572	0.0000	0.0627
31 Aug 1997	0.1903	0.2283	0.2676	0.3192	0.1516	0.1198	0.0904	0.2795	0.1409	0.2492	0.1067	0.2636	0.1828	0.1659	0.1234	0.5106	-0.1524	0.0000	0.0810
31 Jul 1997	0.1729	0.2043	0.2163	0.2404	0.1386	0.1293	0.0771	0.2333	0.1042	0.1802	0.1730	0.2014	0.1988	0.1404	0.1370	0.5952	-0.1417	0.0000	0.0568
30 Jun 1997	0.1372	0.1664	0.1537	0.1864	0.1062	0.0955	0.0547	0.1849	0.0694	0.1974	0.0715	0.1857	0.1401	0.1241	0.0813	0.4520	-0.1658	0.0000	0.0301
31 May 1997	0.1025	0.1272	0.1621	0.2115	0.0798	0.0773	0.0441	0.2159	0.0297	0.2308	0.0402	0.1627	0.0838	0.0895	0.0665	0.4561	-0.1975	0.0000	0.0031
30 Apr 1997	0.1301	0.1807	0.2142	0.2285	0.0878	0.0972	0.0509	0.3010	0.0631	0.1498	0.0445	0.1905	0.1399	0.1023	0.0746	0.4297	-0.1802	0.0000	0.0368
31 Mar 1997	0.1117	0.1442	0.1648	0.1922	0.0832	0.0521	0.0288	0.2518	0.0016	0.1079	0.0826	0.1504	0.1252	0.1101	0.0468	0.3899	-0.1815	0.0000	0.0253
28 Feb 1997	0.1056	0.1282	0.1553	0.2273	0.0791	0.0576	0.0382	0.2356	0.0524	0.1441	0.0513	0.1550	0.0976	0.0954	0.0570	0.4095	-0.1981	0.0000	0.0235
31 Jan 1997	0.0853	0.1132	0.1312	0.1665	0.0570	0.0608	0.0140	0.1789	0.0276	0.0937	0.1212	0.1150	0.0919	0.0489	0.0727	0.4678	-0.1953	0.0000	-0.0012

Date at end of 5-year period	All funds (average)	Winners (>mean)	Winners (>2%)	Winners (>5%)	Losers (<mean)	Losers (< -2%)	Losers (< -5%)	Top Fund Switching	Bottom Fund Switching	Second Best	Second Worst	Quartile 1	Quartile 2	Quartile 3	Quartile 4	Hindsight best case	Hindsight worst case	3 month NCDs	ALSI after costs
31 Dec 1996	0.0972	0.1231	0.1140	0.1515	0.0679	0.0581	0.0442	0.1587	0.0590	0.1499	0.0357	0.1390	0.1017	0.0871	0.0459	0.3695	-0.1634	0.0000	0.0149
30 Nov 1996	0.0951	0.1122	0.1410	0.1822	0.0772	0.0846	0.0556	0.1859	0.0484	0.2192	0.0297	0.1419	0.0708	0.0805	0.0760	0.4007	-0.1852	0.0000	0.0075
31 Oct 1996	0.1063	0.1423	0.1766	0.1899	0.0727	0.0777	0.0526	0.2415	0.0649	0.1271	0.0199	0.1513	0.1113	0.0940	0.0574	0.3774	-0.1738	0.0000	0.0229
30 Sep 1996	0.1258	0.1501	0.1630	0.1929	0.1025	0.0658	0.0407	0.2400	0.0141	0.1351	0.0776	0.1523	0.1398	0.1349	0.0629	0.3834	-0.1594	0.0000	0.0415
31 Aug 1996	0.1035	0.1289	0.1510	0.2184	0.0746	0.0497	0.0165	0.2303	0.0305	0.1058	0.0364	0.1436	0.1112	0.0976	0.0450	0.4089	-0.1880	0.0000	0.0258
31 Jul 1996	0.0927	0.1185	0.1323	0.1468	0.0650	0.0658	0.0177	0.1576	0.0448	0.1063	0.1161	0.1113	0.1030	0.0667	0.0764	0.4476	-0.1781	0.0000	0.0065
30 Jun 1996	0.1335	0.1538	0.1411	0.1722	0.1083	0.1011	0.0931	0.1967	0.1100	0.1944	0.0806	0.1677	0.1361	0.1203	0.0903	0.3691	-0.1288	0.0000	0.0399
31 May 1996	0.1443	0.1629	0.1930	0.2153	0.1252	0.1320	0.1016	0.2304	0.0930	0.2387	0.0426	0.1933	0.1172	0.1277	0.1232	0.4226	-0.1383	0.0000	0.0573
30 Apr 1996	0.1611	0.1945	0.2199	0.2258	0.1279	0.1331	0.1138	0.2741	0.1197	0.1499	0.0692	0.2021	0.1645	0.1507	0.1112	0.4102	-0.1254	0.0000	0.0747
31 Mar 1996	0.1675	0.1869	0.2036	0.2224	0.1453	0.1088	0.0821	0.2701	0.0552	0.1418	0.0959	0.1963	0.1744	0.1763	0.1058	0.4178	-0.1206	0.0000	0.0807
29 Feb 1996	0.1866	0.2139	0.2369	0.2937	0.1512	0.1313	0.1090	0.3024	0.1319	0.1825	0.1131	0.2325	0.1891	0.1706	0.1278	0.4755	-0.1017	0.0000	0.0871
31 Jan 1996	0.2317	0.2504	0.2663	0.2729	0.2026	0.2061	0.1556	0.2900	0.2119	0.2089	0.2101	0.2534	0.2258	0.2047	0.2114	0.5889	-0.0535	0.0000	0.1255
31 Dec 1995	0.1770	0.1938	0.1898	0.2231	0.1500	0.1484	0.1518	0.2477	0.1669	0.2293	0.1276	0.2143	0.1731	0.1647	0.1297	0.4019	-0.0896	0.0000	0.0701
30 Nov 1995	0.1820	0.1984	0.2282	0.2506	0.1628	0.1649	0.1543	0.2663	0.1450	0.2608	0.0759	0.2293	0.1572	0.1664	0.1560	0.4385	-0.0857	0.0000	0.0703
31 Oct 1995	0.1682	0.1970	0.2234	0.2067	0.1378	0.1410	0.1117	0.2542	0.1171	0.1462	0.0923	0.2026	0.1675	0.1559	0.1265	0.4067	-0.0984	0.0000	0.0500
30 Sep 1995	0.1410	0.1605	0.1806	0.1846	0.1155	0.0858	0.0597	0.2302	0.0352	0.1366	0.0784	0.1685	0.1565	0.1413	0.0831	0.3788	-0.1311	0.0000	0.0314
31 Aug 1995	0.1007	0.1292	0.1407	0.2069	0.0675	0.0427	-0.0177	0.2141	0.0050	0.1044	0.0449	0.1429	0.1214	0.0715	0.0485	0.3916	-0.1788	0.0000	-0.0060
31 Jul 1995	0.0663	0.0907	0.1043	0.1081	0.0394	0.0334	-0.0440	0.1195	0.0132	0.0732	0.0626	0.0981	0.0653	0.0562	0.0368	0.3860	-0.2044	0.0000	-0.0302
30 Jun 1995	0.0752	0.0968	0.0998	0.1281	0.0469	0.0484	0.0681	0.1436	0.0839	0.1346	0.0336	0.1162	0.0775	0.0704	0.0244	0.2971	-0.1763	0.0000	-0.0245
31 May 1995	0.0699	0.0785	0.1076	0.1215	0.0602	0.0651	0.0591	0.1393	0.0527	0.1560	-0.0246	0.1101	0.0529	0.0498	0.0575	0.3210	-0.1947	0.0000	-0.0340
30 Apr 1995	0.0858	0.1084	0.1272	0.1189	0.0649	0.0642	0.0496	0.1694	0.0542	0.0743	-0.0012	0.1072	0.0831	0.0836	0.0570	0.3173	-0.1809	0.0000	-0.0183
31 Mar 1995	0.0429	0.0562	0.0705	0.0841	0.0296	0.0042	-0.0150	0.1317	-0.0424	0.0288	0.0023	0.0615	0.0578	0.0378	0.0074	0.2827	-0.2153	0.0000	-0.0538
28 Feb 1995	0.0490	0.0776	0.0870	0.1411	0.0173	-0.0052	-0.0633	0.1600	-0.0434	0.0491	-0.0027	0.0903	0.0693	0.0271	-0.0004	0.3253	-0.2107	0.0000	-0.0459
31 Jan 1995	0.0405	0.0685	0.0702	0.0977	0.0095	0.0047	-0.0705	0.1006	-0.0164	0.0367	0.0420	0.0725	0.0479	0.0318	0.0052	0.3472	-0.2136	0.0000	-0.0639
31 Dec 1994	0.1124	0.1347	0.1352	0.1440	0.0805	0.0873	0.1152	0.1404	0.1329	0.1743	0.0738	0.1533	0.1252	0.0841	0.0667	0.3162	-0.1537	0.0000	0.0039
30 Nov 1994	0.1279	0.1386	0.1680	0.1549	0.1114	0.1197	0.1205	0.1692	0.1196	0.1895	0.0215	0.1646	0.1245	0.0945	0.1109	0.3664	-0.1757	0.0000	0.0095
31 Oct 1994	0.1368	0.1623	0.1801	0.1747	0.1075	0.1085	0.0820	0.2089	0.0844	0.1331	0.0690	0.1545	0.1487	0.1247	0.1016	0.3609	-0.1499	0.0000	0.0257
30 Sep 1994	0.1058	0.1225	0.1335	0.1474	0.0859	0.0511	0.0150	0.1828	-0.0209	0.1051	0.0956	0.1313	0.1201	0.0957	0.0603	0.3412	-0.1813	0.0000	0.0130
31 Aug 1994	0.1094	0.1360	0.1364	0.1851	0.0768	0.0431	-0.0267	0.1883	-0.0171	0.1003	0.0559	0.1410	0.1354	0.0923	0.0552	0.3761	-0.1596	0.0000	0.0185
31 Jul 1994	0.1097	0.1306	0.1276	0.1459	0.0767	0.0630	-0.0181	0.1344	0.0283	0.0965	0.0702	0.1298	0.1171	0.1048	0.0778	0.4048	-0.1454	0.0000	0.0196
30 Jun 1994	0.1007	0.1293	0.1209	0.1374	0.0605	0.0764	0.0973	0.1210	0.1024	0.1474	0.0911	0.1375	0.1277	0.0603	0.0604	0.2979	-0.1752	0.0000	0.0092
31 May 1994	0.1278	0.1435	0.1659	0.1312	0.1090	0.1180	0.1408	0.1195	0.1532	0.1820	0.0359	0.1593	0.1412	0.0697	0.1216	0.3531	-0.1775	0.0000	0.0370
30 Apr 1994	0.0925	0.1028	0.1203	0.1076	0.0776	0.0765	0.0741	0.1147	0.0902	0.0695	0.0500	0.0977	0.0990	0.0799	0.0817	0.2943	-0.1778	0.0000	0.0077
31 Mar 1994	0.0744	0.0824	0.0936	0.0944	0.0593	0.0340	0.0118	0.1067	-0.0010	0.0902	0.0827	0.0905	0.0876	0.0551	0.0505	0.2734	-0.1715	0.0000	-0.0123
28 Feb 1994	0.0879	0.1072	0.1003	0.1170	0.0627	0.0300	-0.0055	0.1210	-0.0045	0.0576	0.0569	0.1015	0.1199	0.0728	0.0447	0.3166	-0.1464	0.0000	0.0132
31 Jan 1994	0.0951	0.1065	0.1024	0.1087	0.0717	0.0582	-0.0046	0.0974	0.0401	0.0809	0.0714	0.1134	0.0908	0.1053	0.0652	0.3430	-0.1467	0.0000	0.0238

Date at end of 5-year period	All funds (average)	Winners (>mean)	Winners (>2%)	Winners (>5%)	Losers (<mean)	Losers (< -2%)	Losers (< -5%)	Top Fund Switching	Bottom Fund Switching	Second Best	Second Worst	Quartile 1	Quartile 2	Quartile 3	Quartile 4	Hindsight best case	Hindsight worst case	3 month NCDs	ALSI after costs
31 Dec 1993	0.1233	0.1464	0.1202	0.1224	0.0923	0.0938	0.1250	0.1068	0.1289	0.1583	0.0690	0.1456	0.1563	0.0894	0.0848	0.2909	-0.1368	0.0000	0.0566
30 Nov 1993	0.0948	0.1078	0.1241	0.0799	0.0794	0.0909	0.1171	0.0672	0.1304	0.1273	0.0269	0.1165	0.1152	0.0348	0.0950	0.3056	-0.1716	0.0000	0.0110
31 Oct 1993	0.0713	0.0824	0.0816	0.0637	0.0560	0.0568	0.0604	0.0715	0.0906	0.0520	0.0054	0.0708	0.0865	0.0582	0.0606	0.2704	-0.1835	0.0000	-0.0113
30 Sep 1993	0.0770	0.0851	0.0849	0.0456	0.0610	0.0300	-0.0146	0.0669	-0.0197	0.1055	0.0580	0.0920	0.0959	0.0528	0.0509	0.2664	-0.1614	0.0000	-0.0034
31 Aug 1993	0.1174	0.1385	0.1304	0.1449	0.0872	0.0497	0.0067	0.1427	0.0035	0.1177	0.0798	0.1379	0.1527	0.0963	0.0635	0.3708	-0.1264	0.0000	0.0432
31 Jul 1993	0.1099	0.1235	0.1198	0.1317	0.0828	0.0687	-0.0118	0.1120	0.0184	0.1128	0.0609	0.1328	0.1034	0.1189	0.0734	0.3623	-0.1394	0.0000	0.0381
30 Jun 1993	0.1173	0.1441	0.1154	0.1160	0.0794	0.0735	0.0890	0.1030	0.0934	0.1490	0.0410	0.1404	0.1607	0.0883	0.0628	0.2986	-0.1492	0.0000	0.0411
31 May 1993	0.1246	0.1371	0.1473	0.1081	0.1074	0.1138	0.1250	0.1133	0.1216	0.1720	0.0736	0.1394	0.1526	0.0678	0.1179	0.3219	-0.1702	0.0000	0.0497
30 Apr 1993	0.1186	0.1315	0.1430	0.1244	0.0974	0.0998	0.0743	0.1280	0.0936	0.1411	0.0894	0.1376	0.1037	0.1021	0.1013	0.3165	-0.1772	0.0000	0.0426
31 Mar 1993	0.1058	0.1129	0.0992	0.1095	0.0878	0.0522	0.0268	0.1299	0.0239	0.0840	0.0552	0.1191	0.1248	0.0879	0.0697	0.3021	-0.1720	0.0000	0.0118
28 Feb 1993	0.1298	0.1286	0.1292	0.1478	0.1089	0.0750	0.0337	0.1844	0.0257	0.0949	0.0847	0.1301	0.1675	0.1135	0.0903	0.3639	-0.1294	0.0000	0.0322
31 Jan 1993	0.1280	0.1302	0.1230	0.1648	0.1047	0.0973	0.0358	0.1563	0.0506	0.0913	0.0874	0.1354	0.1239	0.1286	0.1013	0.3494	-0.1392	0.0000	0.0241
31 Dec 1992	0.0758	0.0941	0.0716	0.0489	0.0440	0.0427	0.0641	0.0459	0.0699	0.1163	0.0143	0.0814	0.1223	0.0467	0.0350	0.2386	-0.1944	0.0000	-0.0373
30 Nov 1992	0.0505	0.0559	0.0521	0.0317	0.0407	0.0519	0.0626	0.0352	0.0616	0.0554	0.0232	0.0431	0.0899	-0.0036	0.0542	0.2429	-0.2377	0.0000	-0.0591
31 Oct 1992	-0.0093	-0.0147	-0.0082	-0.0187	-0.0121	-0.0136	-0.0413	-0.0183	-0.0187	-0.0172	-0.0292	-0.0096	-0.0056	-0.0221	-0.0092	0.2023	-0.2837	0.0000	-0.0919
30 Sep 1992	-0.0754	-0.0765	-0.0862	-0.0902	-0.0776	-0.0907	-0.1118	-0.0744	-0.1027	-0.0975	-0.0767	-0.0719	-0.0533	-0.1054	-0.0704	0.0973	-0.2590	0.0000	-0.1341
31 Aug 1992	-0.0774	-0.0728	-0.0633	-0.0359	-0.0905	-0.1033	-0.1392	-0.0089	-0.1422	-0.0973	-0.0662	-0.0637	-0.0445	-0.0938	-0.0921	0.1130	-0.2652	0.0000	-0.1407
31 Jul 1992	-0.0440	-0.0200	-0.0287	0.0130	-0.0568	-0.0682	-0.1079	0.0073	-0.0908	-0.0650	-0.0665	-0.0216	-0.0494	-0.0368	-0.0642	0.1225	-0.2429	0.0000	-0.1122
30 Jun 1992	0.0018	0.0255	0.0310	0.0142	-0.0232	-0.0192	-0.0084	0.0249	-0.0222	0.0228	-0.0106	0.0165	0.0323	-0.0181	-0.0286	0.1394	-0.2004	0.0000	-0.0607
31 May 1992	0.0071	0.0172	0.0078	-0.0057	0.0004	0.0056	0.0155	0.0052	-0.0007	0.0065	-0.0018	0.0035	0.0449	-0.0417	0.0106	0.1555	-0.2100	0.0000	-0.0541
30 Apr 1992	-0.0049	0.0018	0.0129	0.0148	-0.0162	-0.0205	-0.0548	0.0155	-0.0373	-0.0072	-0.0206	0.0129	-0.0079	-0.0237	-0.0152	0.1752	-0.2155	0.0000	-0.0755
31 Mar 1992	0.0247	0.0377	0.0223	0.0200	0.0113	-0.0053	-0.0196	0.0435	-0.0121	0.0014	0.0056	0.0406	0.0426	-0.0286	0.0212	0.1919	-0.1563	0.0000	-0.0444
29 Feb 1992	0.0444	0.0517	0.0587	0.0755	0.0206	0.0051	-0.0497	0.1028	-0.0541	0.0312	0.0393	0.0618	0.0731	0.0160	0.0186	0.2245	-0.1463	0.0000	-0.0311
31 Jan 1992	0.0567	0.0725	0.0618	0.0994	0.0458	0.0309	-0.0344	0.0934	-0.0203	0.0197	0.0391	0.0695	0.0488	0.0663	0.0356	0.2267	-0.1524	0.0000	-0.0330
31 Dec 1991	0.0613	0.0814	0.0877	0.0800	0.0376	0.0409	0.0276	0.0885	0.0110	0.0626	0.0614	0.0745	0.0861	0.0382	0.0322	0.2018	-0.1596	0.0000	-0.0244
30 Nov 1991	0.0689	0.0741	0.0683	0.0688	0.0648	0.0730	0.0997	0.0779	0.0781	0.0459	0.0429	0.0640	0.0975	0.0134	0.0775	0.2288	-0.1532	0.0000	-0.0175
31 Oct 1991	0.0782	0.0827	0.0948	0.1056	0.0654	0.0638	0.0179	0.1082	0.0540	0.0644	0.0407	0.0967	0.0658	0.0569	0.0667	0.2561	-0.1484	0.0000	-0.0035
30 Sep 1991	0.0569	0.0736	0.0569	0.0707	0.0405	0.0280	0.0383	0.0921	0.0447	0.0198	0.0116	0.0762	0.0667	0.0027	0.0532	0.2211	-0.1367	0.0000	-0.0225
31 Aug 1991	0.0703	0.0740	0.0835	0.1219	0.0487	0.0391	-0.0152	0.1465	-0.0200	0.0555	0.0733	0.0905	0.0803	0.0442	0.0547	0.2426	-0.1287	0.0000	-0.0089
31 Jul 1991	0.1108	0.1260	0.1295	0.1628	0.0985	0.0823	0.0121	0.1577	0.0162	0.0632	0.0843	0.1249	0.1024	0.1222	0.0820	0.2834	-0.1033	0.0000	0.0399
30 Jun 1991	0.1060	0.1300	0.1376	0.1340	0.0776	0.0831	0.0585	0.1357	0.0386	0.1049	0.1016	0.1243	0.1247	0.0759	0.0755	0.2428	-0.1139	0.0000	0.0457
31 May 1991	0.0987	0.1087	0.0994	0.1007	0.0933	0.0978	0.1056	0.1146	0.0842	0.0720	0.0776	0.0952	0.1255	0.0515	0.0978	0.2562	-0.1270	0.0000	0.0458
30 Apr 1991	0.1139	0.1274	0.1434	0.1605	0.0931	0.0880	0.0499	0.1635	0.0846	0.1006	0.0606	0.1413	0.0984	0.0950	0.0906	0.2930	-0.1203	0.0000	0.0516
31 Mar 1991	0.0827	0.0997	0.0807	0.1112	0.0668	0.0519	0.0632	0.1270	0.0690	0.0442	0.0506	0.1041	0.0902	0.0259	0.0775	0.2402	-0.1034	0.0000	0.0203
28 Feb 1991	0.0829	0.0871	0.0963	0.1382	0.0626	0.0456	-0.0183	0.1611	-0.0292	0.0476	0.0896	0.1012	0.0954	0.0704	0.0549	0.2533	-0.1127	0.0000	0.0269
31 Jan 1991	0.0716	0.0921	0.0952	0.1275	0.0510	0.0350	-0.0279	0.1226	-0.0419	0.0218	0.0648	0.0858	0.0720	0.0858	0.0364	0.2428	-0.1309	0.0000	0.0041

Date at end of 5-year period	All funds (average)	Winners (>mean)	Winners (>2%)	Winners (>5%)	Losers (<mean)	Losers (< -2%)	Losers (< -5%)	Top Fund Switching	Bottom Fund Switching	Second Best	Second Worst	Quartile 1	Quartile 2	Quartile 3	Quartile 4	Hindsight best case	Hindsight worst case	3 month NCDs	ALSI after costs
31 Dec 1990	0.0920	0.1182	0.1182	0.0997	0.0654	0.0554	0.0339	0.1023	0.0156	0.0762	0.0720	0.0980	0.1261	0.0681	0.0546	0.2361	-0.1161	0.0000	0.0353
30 Nov 1990	0.0800	0.0937	0.0745	0.0743	0.0725	0.0719	0.0721	0.0890	0.0525	0.0520	0.0546	0.0694	0.1248	0.0317	0.0682	0.2406	-0.1363	0.0000	0.0286
31 Oct 1990	0.0991	0.1144	0.1264	0.1441	0.0776	0.0701	0.0323	0.1469	0.0674	0.1063	0.0483	0.1309	0.0888	0.0764	0.0694	0.2693	-0.1305	0.0000	0.0527
30 Sep 1990	0.1001	0.1220	0.0995	0.1421	0.0774	0.0647	0.0686	0.1573	0.0744	0.0631	0.0581	0.1307	0.1020	0.0454	0.0828	0.2615	-0.0937	0.0000	0.0667
31 Aug 1990	0.1292	0.1405	0.1432	0.1763	0.0954	0.0866	0.0312	0.2001	0.0199	0.1030	0.1222	0.1510	0.1484	0.1042	0.0884	0.2986	-0.0633	0.0000	0.0974
31 Jul 1990	0.1632	0.1902	0.1918	0.2403	0.1304	0.1212	0.0801	0.2343	0.0643	0.1035	0.1219	0.1787	0.1639	0.1682	0.1216	0.3312	-0.0500	0.0000	0.1324
30 Jun 1990	0.1390	0.1659	0.1681	0.1422	0.1104	0.1074	0.0649	0.1475	0.0445	0.1179	0.1374	0.1480	0.1640	0.0979	0.1084	0.2761	-0.0685	0.0000	0.1124
31 May 1990	0.1486	0.1662	0.1569	0.1495	0.1336	0.1232	0.1167	0.1588	0.0943	0.1108	0.1153	0.1442	0.1824	0.1188	0.1190	0.3037	-0.0634	0.0000	0.1209
30 Apr 1990	0.1535	0.1719	0.2035	0.2102	0.1239	0.1200	0.0688	0.2086	0.1028	0.1558	0.1058	0.1978	0.1420	0.1126	0.1159	0.3302	-0.0718	0.0000	0.1183
31 Mar 1990	0.1908	0.2170	0.1945	0.2310	0.1584	0.1295	0.1298	0.2387	0.1377	0.1426	0.1407	0.2157	0.2078	0.1208	0.1586	0.3509	-0.0121	0.0000	0.1520
28 Feb 1990	0.1923	0.2036	0.1903	0.2200	0.1528	0.1441	0.0802	0.2341	0.0711	0.1813	0.1777	0.2125	0.2134	0.1573	0.1457	0.3649	-0.0077	0.0000	0.1609
31 Jan 1990	0.2052	0.2293	0.2353	0.2561	0.1711	0.1604	0.1105	0.2500	0.0956	0.1630	0.1663	0.2176	0.2049	0.2079	0.1602	0.3688	-0.0099	0.0000	0.1680
31 Dec 1989	0.1643	0.1895	0.1904	0.1694	0.1354	0.1293	0.0760	0.1742	0.0510	0.1477	0.1758	0.1732	0.1814	0.1289	0.1300	0.2924	-0.0420	0.0000	0.1398
30 Nov 1989	0.1331	0.1517	0.1405	0.1435	0.1178	0.0992	0.0937	0.1530	0.0736	0.1031	0.1027	0.1318	0.1617	0.1119	0.0994	0.2790	-0.0589	0.0000	0.1130
31 Oct 1989	0.1380	0.1558	0.1803	0.1881	0.1107	0.1020	0.0571	0.1865	0.0907	0.1437	0.0847	0.1823	0.1210	0.1039	0.0993	0.3039	-0.0654	0.0000	0.1093
30 Sep 1989	0.1616	0.1863	0.1609	0.1979	0.1304	0.1073	0.1201	0.2063	0.1280	0.1102	0.0986	0.1781	0.1863	0.0978	0.1298	0.3130	-0.0153	0.0000	0.1232
31 Aug 1989	0.1581	0.1744	0.1611	0.1937	0.1170	0.1126	0.0634	0.2077	0.0546	0.1609	0.1507	0.1859	0.1795	0.1153	0.1100	0.3229	-0.0307	0.0000	0.1205
31 Jul 1989	0.1629	0.1876	0.1997	0.2217	0.1366	0.1258	0.0839	0.2159	0.0692	0.1258	0.1556	0.1808	0.1606	0.1406	0.1301	0.3176	-0.0463	0.0000	0.1256
30 Jun 1989	0.1176	0.1379	0.1265	0.1032	0.0984	0.0810	0.0435	0.1091	0.0213	0.1217	0.1113	0.1223	0.1376	0.1016	0.0775	0.2381	-0.0606	0.0000	0.0909
31 May 1989	0.0893	0.1068	0.0962	0.1128	0.0793	0.0459	0.0312	0.1232	0.0149	0.0744	0.0567	0.0902	0.1190	0.0830	0.0454	0.2252	-0.0795	0.0000	0.0645
30 Apr 1989	0.0999	0.1239	0.1274	0.1396	0.0667	0.0492	0.0081	0.1404	0.0353	0.1202	0.0488	0.1448	0.0947	0.0720	0.0494	0.2659	-0.0925	0.0000	0.0816
31 Mar 1989	0.0895	0.1156	0.0983	0.1381	0.0609	0.0344	0.0486	0.1478	0.0532	0.0392	0.0344	0.1132	0.1116	0.0425	0.0539	0.2465	-0.0744	0.0000	0.0775
28 Feb 1989	0.0826	0.0962	0.0787	0.1187	0.0511	0.0499	0.0079	0.1321	0.0053	0.0944	0.0831	0.1108	0.0983	0.0517	0.0460	0.2430	-0.0864	0.0000	0.0563
31 Jan 1989	0.0947	0.1155	0.1308	0.1543	0.0757	0.0721	0.0345	0.1489	0.0206	0.0536	0.0980	0.1049	0.0987	0.0719	0.0759	0.2423	-0.0876	0.0000	0.0664
31 Dec 1988	0.0660	0.0853	0.0734	0.0503	0.0506	0.0404	-0.0050	0.0574	-0.0243	0.0713	0.0873	0.0685	0.0820	0.0541	0.0375	0.1879	-0.0975	0.0000	0.0420
30 Nov 1988	0.0692	0.0874	0.0723	0.0917	0.0592	0.0231	0.0124	0.1030	-0.0029	0.0493	0.0416	0.0691	0.1018	0.0683	0.0230	0.2063	-0.0924	0.0000	0.0518
31 Oct 1988	0.0860	0.1045	0.1021	0.1154	0.0577	0.0357	-0.0021	0.1154	0.0166	0.1194	0.0563	0.1263	0.0780	0.0631	0.0428	0.2428	-0.0980	0.0000	0.0782
30 Sep 1988	0.0445	0.0693	0.0485	0.0917	0.0214	-0.0086	0.0108	0.0983	0.0108	0.0025	0.0113	0.0629	0.0676	0.0109	0.0130	0.1923	-0.1003	0.0000	0.0311
31 Aug 1988	0.0247	0.0351	0.0204	0.0506	0.0021	0.0029	-0.0289	0.0681	-0.0289	0.0271	0.0225	0.0476	0.0385	0.0045	-0.0016	0.1778	-0.1244	0.0000	-0.0036
31 Jul 1988	0.0438	0.0606	0.0770	0.1044	0.0322	0.0277	-0.0146	0.1044	-0.0185	-0.0098	0.0735	0.0503	0.0481	0.0275	0.0324	0.1901	-0.1261	0.0000	0.0152
30 Jun 1988	0.0287	0.0435	0.0323	0.0056	0.0226	0.0173	-0.0110	0.0183	-0.0295	0.0328	0.0540	0.0290	0.0370	0.0183	0.0156	0.1586	-0.1223	0.0000	0.0076
31 May 1988	0.0210	0.0368	0.0205	0.0372	0.0167	-0.0082	-0.0022	0.0501	-0.0164	-0.0171	-0.0003	0.0180	0.0516	0.0095	-0.0076	0.1622	-0.1157	0.0000	-0.0023
30 Apr 1988	0.0282	0.0431	0.0292	0.0504	0.0089	-0.0083	-0.0098	0.0504	0.0084	0.0445	-0.0089	0.0514	0.0366	0.0075	0.0014	0.1871	-0.1181	0.0000	-0.0045
31 Mar 1988	0.0544	0.0763	0.0712	0.0916	0.0351	0.0095	0.0206	0.0982	0.0206	0.0476	0.0377	0.0760	0.0678	0.0139	0.0315	0.1921	-0.0593	0.0000	0.0294
29 Feb 1988	0.0340	0.0622	0.0420	0.0722	0.0004	0.0016	-0.0446	0.0640	-0.0446	0.0752	0.0309	0.0733	0.0430	0.0069	-0.0057	0.1836	-0.0957	0.0000	0.0085
31 Jan 1988	0.0314	0.0582	0.0860	0.0972	0.0171	-0.0022	-0.0484	0.0972	-0.0525	0.0194	0.0675	0.0616	0.0279	0.0098	0.0106	0.1729	-0.1096	0.0000	-0.0222

Date at end of 5-year period	All funds (average)	Winners (>mean)	Winners (>2%)	Winners (>5%)	Losers (<mean)	Losers (< -2%)	Losers (< -5%)	Top Fund Switching	Bottom Fund Switching	Second Best	Second Worst	Quartile 1	Quartile 2	Quartile 3	Quartile 4	Hindsight best case	Hindsight worst case	3 month NCDs	ALSI after costs
31 Dec 1987	0.0694	0.0987	0.0902	0.0871	0.0410	0.0296	-0.0029	0.1000	-0.0223	0.0798	0.0755	0.0992	0.0823	0.0436	0.0316	0.1953	-0.0704	0.0000	0.0359
30 Nov 1987	0.0894	0.1160	0.1144	0.1280	0.0669	0.0377	0.0339	0.1334	0.0176	0.0830	0.0471	0.1125	0.1157	0.0751	0.0371	0.2207	-0.0531	0.0000	0.0774
31 Oct 1987	0.1495	0.1825	0.1694	0.1941	0.1032	0.0879	0.0656	0.1941	0.0836	0.1638	0.0875	0.1938	0.1550	0.1147	0.0980	0.2869	-0.0161	0.0000	0.1148
30 Sep 1987	0.2793	0.3344	0.3238	0.3371	0.2190	0.1857	0.1870	0.3370	0.1691	0.2683	0.1976	0.3250	0.3116	0.2211	0.1945	0.3980	0.1028	0.0000	0.2167
31 Aug 1987	0.2960	0.3507	0.3197	0.3258	0.2334	0.2265	0.1740	0.3135	0.1740	0.3775	0.2197	0.3599	0.3081	0.2385	0.2150	0.4202	0.1194	0.0000	0.2473
31 Jul 1987	0.3064	0.3311	0.3688	0.3624	0.2751	0.2610	0.2270	0.3624	0.2232	0.2849	0.2539	0.3479	0.2908	0.2653	0.2612	0.4304	0.1000	0.0000	0.2696
30 Jun 1987	0.3009	0.3159	0.3132	0.3022	0.2701	0.2556	0.2028	0.2999	0.2028	0.2517	0.2752	0.3132	0.3162	0.2491	0.2577	0.4178	0.0926	0.0000	0.2723
31 May 1987	0.2842	0.3104	0.3006	0.2762	0.2567	0.2237	0.2080	0.2775	0.2080	0.2976	0.2093	0.2950	0.3132	0.2596	0.2196	0.4340	0.0730	0.0000	0.2443
30 Apr 1987	0.2474	0.2699	0.2519	0.2745	0.2086	0.1906	0.1710	0.2745	0.1898	0.2597	0.1794	0.2790	0.2486	0.2028	0.2059	0.3830	0.0520	0.0000	0.2170
31 Mar 1987	0.2304	0.2605	0.2531	0.2735	0.1840	0.1628	0.1598	0.2735	0.1439	0.1984	0.1767	0.2556	0.2555	0.1862	0.1721	0.3515	0.0548	0.0000	0.2035
28 Feb 1987	0.1590	0.1858	0.1533	0.1648	0.1216	0.1020	0.0639	0.1544	0.0639	0.2113	0.0986	0.1922	0.1868	0.1391	0.0890	0.3028	-0.0017	0.0000	0.1494
31 Jan 1987	0.1384	0.1490	0.1801	0.1870	0.1195	0.1058	0.0971	0.1870	0.0929	0.1208	0.0913	0.1652	0.1314	0.1339	0.1000	0.2780	-0.0402	0.0000	0.1290
31 Dec 1986	0.1099	0.1199	0.1121	0.0719	0.0899	0.0844	0.0685	0.0743	0.0685	0.0964	0.0903	0.0994	0.1452	0.0794	0.0851	0.2452	-0.0798	0.0000	0.1042
30 Nov 1986	0.1085	0.1308	0.1036	0.0441	0.0878	0.0582	0.0349	0.0448	0.0349	0.1431	0.0809	0.1013	0.1564	0.0994	0.0591	0.2484	-0.0894	0.0000	0.1035
31 Oct 1986	0.1048	0.1152	0.1111	0.1271	0.0836	0.0631	0.0522	0.1271	0.0522	0.1157	0.0881	0.1248	0.0969	0.1020	0.0765	0.2461	-0.0695	0.0000	0.0820
30 Sep 1986	0.1113	0.1300	0.1227	0.1437	0.0760	0.0574	0.0414	0.1437	0.0277	0.0874	0.1181	0.1226	0.1472	0.0651	0.0753	0.2482	-0.0411	0.0000	0.0834
31 Aug 1986	0.1139	0.1364	0.1044	0.1048	0.0794	0.0548	0.0167	0.0948	0.0167	0.1950	0.0573	0.1510	0.1425	0.0981	0.0401	0.2611	-0.0379	0.0000	0.0851
31 Jul 1986	0.1005	0.1056	0.1251	0.1352	0.0866	0.0800	0.0754	0.1352	0.0710	0.0911	0.0688	0.1214	0.1009	0.0743	0.0751	0.2399	-0.0774	0.0000	0.0730
30 Jun 1986	0.0951	0.0962	0.0964	0.0517	0.0809	0.0735	0.0758	0.0546	0.0758	0.0769	0.0596	0.0771	0.1318	0.0737	0.0729	0.2328	-0.1023	0.0000	0.0724
31 May 1986	0.0630	0.0735	0.0345	-0.0209	0.0470	0.0209	0.0248	-0.0281	0.0248	0.0970	0.0276	0.0381	0.1173	0.0563	0.0270	0.1990	-0.1278	0.0000	0.0277
30 Apr 1986	0.0469	0.0414	0.0346	0.0384	0.0394	0.0302	0.0112	0.0384	0.0112	0.0578	0.0686	0.0489	0.0358	0.0518	0.0437	0.1807	-0.1116	0.0000	0.0181
31 Mar 1986	0.0736	0.0879	0.0814	0.0895	0.0418	0.0231	0.0172	0.0895	0.0038	0.0562	0.0788	0.0757	0.1088	0.0415	0.0437	0.2044	-0.0735	0.0000	0.0402
28 Feb 1986	0.0851	0.1014	0.0638	0.0492	0.0559	0.0387	0.0147	0.0386	0.0147	0.1839	0.0383	0.1119	0.1100	0.0689	0.0290	0.2223	-0.0541	0.0000	0.0451
31 Jan 1986	0.0861	0.0860	0.1031	0.1059	0.0848	0.0790	0.0780	0.1059	0.0780	0.0811	0.0599	0.0978	0.0847	0.0577	0.0740	0.2150	-0.0806	0.0000	0.0509
31 Dec 1985	0.0409	0.0337	0.0427	0.0149	0.0350	0.0415	0.0457	0.0183	0.0457	0.0293	0.0296	0.0285	0.0585	0.0173	0.0407	0.1627	-0.1389	0.0000	-0.0006
30 Nov 1985	0.0265	0.0302	-0.0034	-0.0581	0.0175	-0.0033	0.0060	-0.0657	0.0060	0.0628	0.0058	0.0008	0.0662	0.0289	0.0066	0.1522	-0.1538	0.0000	-0.0150
31 Oct 1985	-0.0120	-0.0250	-0.0295	-0.0236	-0.0120	-0.0164	-0.0328	-0.0236	-0.0328	-0.0234	0.0093	-0.0225	-0.0175	0.0143	-0.0114	0.1238	-0.1632	0.0000	-0.0431
30 Sep 1985	0.0099	0.0081	0.0076	0.0151	-0.0046	-0.0301	-0.0244	0.0151	-0.0368	-0.0221	0.0356	-0.0032	0.0465	-0.0166	0.0001	0.1249	-0.1157	0.0000	-0.0407
31 Aug 1985	0.0097	0.0154	-0.0105	-0.0248	-0.0039	-0.0198	-0.0411	-0.0345	-0.0411	0.0833	-0.0223	0.0253	0.0293	0.0196	-0.0327	0.1349	-0.1133	0.0000	-0.0290
31 Jul 1985	0.0189	0.0100	0.0235	0.0270	0.0263	0.0230	0.0094	0.0270	0.0094	0.0012	0.0090	0.0152	0.0361	-0.0075	0.0116	0.1421	-0.1268	0.0000	-0.0309
30 Jun 1985	0.0588	0.0505	0.0511	0.0249	0.0533	0.0538	0.0758	0.0281	0.0758	0.0459	0.0234	0.0429	0.0834	0.0367	0.0530	0.1748	-0.1208	0.0000	0.0000
31 May 1985	0.0773	0.0822	0.0395	-0.0176	0.0673	0.0550	0.0669	-0.0244	0.0669	0.1206	0.0551	0.0506	0.1138	0.0660	0.0635	0.1890	-0.1000	0.0000	0.0236
30 Apr 1985	0.0840	0.0659	0.0398	0.0489	0.0878	0.0812	0.0715	0.0489	0.0715	0.0621	0.0867	0.0560	0.0848	0.1130	0.0826	0.2022	-0.0628	0.0000	0.0391
31 Mar 1985	0.0641	0.0563	0.0570	0.0624	0.0528	0.0387	0.0427	0.0624	0.0293	0.0339	0.0845	0.0505	0.0905	0.0343	0.0592	0.1711	-0.0507	0.0000	0.0304
28 Feb 1985	0.0401	0.0418	0.0328	0.0203	0.0315	0.0175	0.0013	0.0105	0.0013	0.0990	0.0115	0.0552	0.0505	0.0440	0.0071	0.1544	-0.0761	0.0000	-0.0064
31 Jan 1985	0.0648	0.0512	0.0736	0.0857	0.0781	0.0771	0.0701	0.0857	0.0701	0.0343	0.0450	0.0630	0.0667	0.0442	0.0636	0.1838	-0.0853	0.0000	0.0203
31 Dec 1984	0.0907	0.0788	0.0742	0.0498	0.0884	0.0862	0.1185	0.0526	0.1185	0.0726	0.0421	0.0712	0.1158	0.0692	0.0843	0.1998	-0.0825	0.0000	0.0290