Return reversal in UK shares

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ABSTRACT

We observe systematic long-term reversal of share returns for companies listed on the London Stock Exchange over the period 1960-2002. Loser shares (the worst performing shares in the prior five years) out-perform winner shares (the best performing shares over the prior five years) by about 14% per year. By separating the firm size effect from the return reversal effect we show the presence of both. This evidence is in direct contradiction to Clare and Thomas (1995), who found no return reversal following an adjustment for size. Return reversal is a feature of large as well as small companies. A seven-part consideration of risk does not substantiate the argument that loser out-performance is compensation for risk.

JEL classification: G14, information and market efficiency

Key words: Return reversal, Overreaction, Market inefficiency, Market efficiency

1. Introduction

A strong return reversal effect has been shown in US studies (e.g. De Bondt and Thaler, 1985, 1987; Chopra, *et. al*., 1992). That is, portfolios of shares showing the worst total return performance over a three or five year period subsequently significantly out-perform portfolios of shares made up of prior period 'winners', and the market portfolio, over the long horizon. This out-performance is remarkably high: extreme prior losers out-perform extreme prior winners by 5-10 per cent per year. Studies from around the world have drawn similar conclusions[1].

Contradicting the consensus developed in the US and elsewhere, in 1995 Clare and Thomas published the most comprehensive analysis to that date of UK shares, and concluded that the return reversal effect disappeared if the influence of market capitalization (size effect) is adjusted for. Thus, we have doubt thrown on belief in the generality of the return reversal effect. If it is not present in the second most important stock market in the world where does that leave the argument that share returns tend to go into reverse across markets and at various points in stock market histories? Are the reported results a product of mining data in particular markets in specific time periods?

Clare and Thomas' work, however, suffered from some serious methodological flaws. This paper provides a more robust analysis. It also extends the study period to 48 years, ending in 2002, rather than 1990, permitting us to observe the phenomenon at the height of the bull market. Our results indicate the presence of an economically significant return reversal effect in the UK share market. Moreover, it is unlikely that this effect can be attributed to the influence of size or risk. We find that extreme losers outperform extreme winners by about 14% per year in the five years following portfolio formation. The effect is present in both the full sample and in the largest 20% of firms, but is stronger for smaller companies.

2. UK Empirical Studies

In comparison with the US there have been few studies of return reversal in UK shares. Those that are available differ in the period studied, length of study and methodology used. Power, Lonie and Lonie (1991) take the list of the 'top 200' UK companies in the June 1982 edition of *Management Today*. They calculate the share price changes plus dividends for each company over the 10 years to 1982. The 30 best performing companies are assigned to a winner portfolio. The bottom 30 companies combine to form a loser portfolio. They report positive cumulative abnormal returns for prior-period losers of 86% in the five-year test period, while the prior-period winners showed negative abnormal returns of -47%.

The study by MacDonald and Power (1991) cumulates market-adjusted excess return over three year formation periods. The winners are defined as the top 5% of firms and the losers as the bottom 5%. They establish eight sets of portfolio formations at three-year intervals between 1959 and 1985, and examine cumulative excess returns of the portfolios over three year holding periods. They find a reversal in the performance of the winner and loser portfolios in the test period. The average cumulative abnormal return from the arbitrage strategy of selling short the shares in the winner portfolios and buying shares in the loser portfolios is a statistically significant 29.15%. However, MacDonald and Power (1993) examine the predictability of 40 individual UK shares over the period 1982 to 1990 and conclude that rather than return reversal, 'for the vast majority of the firms in the sample, share prices appear to follow a random-walk process….the findings of this paper, therefore, would appear to lend support to the proponents of a traditional view of stock market efficiency'. (p.38)

Clare and Thomas (1995) declared, after examining a random sample of up to 1000 shares between 1955 and 1990, that losers outperform winners by a statistically significant 1.7% per annum, "However, after controlling for firm size we find that this return difference can be explained by the small firm effect. Our findings thus provide no evidence of overreaction in the UK stockmarket" (p.963). There are a number of problems with their approach, which, when

combined, may help to explain why they were unable to detect return reversal. First, they tested only six series of portfolio returns (six portfolio formations) for periods of three years. We argue that many more portfolios need to be formed and tested to gain insight into the persistence of return reversal. This study examines 39 portfolio formations over 12, 24, 36, 48 and 60 month holding periods. Second, their method of adjusting for size lacked sensitivity – we undertake a more comprehensive and sensitive analysis separating the return reversal effect from the size effect. Third, Clare and Thomas required firms to be "continuously quoted" to be included in their sample. As they freely admit, this introduced survivorship bias. Fourth, they used quintile portfolios, rather than deciles, leading to less sensitive tests. Fifth, they only examined portfolios formed by equally weighting the constituent shares, rather than considering the impact of value weighting within the portfolios. Sixth, Clare and Thomas used cumulative abnormal returns (CAR) rather than buy-and-hold returns to measure both formation and test period returns. Given the extensive literature describing the distortions caused by the use of CARs in long-run studies (e.g. Dissanaike, 1994, Barber and Lyon, 1997) it is important that the data be analysed using the buy-and-hold method

Dissanaike (1997, 2002) conducts an analysis of return reversal, extending the test periods to 48 months. He shows return reversal for eight out of the ten portfolio formations examined even after adjustment for firm size. However he left open the question of whether the return reversal effect is evident in the entire cohort of London Stock Exchange (LSE) listed companies, because only those companies in the FT 500 share index (the largest 500 by market capitalization) are included in these studies. Following the imposition of the condition that only those companies without missing returns over the prior 48 months are included he was left with an average of 450 companies in each formation year. Dissanaike focused on returns on portfolios formed over the short period between 1979 and 1988. It is possible for sceptical readers to draw the conclusion that this evidence of a tendency for loser firms to outperform

winner firms can easily be explained away as an event occurring in the 1980s, and so does not pose an overwhelming challenge to the efficient markets hypothesis.

Campbell and Limmack (1997) in examining portfolios of loser companies and portfolios of winner companies found, over a five year period following portfolio formation, that a "reversal in the abnormal returns of winner and loser portfolios was experienced over each of the years 2-5, thus lending support to the winner-loser effect" (p.537). In their study the companies are defined as winners and losers on the basis of abnormal returns calculated over only 12 months. This is unusual in the 'long-term' return reversal literature, given that prior period returns are generally calculated over 3 or 5 year periods.

In sum, the studies reported in the literature have produced somewhat conflicting results. It seems clear that there is a return reversal effect, but its size is unclear, and the question of whether it is subsumed by the firm size effect remains.

It is therefore important to ascertain the strength of the return reversal phenomenon when a larger data set and up-to-date analytical techniques are employed. This paper extends the study period to 48 years, ending in 2002, permitting us to observe the phenomenon at the height of the recent bull market as well as observing the strength of return reversal in each of the decades from the 1960s to the 1990s, thereby gaining a much broader picture. In all, this study examines 39 portfolio formations, far more than any previous paper. Furthermore, test period market-adjusted returns are reported for 12, 24, 36, 48 and 60 months.

In addition to using the buy-and-hold method to analyse the data we extend the analysis further by considering market capitalization weighting within portfolios and examine returns against both an equally weighted and a value weighted market portfolio. In addition, these portfolios are formed from companies ranked by prior period returns and formed into deciles, leading to a more sensitive test than a quintile based analysis. The survivorship bias problem is

dealt with by including all firms in the sample whether or not they are liquidated during the test period.

We perform two tests to separate the size effect from the return reversal effect and conduct a seven-part consideration of risk, which includes making use of the Fama and French three-factor model (1993, 1996). This paper also contributes to the literature by observing the return reversal effect in both large and small firms.

3. Hypotheses

We test the following hypotheses:

- On average shares that exhibit extreme negative movements in returns over a period of five years will, during the subsequent five years, experience high returns relative to both the market index and to those shares that produced very high returns in the prior five-year period.
- The more extreme the return in the prior five years, the greater will be the subsequent adjustment.
- The reversal of return performance is explained by additional risk carried by the extreme loser shares.
- The return reversal effect is subsumed by the size effect.
- The return reversal effect is present in the investible universe relevant for most institutional investors, i.e. in the largest 20% of companies, as well as in the small company cohort.

4. Return reversal and overreaction

The term overreaction has become so linked with the phenomenon of long-term share return reversal that this area of study has become known as the overreaction literature. However,

it is important to maintain the distinction between the observation of share return reversals and the concept of overreaction. The two may be consistent with each other, and may provide mutually supportive evidence, but they have different roots and meanings. The study of return reversal is the examination of time series share (strictly, share portfolio) relationships, and the untangling of this effect from other potential explanations for patterns observable in the data, such as the size effect, or the impact of beta risk.

The overreaction discussion owes its origin to departures from Bayesian rationality documented in the field of experimental psychology. The Bayesian hypothesis for learning is for the consistent use of conditional probabilities for changing beliefs on the basis of new information. It would seem that such high levels of rationality are not an accurate characterization of how individuals behave when faced with new data (Kahneman *et al.*, 1982, Kahneman and Tversky, 2000). Individuals, when revising their beliefs, tend to overweight recent information and underweight prior (or 'base-rate frequency') data. They often fall victim to the representative heuristic (Tversky and Kahneman, 1971, 1974, Kahneman and Tversky, 1972, Arrow 1982) under which an individual judges the likelihood of a future event by the similarity of the present (recent) evidence to it.

In behaving this way decision takers fail to properly allow for the necessity of moderating extreme predictions. They overreact to recent unexpected, dramatic and salient news. Grether (1980), for example, found this in his laboratory experiments with students. Gilovich et al. (1985) found it in the sports market, where players and fans of basketball believe that a player is more likely to hit a shot if his previous shot was a hit, despite the evidence of a lack of correlation between successive shots. Clapp and Tirtiroglu (1994) found positive feedback in the housing market where recent rates of change become over weighted information used by decision-makers. There are many more examples in a wide variety of fields. Coming back to finance, it has been observed that the actions of professional security analysts, private investors

and institutional fund managers display behaviour consistent with this overreaction view; for example, Dreman and Berry (1995), Dreman (1998), Bauman *et al*. (1999) and Dreman and Lufkin (2000) observing returns on value and growth shares, and Stein (1989) in the options market.

When applied to share return patterns the overreaction interpretation is as follows. Winner shares build a reputation over many years for high performance, usually based on corporate performance, such as abnormal rises in earnings per share. The winners are subject to greater publicity than other shares. Their high quality image and acclaim are not readily dissipated. These acknowledged 'good companies' are also regarded as 'good shares' to hold. They become overvalued. On the other hand loser companies, with a history of disappointing results, are stereotyped as forever on a downward course. The overreaction of investors leads to under-valuation after investors become excessively pessimistic.

For both the winner and the loser shares investor judgment on future performance is 'anchored' on recent historic performance. Investors fail to allow sufficiently for the base-rate data, which show a tendency for company earnings growth to revert to the mean, i.e. those showing particularly strong growth in the past show weaker growth in the future, while those with an extreme declining pattern over many years tend to show an increasing profit trend (Little, 1962; Whittington, 1971, 1972, 1978; Mueller 1977; DeBondt and Thaler 1987; Power, Lonie and Lonie 1991; Fuller *et al*. 1993; Power and Lonie, 1993; Chan *et al*., 2003). As investors observe the improving position of the losers and the worse than anticipated pattern in the winners their stereotyping and anchoring is gradually eroded. Share prices begin to move in the opposite direction, resulting in the mean reverting pattern of share returns.

This paper reports evidence showing the presence of a strong return reversal effect in the UK, persistent over four decades and robust to adjustment for the size effect and to various measures of risk. The results are consistent with the theory of overreaction, but do not, in

themselves, prove that the cause of the pattern in share returns is overreaction. We merely suggest that the overreaction hypothesis is a parsimonious explanation for the empirical observations. However, the alternative explanation for the data pattern we observe, namely compensation for additional risk bearing, seems less plausible than overreaction, given the strength of our results.

5. Data, Sample Selection and Method

Monthly return data are taken from the London Share Price Data (LSPD) for the period January 1955 to December 2002. This provides returns for every share listed on the London Stock Exchange, LSE, in the period 1975-2002. For the first 20 years of the study period (1955 to the end of 1974) the LSPD provides returns for only one-third of the listed companies; these are randomly selected[2]. The analysis includes all the shares in the one-third random sample for the period January 1955 to December 1974 and all the LSE listed companies thereafter, except investment trusts and foreign companies in both periods. The firms on the lightly regulated markets operated by the LSE (The Alternative Investment Market, Third Market or the Unlisted Securities Market) are not "listed" and so are excluded from the analysis. Companies on OFEX and the O.T.C. market are also excluded.

All shares continuously listed for the prior five calendar years are ranked each year on the basis of their five-year buy-and-hold returns and assigned to one of ten portfolios. The first ranking period ends at the end of December 1959, and the last one ends at the end of December 1997, a total of 39 ranking periods. Portfolios are formed at the beginning of January each year from 1960 to 1998[3].

Test period buy-and-hold returns for a portfolio are calculated from individual monthly share prices and dividend payments, allowing for stock splits and other capital changes[4] [5]. The returns for a portfolio are then market adjusted, either by an equally weighted market index or by

a market capitalization (value) weighted market index. We examine the portfolio performance both when the portfolio shares are equally weighted within the portfolio and when they are weighted by market capitalization within the portfolio. Under market capitalization weighting each firm's weight is expressed as a proportion of the total market capitalization of all the firms in the decile portfolio at the date of portfolio formation. We first report equally weighted returns for each portfolio as this more closely represents a strategy implementable by all but the largest of investors. The effect of value weighting within the portfolios is to reduce the return premium to losers owing to the tendency of losers to be smaller firms. This leads to the reporting of the most conservative results. These may also be the results of most interest to the large investors who might allocate portfolio funds by market capitalisation.

Shares whose type of death from the LSPD database is described as liquidation (death code type 7) quotations cancelled for reasons unknown (14), receiver appointed/liquidation (16), in administration/administrative receivership (20), and cancelled assumed valueless (21), are regarded as losing all value in the delisting month. However, if there is a post-liquidation dividend this is invested equally among the remaining shares in the portfolio. By including even those companies that delist during the test period, many of which show a –100% return, we avoid survivorship bias.

If a company is deleted from the LSPD database for any of the following reasons the money received (or value of shares or other securities received) is reinvested in the portfolio on an equally weighted basis. That is, the remaining investments in the portfolio are scaled up:

- Acquisition/takeover/merger (5)
- Suspension/cancellation with shares acquired later (6).
- Quotation cancelled as the company becomes a private company (8 and 9)
- Quotation suspended (10)
- Voluntary liquidation (11)

- Change to foreign registration (12)
- Quotation cancelled for reason unknown, dealings under rule 163 (13)
- Converted into an alternative security for the same company (15)
- Nationalisation (18)

If the amount received from these deletions is unknown then the last share value on LSPD is used as the amount available to invest in the shares remaining in the portfolio.

The number of firms in the sample grows from 925 in the first sample selection year (1960) to 1152 in the last year (1998). The peak year is 1980 with 1594 firms. On average the sample comprises 810 firms over the portfolio formation years 1960 to 1979 (when a one-third random sample of shares is used) and 1240 firms for the portfolios formed from 1980 to 1998, when all listed ordinary shares are included.

Finally, throughout this paper returns are calculated as the proportional changes in share value over a period, except in the calculation of betas, where continuously compounded returns are used.

6. Average performance across portfolio formations

In this section we report average results over the 39 test periods for each of the decile portfolio market-adjusted returns. The market index, used to adjust returns, comprises all shares in the sample. Table 1 shows a striking inverse relation between the past and subsequent returns. When equal weights are used for both within the portfolio and for the market index (the method commonly used in previous studies) we find that the loser portfolio out-performs the market by 53% over five years, or 8.9% per year. In contrast, the prior period winners under-perform in the subsequent five years by 47%. If the market index is constructed on the basis of value weighting (in a similar manner to the FTSE 100 or the FTSE All Share index) the results are even more

dramatic for the loser portfolio. Now, with a greater weight given to the largest companies in the index, the loser portfolio out-performs the index by 109% over five years or 15.9% per year. The difference between the results shown in the two parts of panel A suggest a strong size effect (Banz (1981), Dimson and Marsh (1986, 2001)) in the UK share market given the lower index returns when greater weight is given to large companies. The influence of the size effect is explored in section 11 of the paper.

Decile performance rank is remarkably well ordered in panel A: the highest test period returns are from portfolio 1 and the lowest from portfolio 10; all the other deciles are in the expected order over both four and five year test periods. This adds considerable support to the overreaction hypothesis, as it shows that return reversal is not confined to the extreme cases. All the return differentials in panel A (equal-weighted market index) are statistically significant at the 1 per cent level for test period years four and five except for portfolios 3, 4 and 5. Consistent with overreaction the middle portfolios do not show market-adjusted returns significantly different from zero, because at the time of portfolio formation they are not expected to be subject in any significant way to either over-optimism or over-pessimism.

Anomalies in long-term share price behaviour have been observed to diminish or evaporate when firms within the portfolio under study are value weighted. For example Fama (1998) notes: "we find that apparent anomalies in long-term post-event returns typically shrink a lot and often disappear when event firms are value-weighted rather than equal-weighted. One can argue that value-weight returns give the right perspective on an anomaly because they more accurately capture the total wealth effects experienced by investors" (p.296). The smallest firms in the portfolio may be creating most of the effect. By moving away from equal weighting to value weighting the influence of very small firms is reduced. If, by switching to value weighting within the decile portfolios we find that the abnormal returns on the loser and winner portfolios are greatly reduced we can plausibly argue that the anomaly is driven mainly by the over-

weighting of small and micro-firms within the deciles. Panel B shows the results of this analysis. We find very similar results to those shown in panel A for the extreme portfolios; the numbers being only slightly less when the portfolios are value weighted. However, the ranking of the 10 portfolios is less well behaved, particularly in the case where the market portfolio is constructed by equal weighting; for example, portfolio 10 (winner) shows a higher return than portfolio 9.

TABLE 1 HERE

The month-by-month average cumulative market-adjusted returns for the portfolios are shown in Figure 1. These are calculated by equally weighting within the deciles and by market adjusting with an equally weighted market index. Throughout the post-formation period the performance of each portfolio is positioned *vis a vis* other portfolios as we would expect under the overreaction hypothesis. That is, from the outset the most extreme formation period losers become the highest performers in the test period. Portfolio 2 takes second place, followed by portfolio 3, and so on, down to the winner portfolio being the worst.

FIGURE 1 HERE

7. Large firm analysis

Chopra *et al.* (1992) find no return reversal effect in larger firms: 'for the largest 20% of the NYSE firms (roughly the S&P 500) no overreaction effect is apparent.' (p.256). Chopra *et al.* go on to argue that this evidence is consistent with the hypothesis that individuals, who tend to be the primary holders of smaller firms, overreact, whereas institutions, the dominant holders of larger firms do not. We examine the largest 20% of UK listed firms in the sample (by market capitalization). The evidence shown in Table 2 is the start of a series of results (the remainder shown in section 11), which address the critique that the return reversal effect is explained by the small firm effect.

The data in Table 2 is constructed in the same way as Table 1 except that only the largest 20 per cent of companies (at portfolio formation dates) are included in the deciles. Examining the ranking period data first, we find that the returns prior to portfolio formation are less extreme than those for the all-company analysis. For example, whereas the loser portfolio constructed from companies of all sizes has a five-year market-adjusted ranking period return of –227%[6], the corresponding return for the loser portfolio comprising the largest 20% of companies is a mere -30%. For the winner portfolio the figures are somewhat closer together: 391% compared with 581%. By focusing on the larger companies we tend to exclude those firms with the most extreme prior period returns. This is especially the case for losers, because if a company shows a large negative return it simply falls out of the top 20% at the portfolio formation date so that only the moderate losers are included in the analysis in Table 2. This makes the large company analysis a particularly tough test for return reversal and overreaction because it is reasonable to expect it to be most apparent in the *extreme* losers and winners, rather than moderate losers and winners.

When the test period returns of portfolios containing only large firms are compared with an index comprising shares of all sizes we might expect, given the small firm effect, that these portfolios will generally under-perform the index. This is indeed the case, as shown on the left side of Table 2, where no portfolios produce statistically significant positive market-adjusted returns. There is, however, a clear downward trend in performance as we move from portfolio 1 to portfolio 10. The difference in return between losers and winners over five years is 71% when the shares within the portfolio are equally weighted and 92% when they are value weighted[7]. If we market adjust returns using an index that gives much greater weight to large companies, and is therefore closer to the size profile of the companies in the decile portfolios in Table 2, we find a much clearer superiority of the loser portfolio to the market – shown on the right side of Table 2, where losers out-perform by 61% or 89%.

Overall, the results from Table 2, while not as strong as those in Table 1, nevertheless demonstrate a return reversal effect in the largest companies listed on the LSE. Perhaps the supposition that institutional investors are less susceptible to overreaction is suspect. Perhaps professional investors are less resistant to cognitive errors, such as the representativeness heuristic (Tversky and Kahneman, 1971, 1974, Kahneman and Tversky, 1972, Arrow, 1982) than they like to think. This is certainly an opinion held by a number of experienced investors, for example, Graham (1973, with Dodd, 1934), Buffett (1986), Lynch (1989) and Dreman (1998).

TABLE 2 here

8. Reliability of the loser and loser minus winner strategy

Establishing the superior profitability of the loser strategy on average over the second half of the twentieth century, while fascinating, is insufficient for practitioners and academics alike. A key fact we need to know is whether there are long periods when the strategy fails to pay-off. An investor, individual or institutional, needs to know that the strategy is fairly consistent in providing high returns. Many investors are not prepared to accept even two consecutive years of under performance, regardless of the out-performance over decades. Financial economists, in order to comment on implications of the evidence for the debate on the pricing efficiency of the LSE, need to know whether loser shares under-perform winner shares with some regularity. This is of particular interest in poor states of the world, such as down markets or economic recessions, when the marginal utility of consumption is high, making loser shares unattractive to risk averse investors (Lakonishok *et al*. 1994).

We record in Figures 2(a), 2(b) and 2(c) the formation years that are followed by positive or negative five-year returns for the loser-winner portfolio. In addition we show the years when there was a bear market (defined as a negative real return for the calendar year), or when gross

domestic product growth is negative, to see if poor performance is particularly prevalent in these bad states of the world. Given the space constraints of this paper the figures only show the results for three strategies over five years. The results for alternative weightings within the portfolio and for alternative weightings within the market index are available from the authors. They show similar results. Also available are the results for each individual portfolio formation when the test periods are 1, 2, 3, and 4 years. In all, 40 analyses were carried out: 4 combinations of weightings x 2 samples (all companies or large companies only) x 5 test period lengths.

The figures show an overwhelming preponderance of positive returns over the five years following portfolio formation. When value weighting is used (Figure 2 (b)), however, there is a cluster of formations in the 1970s where winners out-performed losers. An investor allocating a fund on the basis of market capitalisation would have suffered a frustrating period in the late 1970s and early 1980s as four of these arbitrage portfolios lose money[8]. This introduces a form of risk to which the typical investor may conceivably be so averse that the high returns to the repeated use of the loser-winner strategy over a decade or more are merely a rational reward for accepting this risk – the portfolios produce an 'expected return'. This is an extreme interpretation of the risk return trade-off, but we cannot completely discount it. Turning to the largest 20% of companies (Figure 2 (c)) we find, again, a generally positive picture. However, there is an obvious lengthy cluster of negative returns during the late 1980s and early 1990s, where going short on the winners and long on the losers produced a loss. We see no obvious relationship between performance of the loser-winner arbitrage portfolios and either market downturns or recessions.

Table 3 shows the number of occasions when the loser portfolios produced negative market-adjusted returns over five years. It also shows the number of occasions when the loser-winner strategy failed to pay-off. Examining the results for the full sample, we find the strategy

of investing in the loser portfolio produces abnormally high returns in the majority of years in each of the decades, 1960s, 1970s and 1990s. However, the evidence for the 1980s is more mixed, with up to six of the loser portfolio formations producing sub-market returns. For both the full sample and for the largest companies, when the decile portfolios and the market portfolios are both calculated using value weighting, the loser portfolio under-performs the market around one-quarter of the time. Thus, the strategy is fairly, but not completely, reliable. The failure to out-perform in one out of four occasions may be sufficiently off-putting to investors to explain the overall out-performance of losers. Perhaps, rather than a 'rational' response to the risk of occasional under-performance, myopic loss aversion (Benartzi and Thaler, 1995) has a role to play here. Investors are unreasonably sensitive to short-term losses and they evaluate their portfolios frequently, e.g. monthly or yearly, resulting in a demand for large premiums to accept variability in return.

FIGURE 2(a) here, FIGURE 2(b) here, FIGURE 2(c) here, TABLE 3 HERE

9. Deletions and liquidations

Firms that have lost market value over a five-year period are more likely to be delisted in the subsequent five years. The higher rate of firm attrition through deletion in the test period for loser portfolios than for winner portfolios is evident in Table 4. Of the 95.6 companies that on average comprised the loser portfolios at portfolio formation only 59.9 remained quoted 5 years later. The most significant reason for removal from the loser portfolio is that the firm merged or was taken over (21.9 out of the 35.7 firms deleted). Within 60 months 11.3 or 11.8% of the loser decile companies on average (across 39 portfolio formations) failed compared with only 3% of the winner portfolios. Despite one-eighth of the stocks in the loser portfolios falling into liquidation and providing a significant downward push to the portfolio test period performance, these portfolios still out-performed due to the exceptional returns gained on the survivors.

However, if investors are particularly sensitive to experiencing 11.8% of their portfolio running into extreme financial distress then the risk explanation, based on distress, for the out-performance of loser shares may have some support from these results (Chan and Chen (1991), Fama and French (1996) refer to financial distress risk).

An interesting observation is that between one-fifth and one-quarter of companies merge within five years, and the merger rate does not follow any discernable pattern across rank period return deciles.

TABLE 4 HERE

10. Further risk tests

Various authors have argued that return reversals are due to investors rationally requiring higher returns on loser shares and lower returns on winners due to a difference in risk. One argument is that leverage change over the rank-period as a result of diminishing (increasing) equity capital values for losers (winners) produces changes in equilibrium-required returns. A series of negative abnormal returns increases the equity beta of loser firms, thus raising expected return (e.g. Chan (1988), Ball and Kothari (1989)). Winners experience a decrease in equity betas as leverage falls over the rank period and therefore have lower equilibrium expected returns[9]. Chan (1988) also suggests that the risk of the loser firm may increase because of the loss of economies of scale and the increase in operating leverage, which will be reflected in the share's CAPM-beta.

In this section we further explore whether loser portfolios are indeed fundamentally riskier than winner portfolios. We examined two forms of risk above: the frequency with which loser or loser-winner strategies under-perform and the risk of liquidation. We now broaden our analysis by examining risk in five additional ways. As well as considering beta and standard deviation we observe the performance of the portfolios in months (rather than years) of poor and

good stock market return and during quarters (rather than years) of low and high economic growth. We also apply Fama and French's three-factor model.

10.1. Worst stock market months and worst GDP quarters.

Exploring the risk of the portfolios by examining five-year returns, while interesting, is incomplete. Conceivably, loser portfolios could perform well over the entire five years, but be subject to severe declines for particular periods within those five years. Perhaps when there are large declines in the stock market index over a period of a month the returns on the loser portfolios fall to an exaggerated extent, showing them to be more risky than both the market and the winner portfolio. Perhaps when quarterly real GDP declines the loser portfolios suffer more than other shares.

Thus an investor with a time horizon of less than five years might be concerned about these kinds of intra-year vulnerability to events. To test the risk of portfolios over short periods we observe returns on the loser and winner portfolios as well as the market portfolio during each of the 516 months from January 1960 to December 2002. These month are placed into four categories:

- The 50 months when the value-weighted market index return was at its worst ('W_{50}')
- The other 137 months when the value-weighted market index fell ('N_{137}')
- The 50 months with the highest value-weighted market index returns ('B_{50}')
- The other 279 months when the value-weighted market portfolio rose ('P_{279}')

Each of the 60 test months for each of the 39 portfolio formations are allocated to one of the four categories. The raw (not market adjusted) returns for each of the portfolios falling in a particular month are observed. For any one month between January 1960 and December 2002 the maximum number of portfolios held is five, but this can fall to as low as one in 1960 and in

2002. There are 516 possible observations months and 39x60 = 2340 monthly returns observable for those months amounting to an average of 4.53 observed returns per month.

A similar analysis is conducted for the worst and the best quarters as measured by real GDP growth. Quarterly real GDP data are obtained from Datastream. The 172 quarters are allocated to the following categories:

- The 25 poorest real GDP growth quarters ('W_{25}')
- The next 61 lowest real GDP growth quarters ('L_{61}')
- The 25 best real GDP growth quarters ('B_{25}')
- The next 61 highest real GDP growth quarters ('H_{61}')

The returns for each of 60 months for each portfolio are allocated to one of the four categories depending on the real GDP growth in the relevant quarter. The monthly portfolio returns falling in a real GDP category are averaged for all months in that category.

In a separate analysis the monthly returns on the loser and winner portfolios are matched up with the changes in real GDP for one quarter ahead, given the evidence indicating that the stock market leads real GDP by approximately one quarter.

Panel A of Table 5 presents the performance of portfolios in various months as defined by the extent of the rise or fall in the market index that month. The average difference in returns between the loser and winner for each state is also reported along with t-statistics for the test that the difference of returns is equal to zero. The results show that losers out-perform winners in all states of the market (although the results are statistically insignificant for the best 50 months). The largest difference is for the worst stock market months, followed by other negative index months. This evidence does not support the view that losers are riskier than winners[10].

Panel B of Table 5 provides information on returns in various states of the world as defined by real GDP growth in the quarter. The results show, again, that losers perform better than winners in all states. This time, however, the largest difference in returns is during the best

GDP growth quarters, and the difference between losers and winners in the worst 25 quarters is statistically indistinguishable at the 90% confidence level. Panel C shows the results if the monthly returns on the loser or winner portfolio are matched up with the real GDP growth one quarter ahead. The results do not alter the general conclusion that we find no evidence in Table 5 supporting a conventional asset pricing equilibrium in which the higher returns on the loser portfolio are compensation for the under-performance in bad states of the world risk – it would seem that the loser strategy does not expose investors to greater downside risk.

TABLE 5 HERE

10.2. Beta and standard deviation

Table 6 presents betas and standard deviations for each of the decile portfolios. Annual returns data from the test period are used because of the problems associated with the use of rank-period data to compute betas and standard deviation of portfolios (Chan (1988), Ball and Kothari (1989)). For each decile portfolio we have 39 annual observations on returns in the first year following formation. We have also computed the corresponding annual returns on a value-weighted market portfolio comprising all shares in the sample. The risk-free interest rate is taken as the 90-day Treasury rate[11]. Hence we can calculate beta and standard deviation. Beta is calculated from the following formulae:

$$r_{pt} - r_{ft} = \alpha_p + \beta_p (r_{mt} - r_{ft}) + e_t \quad (1)$$

$$r_{Lt} - r_{Wt} = \alpha_{L-W} + \beta_{L-W} (r_{mt} - r_{ft}) + e_t \quad (2)$$

Where all returns are continually compounded, and: r_{mt} is the return on the value weighted market portfolio comprising all listed UK stocks (excluding investment trusts) in the sample in first test period year t,

r_{pt} is the return on the equally weighted decile portfolio in the test period year t,

r_{ft} is the risk-free rate of return in year t,

β_p is the portfolio beta,

L and W represent the loser and winner decile portfolios respectively.

Parallel analyses are conducted for each of the test period years.

In Table 6 loser portfolios do not have much/any higher beta than the winners, while their alpha is positive, and the arbitrage portfolio has positive alpha and very small beta, i.e. it gives an independent gain.

The differences in standard deviation between the loser firms and the winner firms in the test period at first glance seem large. However, to put these in perspective we can contrast these standard deviations with the large differences between the standard deviation on London listed equity (20%) and Treasury bills (6.6%) over 101 years to end of 2000 (Dimson, Marsh and Staunton, 2001). Equity returns were three times as volatile as Treasury bill returns and provided additional annual returns of 4.8%. The loser portfolio provided additional returns of 14%-15% per year above those of the winner portfolio for an increase in standard deviation from 14.33%-18.66% to 19.16%-23.39%. The reward-to-risk ratio for loser shares *vis-à-vis* winner shares seems high compared with reward-to-risk ratio for equity compared with T-bills. Furthermore, because the losers have much higher mean return than the winners, the higher standard deviation does not translate into greater downside risk. A standard deviation based risk model cannot explain all the superior returns on loser stocks.

TABLE 6 HERE

10.3. Applying the Fama and French three-factor model, and tests for potential bias

The Fama and French 'risk' adjustment model is controversial. Behaviouralists are not prepared to accept the model as a rational risk model because they do not interpret the book-to-market ratio as a risk measure. Rather, the book-to-market ratio is regarded as a mis-pricing measure (see, e.g. Lakonishok, Shleifer and Vishny (1994), Daniel and Titman (1997)). It is therefore

arguable that the Fama and French (1993, 1996) (FF) alpha is not useful. Nevertheless, we provide the three-factor alphas for completeness.

FF (1993, 1996) observe that the expected return on a portfolio of US shares in excess of the risk free rate [$E(r_p) - r_f$] is 'explained' by the sensitivity of its return to three factors: (i) the excess return on a broad market portfolio ($r_m - r_f$); (ii) the difference between the return on a portfolio of small firm's shares and the return on a portfolio of large market capitalization company shares (SMB, small minus big); and (iii) the difference between the return on a portfolio of high-book-to-market shares and the return on a portfolio of low-book-to-market shares (HML, high minus low). Specifically, the expected excess return on a portfolio *p* is,

$$E(r_p) - r_f = b_p[E(r_m) - r_f] + s_pE(SMB) + h_pE(HML)$$

Where $E(r_m) - r_f$, E(SMB) and E(HML) are expected premiums and the factor sensitivities or loadings, b_p, s_p, and h_p are the slopes in the time series regression,

$$r_p - r_f = \alpha_p + b_p(r_m - r_f) + s_p(SMB) + h_p(HML) + \epsilon_p$$

FF claim that book-to-market equity and slopes on HML proxy for relative distress, and so high book-to-market equity firms offer higher average returns; there is also an additional compensatory return for investing in small capitalization companies. They go further and claim that their model 'also captures the reversal of long-term returns documented by DeBondt and Thaler (1985). Stocks with low long-term past returns (losers) tend to have positive SMB and HML slopes (they are smaller and relatively distressed) and higher future average returns. Conversely, long-term winners tend to be strong stocks that have negative slopes on HML and low future returns.' (FF (1996) p. 56).

For the FF regressions shown in table 7 the market factor is defined as the monthly value-weighted return on all shares on the Official List included in the LSPD (except for investment trusts and overseas companies). For each of the decile portfolios excess return is computed as the

value-weighted portfolio return over the monthly Treasury bill rate observed at the beginning of the month, taken from LSPD.

Datastream does not contain historic accounting data for all the companies within the LSPD. For the period 1978 to 2000, 83% of companies in the LSPD also have data on Datastream. For the earlier periods the problem of missing data becomes extreme. Between 1966 and 1977, Datastream covers only 31% of LSPD companies, and for the period 1955 to 1965, Datastream does not present any accounting data (Nagel, 2001). This makes the calculation of meaningful SMB and HML factors going back to 1960 difficult. To deal with this problem (and other empirical finance problems) Nagel (2001) and Dimson, Nagel and Quigley (2003) created a new database which combines what there is on Datastream with the Cambridge/DTI database and with data obtained by hand collecting balance sheets for all remaining firms not covered in these sources. It includes virtually the whole population of listed firms since 1953, with close to 100,000 firm-years. From this he/they calculate SMB and HML factors for every month between 1955 and 2001 in a similar fashion to FF (1993, 1996). This more complete set of SMB and HML factors are used in the FF three-factor analysis shown in table 7.

FF (1996) estimate three-factor models for portfolios for only one month post-formation. This paper, however, has demonstrated excess returns to the loser strategies occurring up to five years. In this section we therefore estimate five separate regression models, one for each of the test years. For the one-year horizon, we regress monthly excess returns on the portfolio for January to December on the contemporaneous excess market return and the returns to HML and SMB factors for the same months. For the two year horizon, we regress monthly excess returns on the portfolio in the year starting 13 months after portfolio formation on the contemporaneous excess return on the market factor and on the HML and SMB factors created in the first test period year[12]. The procedures for the three- four- and five-year horizons are analogous.

Table 7 shows the results for portfolios 1, 2, 9 and 10. The final alpha shown for each year is the average monthly 'abnormal return' for the loser minus winner arbitrage portfolio. For all years, this alpha is positive, and after the first year its p-value is very small (This is the p-value for a 1-sided test that alpha is greater than zero), e.g. in year 2 the p-value is 0.000004, or 0.0004%. This means that the probability of getting such a high result by chance if alpha is really zero is 0.0004%, so we can safely assume that the arbitrage alpha is positive. Table 7 convincingly shows that the arbitrage advantage of losers over winners cannot be explained away by firm size or book to market ratio effects.

We also need to discuss various biases identified by Barber and Lyon (1997) and Lyon, Barber and Tsai (1999): new listing bias, rebalancing bias, and skewness bias. Do these invalidate our results? New listing bias is the bias whereby (say) the observed return on a loser portfolio relative to the market is distorted by the fact that the loser portfolio firms generally have a long post-event history of returns because the portfolio is bought at one point in time and held for up to five years with no new shares added, while firms in the market index include new firms that began trading subsequent to the event month. 'Since newly listed firms underperform market averages (Ritter, 1991), we anticipate that the new listing bias will lead to a positive bias in the population mean of long-run buy-and-hold abnormal returns' (Barber and Lyon, 1997, p. 347). To investigate the influence of the new listing bias on our results we adjust the monthly market return by removing companies listed within the previous 12 months. This gave adjusted returns that had a Pearson correlation of 0.999 with unadjusted market returns. The average return changed by only 1.2% of its previous value. New listing bias is unlikely to have a large effect. Moreover, in looking at the arbitrage portfolio, there is no comparison made with market return, but rather with a `control' portfolio (e.g. losers compared with winners) as advocated by Barber and Lyon.

Rebalancing bias arises because the compounding of return of the market portfolio is calculated assuming monthly rebalancing, while the return of the sample firms is compounded without rebalancing. This bias would tend, if anything, to a strengthening of the power of our results because 'As it turns out, this monthly rebalancing leads to inflated returns on the market index and a negative bias in buy-and-hold abnormal returns' (Barber and Lyon, 1997, p. 348). Rebalancing bias only affects the comparison of a given portfolio with the market. It would not affect the results shown for the arbitrage portfolio.

Finally, skewness bias is a potential problem because in measuring long-run returns it is common to observe a sample firm with an annual excess return greater than 100%, but uncommon to observe a return on the market index in excess of 100%. Skewness bias could affect the statistical significance of tests for positivity of alpha. 'The inflated estimate of the cross-sectional standard deviation will lead to a downwardly biased test statistic, conditional on observing a positive sample mean. [But] lead to a positively biased test statistic…conditional on observing a negative sample mean' (Barber and Lyon, 1997, p. 347). The concern here is that the distribution of portfolio returns could be long-tailed, giving rise to an inaccurate p-value. The fit residuals from the FF regressions were examined. The distribution was (by eye) roughly normal, with a skewness of 0.29 and a kurtosis of 1.517. The skewness is tiny, probably because the arbitrage portfolio is the difference of two skew abnormal returns. The positive kurtosis means that the distribution of fit residuals is slightly long-tailed. However, this fairly small kurtosis could not invalidate the huge statistical significance of the test for positive alpha.

Overall, the biases discussed by Barber and Lyon, to the extent that they have any impact on our results, will militate against the finding of statistically significant abnormal returns: 'Long-run buy-and-hold returns are more affected by the rebalancing and skewness biases. As a result, long-run buy-and-hold abnormal returns and the associated test statistics are generally negatively biased.' (Barber and Lyon, 1997, p. 370).

TABLE 7 HERE

11. Size-adjusted returns

It has been argued that the reason losers out-perform winners is that loser portfolios tend to consist of smaller firms, and winner portfolios of larger firms (Zarowin, 1990). The phenomenon being observed, it is alleged, is merely a size effect and not due to overreaction. This section focuses on discrimination between size (as measured by the market value of equity) and the return reversal effect.

To get an overall impression of the relationship between the rank period return decile for a share and size of a company at each formation date, shares are allocated to ten deciles by prior five-year returns. They are also separately ranked by market capitalization and allocated to 10 size portfolios. Table 8 shows the proportion of companies within each size decile falling into each of the rank period return deciles. Size decile 1 consists of the smallest 10 per cent of companies. Rank period return decile 1 consists of the worst performers in the rank period (losers). So, for example 24.5% of the companies in the smallest decile are loser shares and only 2.3% are winner shares when companies are ranked independently on size and prior period returns. A positive relationship between rank period returns and size is apparent in Table 8. This is expected given that the average market capitalization of the loser shares decreases, and that of the winner shares increases, over the five-year rank period. However, we need to know if the fact that loser shares are disproportionately small causes their subsequent out-performance or whether the return reversal effect is independent of the size effect. The obvious and high relation between size and rank period returns means that if we are to be able to say something of value about the strength of the return reversal effect we must separate it from the size effect.

TABLE 8 HERE

In the first size adjustment analysis, companies falling in a particular size decile and prior period return decile are grouped together as a portfolio. In this way the shares allocated to the 100 portfolios shown in Table 8 are constituted as portfolios for testing. The five-year buy and hold raw (not market-adjusted) returns are calculated for the portfolios formed each January from 1960 to 1998. The results shown in Table 9 are the averages over 39 portfolio formations. Note that this method causes there to be only two or three shares in some of the 100 portfolios at some of the portfolio dates. However, by averaging over 39 portfolio formations we obtain reasonably robust results.

The portfolio representing the loser shares within the smallest size category (1,1) produces an average return (over 39 test periods) of 279% over five years, or 30.5% per year. At the other extreme a portfolio of large winners (10,10) generates on average over five years a return of 99%, or 14.7% per annum. Moreover, these extreme observations fit into a pattern: the bottom right quarter of the table (larger companies and good performers in the ranking period) consists entirely of low numbers; the top left quarter (smaller companies and poor performers in the rank period) generally shows large percentage gains over five years.

On average, holding size constant, the extreme loser decile has a 187% return compared with an average return of 126% for the extreme winner decile. On average, holding rank period returns constant, the smallest decile has a 245% average return compared with 108% for the largest size decile. The overall impression is that, holding size constant, test period returns increase for lower rank period return deciles, and holding rank period returns constant, test period returns are higher the smaller the size. Table 9 indicates both a size and a return reversal effect.

TABLE 9 HERE

In a second size-adjusted analysis we create portfolios, which we term “size-control” portfolios. To generate these we first allocate shares to deciles on the basis of their prior five-

year returns. Then for each of the 10 portfolios we observe the size of each of the companies (market capitalization). This provides a profile for each portfolio in terms of the distribution of the component shares with respect to size deciles. So, for example, if a portfolio of losers with 100 shares is analysed on size we might find that 25% fell into the smallest size based decile of shares, 20% in the second size-based decile, 15% in the third, and so on.

Once the size profile of the rank period return defined portfolio is known, the return over the subsequent five years is calculated on the assumption that return is due solely to the size-decile make up of the portfolio. In other words, size-control portfolios are constructed to have the same size composition as the corresponding rank period return portfolios, with weights being determined by the proportion of the companies in a rank period return portfolio falling in each size (market capitalization) classification. The benchmark size-control portfolio test period returns are calculated based on a buy-and-hold strategy for five-year periods. The size-adjusted returns on the rank period return constructed portfolios are computed as five-year average test period returns on the portfolios minus the five-year average return on the size-control (benchmark) portfolio over the test period. Note that in this analysis the returns are not adjusted for market portfolio movement. The results are presented in Table 10, which confirms the presence of return reversal after eliminating the influence of size. Portfolio 1 shows a size-adjusted return much higher than that for portfolio 10, of 58% over five years or 9.6% per year (the t-tests show the results to be very significant).

TABLE 10 HERE

12. Concluding discussion

This paper has tested a number of hypotheses. The results establish five propositions:

First, an investment strategy buying a portfolio of loser shares out-performs one buying winner shares and also out-performs the UK market consistently over a long period. The

evidence supports the view that there are systematic valuation errors in the stock market caused by investor overreaction.

Second, the more extreme the return in the initial (rank period) five years, the greater is the subsequent adjustment.

Third, measuring risk by CAPM-beta we find losers to be lower risk than winners. Losers display a higher standard deviation than winners, but this raised level is insufficient to explain their extraordinary out-performance. The absence of additional vulnerability to bad states of the world risk, that is months when the stock market fell or when quarterly real GDP was down, shows losers not to be more risky than winners. Roughly one-quarter of the time loser portfolios fail to out-perform winner portfolios or the market. If investors are highly sensitive to under-performance, even for periods of only one or two consecutive years, then this form of risk may have some role in explaining the out-performance of losers. However, to take this line of reasoning is to take quite an extreme view of risk, especially in light of the fact that winners under-perform approximately three-quarters of the time, and so, by the same measure, would be considered more risky than losers. Over the five years following portfolio formation a higher proportion of losers fall into liquidation than winners. Perhaps this form of risk is unacceptable to investors? However, this is, again, to take an extreme view of the risk given that 88.2% of losers are not liquidated in the five years, and investors are more than adequately compensated by the performance of the surviving companies for the one in eight failure rate to be accepted. The overall impression given is that the losers may display a raised level of risk, if risk is very narrowly defined and we ignore those risk measures showing losers to be less risky. But, even with these caveats the evidence presented on risk is unable to explain all, or most, of the out-performance.

Fourth, the size effect is strong in the London Stock Exchange. However, we are unable to explain the out-performance of loser stocks as being a manifestation of the small firm effect.

Fifth, the return reversal effect is present in the largest 20% of companies, as defined by market capitalization, and is not confined to mid-caps, small-caps and micro-caps.

We judge the results to be economically significant given the low transaction costs associated with a long-term buy-and-hold strategy. This is despite the fact that a disproportionate number of the losers are very small companies with large bid-offer spreads on their shares.

These conclusions lead on to the question of why the return reversal phenomenon has persisted for so long. We offer some potential explanations, but leave much open for further research. First, the analysis is based on data snooping and we have merely fallen upon an *ex post* pattern in the data (Conrad *et al*. (2003)). This is a weak argument given that the strength of the evidence in the US and in more than a dozen other countries has been corroborated in the UK context. In addition there is a growing body of theory explaining the tendency to overreaction (see Hirshleifer, 2001).

Another possibility is that investors are unaware of the overreaction phenomenon and the potential for out-performance and so do not act to correct the market "anomaly". Some plausibility can be attached to this argument. Not only do we acknowledge that rigorous statistical analysis of the issue is relatively recent and that most investors might not have been able to perform the quantitative portfolio selection and evaluation done in this paper, but it could be argued that it takes a long time for ideas and new evidence to diffuse through a body of investors pre-occupied with day-to-day activities. On the other hand, anecdotal evidence supporting return reversal and overreaction has been presented by some powerful advocates, for example, Keynes (1936) and Graham and Dodd (1934). Perhaps the message goes unheeded in the cacophony created by advocates of alternative strategies ranging from chartism to 'theme investing' (e.g. new economy shares). Perhaps the evidence is not regarded as compelling, given the previous absence of sound statistical analysis and the ambiguity of evidence presented in the

UK literature. Hirshleifer (2001) takes the view that even when people have available to them statistical analysis they still place too much weight on more easily processed information, such as recent trends in prices or salient newsflow about 'winning' companies, "There is evidence that information that is presented in a cognitively costly form is weighed less: information that is abstract and statistical, such as sample size and probabilistic base-rate information. Furthermore, people may overreact to information that is easily processed, that is, scenarios and concrete examples" (p.1546)

The ignorance explanation is not entirely convincing. It is not necessary for the majority of the investors to be aware of, and respond to, the phenomenon for its elimination over time by arbitrage. We conjecture there must be some mechanism that prevents efficient arbitrage. It seems likely that investors as a group develop an unreasonable preference for winner shares. This may be because they extrapolate past return rates on shares (and/or past growth rates in earnings) even when such trends are unlikely to persist. Barberis and Shleifer (2003) model investors' behaviour as being driven by a tendency to invest in styles that have performed well recently (e.g. winner shares) and to withdraw funds from styles that have performed poorly. Sirri and Tufano (1998) confirm this tendency in the flow of money into mutual funds. Investors base their fund purchase decisions on prior performance information. As a result of the enthusiasm for winning styles, prices are pushed beyond the level warranted by fundamentals, whilst those out of favour are driven down. This reinforces the attractions of the winning style, while diminishing those of the losing. This in turn, generates more flows from the relatively bad style to the relatively good style. This is reinforced again by agency considerations; actuaries and financial advisors may recommend fund managers on the basis of past performance, purely because it is easy to justify *ex post* to the investor. Furthermore, investors equate good corporations (those that are well managed and in strong strategic positions with good earnings growth prospects) with good shares, thus bidding up the price excessively while ignoring the so-

called “dogs” (Solt and Statman (1989) and Shefrin and Statman (1995)). Evidence for this was found by La Porta *et al*. (1997), who showed that investors make systematic errors in pricing.

So, why don’t arbitrageurs counteract the powers of ignorance and herd behaviour? Keynes (1936), Arrow (1982), De Long et al. (1989), Shleifer and Vishny (1997), Barberis et al. (1998) and Shleifer (2000) and others argue that there are severe constraints on arbitrage activity. Even when deviations from rationality are encountered potential arbitrageurs are aware that they can lose money by being ‘rational’. The ‘crowd’, in Keynes’ parlance, may push prices to even higher levels of irrationality in the short and medium term, causing arbitrage losses for all but the long-term focused investor (‘noise trader risk’). Thus, rational investors are frequently unable or unwilling to swim against the tide of investor sentiment. Indeed, rational investors often do the opposite by acting as positive feedback traders, pushing the prices of losers to further lows and the prices of winners to greater highs. They deliberately reinforce the mispricing by exploiting the trend (De Long *et al.* (1990), Soros (1987)).

It is often assumed that professional investors, working in an institutional setting, would correct the cognitive errors of the “ignorant and emotional” private investors, thus restoring risk-return equilibrium. However, as Lakonishok *et al.* (1994) point out, the context of institutional money management means that they are often constrained from correcting market errors. Fund manager decisions need to be justified to sponsors or senior management committees. It is far easier to explain an investment in a well-known company widely acknowledged to be a winning share than one in a share whose performance has declined for the past five years. Loser shares have a higher rate of insolvency than prior winner shares and so a fund manager would be perceived as countenancing the adoption of too much risk in advancing the case for investment in a series of loser shares. Fund managers are often led to believe that it is better to fail conventionally than to succeed unconventionally:

'..it is the long-term investor, he who most promotes the public interest, who will in practice come in for most criticism, wherever investment funds are managed by committees or boards or banks. For it is in the essence of his behaviour that he should be eccentric, unconventional and rash in the eyes of average opinion. If he is successful, that will only confirm the general belief in his rashness; and if in the short run he is unsuccessful, which is very likely, he will not receive much mercy. Worldly wisdom teaches that it is better for reputation to fail conventionally than to succeed unconventionally. (Keynes (1936) p. 157-8)

This organizational constraint (an example of the principal-agent problem) could reduce the number of active arbitrageurs sufficiently to permit a continuation of the return reversal effect over many decades. In the face of these strong pressures, it is a brave fund manager who stands his/her ground and argues that prior period loser stocks, when taken as a whole, are not fundamentally more risky and that they earn a higher return over an extended period of time.

In conclusion, we have observed the presence of an economically important return reversal effect in the most significant stock exchange in Europe – larger than the effect reported in the US data. While we have not uncovered the underlying reasons for the persistence of valuation errors, the fact that the return reversal effect is not subsumed by the size effect or explained away by risk is a serious challenge to the efficient market paradigm. The phenomena that we have documented seem to lend more support to the behavioral finance school of thought than the rational-Bayesian-optimizing-man school of thought.

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Table 1 Average market-adjusted buy-and-hold test period returns for decile portfolios formed on the basis of five-year rank period buy-and-hold returns.

London Stock Exchange listed UK shares with a continuous listing for five years are ranked and assigned to deciles annually on the basis of their returns over five year periods to end December 1959 and all subsequent Decembers to 1997. Starting at the beginning of January each year 1960 to 1998 average market-adjusted returns for shares within a decile portfolio are calculated for periods of 1, 2, 3, 4 and 5 years post-formation. First, an equally weighted market index including all shares from all deciles is used to adjust returns. Second, a market-capitalisation weighted market index including all shares from all deciles is used to adjust returns. All numbers presented are averages over the 39 test periods computed for corresponding portfolios. L-W is the difference in market adjusted returns between losers and winners. One-sample t-tests based on monthly excess returns over the market are shown in parentheses. PANEL A. Shares within the decile portfolio are equally weighted. PANEL B. Shares within the decile portfolio are value weighted

PANEL A. Shares in decile portfolio are equally weighted

		Test period buy-and-hold market-adjusted returns.									
	Rank period 5-year	Equally weighted market index					Value weighted market index				
	Buy-and-hold return	Months after portfolio formation					Months after portfolio formation				
Portfolio		12	24	36	48	60	12	24	36	48	60

1 (loser)	-2.27	0.03	0.15	0.29	0.36	0.53	0.08	0.28	0.54	0.76	1.09
		(1.51)	(3.40)	(4.12)	(3.96)	(4.19)	(1.79)	(3.29)	(4.21)	(4.57)	(4.96)
2	-1.81	0.05	0.15	0.21	0.25	0.29	0.09	0.29	0.46	0.65	0.85
		(2.44)	(2.79)	(3.21)	(3.17)	(3.59)	(2.51)	(3.68)	(4.43)	(4.57)	(5.13)
3	-1.48	0.04	0.05	0.12	0.10	0.08	0.09	0.18	0.37	0.49	0.65
		(2.65)	(2.01)	(2.00)	(2.06)	(1.05)	(2.61)	(3.34)	(4.31)	(4.95)	(4.98)
4	-1.20	0.02	0.04	0.06	0.04	0.02	0.07	0.17	0.31	0.44	0.58
		(1.73)	(1.52)	(1.32)	(0.93)	(0.43)	(2.15)	(3.08)	(3.64)	(4.00)	(4.67)
5	-0.91	-0.02	-0.01	-0.04	-0.10	-0.11	0.02	0.12	0.21	0.30	0.45
		(-2.34)	(-0.77)	(-1.28)	(-1.70)	(-1.61)	(0.86)	(2.59)	(3.47)	(3.56)	(4.13)
6	-0.60	-0.02	-0.02	-0.06	-0.11	-0.17	0.02	0.11	0.19	0.28	0.40
		(-2.93)	(-1.03)	(-1.67)	(-2.14)	(-2.17)	(0.90)	(2.01)	(2.32)	(2.87)	(3.28)
7	-0.21	-0.03	-0.09	-0.16	-0.17	-0.25	0.01	0.05	0.10	0.22	0.32
		(-3.66)	(-4.68)	(-5.64)	(-3.42)	(-4.38)	(0.45)	(1.05)	(1.59)	(2.52)	(2.80)
8	0.32	-0.04	-0.09	-0.16	-0.23	-0.30	0.00	0.04	0.09	0.17	0.26
		(-3.26)	(-4.68)	(-5.32)	(-6.03)	(-4.21)	(0.17)	(0.97)	(1.69)	(2.22)	(2.49)
9	1.22	-0.05	-0.12	-0.21	-0.32	-0.43	-0.01	0.01	0.04	0.08	0.14
		(-4.02)	(-5.69)	(-5.80)	(-7.02)	(-7.68)	(-0.31)	(0.27)	(0.73)	(1.01)	(1.51)
10 (winner)	5.81	-0.05	-0.12	-0.20	-0.33	-0.47	0.00	0.02	0.05	0.07	0.10
		(-2.47)	(-4.35)	(-4.13)	(-6.21)	(-6.17)	(-0.02)	(0.33)	(0.79)	(0.97)	(1.06)
L-W		0.08	0.27	0.49	0.69	1.00	0.08	0.26	0.49	0.69	0.99

PANEL B. Shares in decile portfolio are value weighted

Test period buy-and-hold market-adjusted returns.

	Equally weighted market index					Value weighted market index				
	Months after portfolio formation					Months after portfolio formation				
Portfolio	12	24	36	48	60	12	24	36	48	60
1 (loser)	0.01	0.13	0.21	0.30	0.47	0.06	0.26	0.46	0.70	1.03
	(0.44)	(2.38)	(2.67)	(3.18)	(3.72)	(1.36)	(3.17)	(3.92)	(4.60)	(5.51)
2	0.01	0.04	0.07	0.03	0.04	0.06	0.17	0.33	0.43	0.60
	(0.64)	(1.17)	(1.25)	(0.48)	(0.47)	(2.02)	(3.22)	(3.76)	(3.66)	(3.93)
3	0.02	0.03	-0.02	-0.06	-0.14	0.07	0.17	0.24	0.33	0.42
	(1.24)	(0.65)	(-0.36)	(-1.15)	(-2.07)	(1.99)	(2.36)	(3.19)	(3.79)	(4.02)
4	-0.01	0.02	0.04	0.00	-0.05	0.04	0.15	0.29	0.40	0.51
	(-0.31)	(0.53)	(0.49)	(0.02)	(0.43)	(1.32)	(2.54)	(2.59)	(3.06)	(4.11)
5	-0.04	-0.04	-0.08	-0.16	-0.18	0.00	0.09	0.17	0.24	0.38
	(-3.31)	(-1.68)	(-1.89)	(-2.46)	(-2.07)	(0.20)	(2.17)	(3.10)	(3.25)	(3.38)
6	-0.04	-0.09	-0.18	-0.29	-0.38	0.01	0.04	0.07	0.11	0.19
	(-2.56)	(-3.07)	(-4.39)	(-4.77)	(-4.42)	(0.37)	(1.08)	(1.21)	(1.57)	(2.10)
7	-0.06	-0.15	-0.25	-0.34	-0.42	-0.02	-0.02	0.00	0.05	0.14
	(-4.66)	(-5.03)	(-5.84)	(-6.06)	(-5.62)	(-0.91)	(-0.39)	(0.07)	(0.78)	(1.45)
8	-0.05	-0.13	-0.25	-0.34	-0.49	-0.01	0.00	0.00	0.05	0.08
	(-2.31)	(-4.11)	(-5.31)	(-5.34)	(-5.49)	(-0.22)	(-0.01)	(-0.02)	(0.91)	(0.95)
9	-0.06	-0.18	-0.29	-0.45	-0.58	-0.02	-0.05	-0.04	-0.06	-0.02
	(-3.04)	(-4.56)	(-5.28)	(-6.36)	(-6.56)	(-0.69)	(-1.29)	(-0.91)	(-0.92)	(-0.25)
10 (winner)	-0.03	-0.09	-0.22	-0.36	-0.49	0.02	0.04	0.03	0.04	0.08
	(-0.84)	(-2.11)	(-3.21)	(-4.59)	(-4.65)	(0.51)	(0.74)	(0.40)	(0.43)	(0.63)
L-W	0.04	0.22	0.43	0.66	0.96	0.04	0.22	0.43	0.66	0.95

Note that a figure of, say, 0.53 should be interpreted as a market-adjusted return of 53%.
The first rank (formation) period, January 1955 to December 1959 is actually a 59-month period.

Table 2 Large capitalization company analysis.
Average market-adjusted buy-and-hold test period returns for decile portfolios formed on the basis of five-year rank period buy-and-hold returns.

The largest 20% of firms in the sample with a continuous listing for five years are ranked and assigned to deciles annually on the basis of their returns over five year periods to end December 1959 and all subsequent Decembers to 1997. At the beginning of January each year 1960 to 1998 average market-adjusted returns for shares within a decile portfolio are calculated for periods of 1, 2, 3, 4 and 5 years post-formation. First, an equally weighted market index including all shares (as in table 1) is used to adjust returns. Second, a market-capitalisation weighted market index (as in table 1) is used to adjust returns. The market indices are constructed using all the companies in the sample, not just the largest 20 per cent. All numbers presented are averages over the 39 rank periods computed for corresponding portfolios. L-W is the difference in market-adjusted returns between losers and winners. One-sample t-tests based on monthly excess returns over the market are shown in parentheses. PANEL A. Shares within the decile portfolio are equally weighted. PANEL B. Shares within the decile portfolio are value weighted

PANEL A. Shares in decile portfolio are equally weighted

		Test period buy-and-hold market-adjusted returns.									
	Rank period 5-year buy-and-hold return	Equally weighted market index Months after portfolio formation					Value weighted market index Months after portfolio formation				
Portfolio		12	24	36	48	60	12	24	36	48	60
1 (loser)	-0.30	-0.02	0.01	0.02	-0.02	0.04	0.02	0.15	0.27	0.38	0.61
		(-0.69)	(0.21)	(0.28)	(-0.18)	(0.28)	(0.62)	(2.30)	(3.02)	(3.20)	(3.22)
2	0.19	0.00	0.02	0.11	0.10	0.10	0.04	0.15	0.36	0.50	0.66
		(-0.03)	(0.33)	(0.65)	(0.65)	(0.57)	(1.34)	(2.65)	(2.05)	(2.52)	(2.88)
3	0.50	-0.01	-0.06	-0.14	-0.17	-0.18	0.03	0.07	0.11	0.23	0.38
		(-0.31)	(-1.16)	(-2.30)	(-2.31)	(-1.51)	(0.96)	(1.60)	(1.80)	(3.06)	(3.17)
4	0.70	-0.01	-0.06	-0.09	-0.17	-0.21	0.04	0.07	0.16	0.23	0.35
		(-0.33)	(-1.11)	(-0.97)	(-1.49)	(-1.59)	(1.39)	(1.63)	(1.71)	(1.82)	(2.57)
5	0.91	-0.03	-0.07	-0.17	-0.28	-0.38	0.01	0.06	0.08	0.11	0.18
		(-1.22)	(-1.54)	(-3.04)	(-3.22)	(-3.15)	(0.68)	(1.66)	(1.40)	(1.52)	(1.55)
6	1.14	-0.06	-0.13	-0.19	-0.35	-0.49	-0.01	0.00	0.06	0.05	0.07
		(-2.12)	(-2.72)	(-2.86)	(-3.86)	(-5.16)	(-0.70)	(0.16)	(1.19)	(0.67)	(0.88)
7	1.40	-0.05	-0.12	-0.21	-0.29	-0.36	-0.01	0.02	0.04	0.11	0.20
		(-2.02)	(-1.84)	(-3.19)	(-3.42)	(-2.98)	(-0.43)	(0.30)	(0.64)	(1.37)	(1.87)
8	1.73	-0.04	-0.15	-0.26	-0.38	-0.56	0.00	-0.02	0.00	0.02	0.00
		(-1.79)	(-3.63)	(-3.71)	(-3.17)	(-3.79)	(0.01)	(-0.54)	(-0.08)	(0.23)	(0.05)
9	2.27	-0.08	-0.20	-0.35	-0.56	-0.75	-0.04	-0.07	-0.09	-0.16	-0.19
		(-2.70)	(-3.94)	(-5.21)	(-6.60)	(-6.40)	(-2.23)	(-2.11)	(-2.62)	(-3.56)	(-3.37)

10 (winner)	3.91	-0.05 (-1.88)	-0.15 (-2.66)	-0.30 (-3.40)	-0.47 (-3.74)	-0.67 (-4.30)	-0.01 (-0.37)	-0.02 (-0.50)	-0.05 (-1.01)	-0.07 (-1.01)	-0.11 (-1.19)
L-W		0.03	0.16	0.32	0.45	0.71	0.03	0.17	0.32	0.45	0.72

Table 2 (continued)

PANEL B. Shares in decile portfolio are value weighted

	Test period buy-and-hold market-adjusted returns.									
	Equally weighted market index					Value weighted market index				
	Months after portfolio formation					Months after portfolio formation				
Portfolio	12	24	36	48	60	12	24	36	48	60
1 (loser)	0.02 (0.44)	0.07 (0.82)	0.14 (1.09)	0.15 (1.06)	0.33 (1.80)	0.06 (1.81)	0.20 (2.68)	0.39 (3.21)	0.54 (3.78)	0.89 (4.13)
2	0.01 (0.27)	0.04 (0.66)	0.02 (0.26)	0.01 (0.10)	0.02 (0.13)	0.05 (1.47)	0.17 (2.83)	0.28 (2.97)	0.41 (3.07)	0.58 (3.62)
3	-0.03 (-1.08)	-0.08 (-1.43)	-0.20 (-3.11)	-0.17 (-1.56)	-0.15 (-0.86)	0.02 (0.85)	0.06 (1.40)	0.06 (1.03)	0.23 (2.16)	0.42 (2.42)
4	-0.00 (0.13)	-0.03 (-0.42)	-0.08 (-0.84)	-0.21 (-2.06)	-0.28 (-2.38)	0.05 (1.71)	0.11 (2.08)	0.17 (1.84)	0.18 (1.60)	0.29 (2.26)
5	-0.02 (-0.68)	-0.05 (-1.25)	-0.16 (-2.85)	-0.29 (-3.32)	-0.40 (-3.08)	0.03 (1.18)	0.08 (2.12)	0.10 (1.84)	0.10 (1.38)	0.17 (1.40)
6	-0.07 (-2.57)	-0.16 (-3.16)	-0.25 (-3.63)	-0.39 (-4.65)	-0.53 (-5.31)	-0.02 (-1.31)	-0.03 (-0.77)	0.00 (0.09)	0.01 (0.17)	0.03 (0.37)
7	-0.07 (-2.33)	-0.15 (-2.85)	-0.25 (-3.72)	-0.32 (-3.43)	-0.42 (-2.93)	-0.02 (-1.15)	-0.02 (-0.49)	0.00 (0.02)	0.07 (1.01)	0.14 (1.25)
8	-0.04 (-1.44)	-0.15 (-3.23)	-0.25 (-3.37)	-0.36 (-2.83)	-0.58 (-3.71)	0.00 (0.19)	-0.01 (-0.45)	0.00 (-0.01)	0.04 (0.37)	-0.01 (-0.12)
9	-0.07 (-1.73)	-0.17 (-2.59)	-0.36 (-4.64)	-0.56 (-5.31)	-0.77 (-5.66)	-0.03 (-0.87)	-0.04 (-0.72)	-0.10 (-2.18)	-0.16 (-2.68)	-0.20 (-2.88)
10 (winner)	-0.04 (-1.19)	-0.16 (-2.43)	-0.30 (-3.24)	-0.46 (-3.45)	-0.59 (-3.35)	0.01 (0.25)	-0.03 (-0.65)	-0.05 (-0.92)	-0.07 (-0.79)	-0.03 (-0.24)
L-W	0.06	0.23	0.44	0.61	0.92	0.05	0.23	0.44	0.61	0.92

Note that a figure of, say, -0.02 should be interpreted as a market-adjusted return of -2%.

Table 3. Number of occasions when portfolios produce negative market-adjusted returns when portfolios are held for five years

Panel A. All companies

Decile portfolio weighting	Market portfolio weighting	Entire sample period		Decades							
				Losers				L-W			
		Loser	L-W	1960s	1970s	1980s	1990s	1960s	1970s	1980s	1990s
		out of 39	out of 39	Out of 10	Out of 10	Out of 10	Out of 9	Out of 10	Out of 10	Out of 10	Out of 9
Equal	Equal	10	4	3	1	3	3	2	0	1	1
Equal	Value	7	4	1	0	4	2	2	0	1	1
Value	Equal	17	12	3	4	6	4	2	3	5	2
Value	Value	10	12	0	2	5	3	2	3	5	2

Panel B. Largest 20% of companies only

Equal	Equal	19	12	3	6	6	4	0	3	4	5
Equal	Value	11	12	1	1	5	4	0	3	4	5
Value	Equal	17	11	4	6	4	3	1	2	3	5
Value	Value	10	11	1	2	3	4	1	2	3	5

Table 4
Average number of shares in each portfolio during the test period and number of companies deleted in the test period – full sample.

PANEL A: The number of shares remaining in each portfolio after 1, 2, 3, 4 and 5 years averaged for the 39 portfolio formations

	Months after formation					
	0	12	24	36	48	60
Portfolio						
1 (loser)	95.6	86.4	79.0	72.0	65.8	59.9
2	95.7	95.6	81.5	75.6	70.1	64.4
3	95.8	95.7	84.2	78.9	73.7	68.4
4	95.9	95.7	84.0	78.3	73.8	69.4
5	96.0	95.9	85.0	79.9	74.5	69.8
6	96.2	96.1	85.6	80.6	75.2	70.6
7	96.3	96.1	86.5	81.7	77.0	72.7
8	96.4	96.2	86.8	82.1	77.2	72.8
9	96.5	96.3	86.4	82.0	77.5	73.8
10 (winner)	96.6	96.4	87.0	81.6	76.7	71.7

PANEL B Number of companies deleted (cumulative) due to mergers, liquidations and other reasons

Li = number of companies deleted due to liquidation, M = number of companies deleted due to being acquired in merger/takeover, O = number of companies deleted due to other reasons.

Months after formation	12			24			36			48			60		
Portfolio	M	**Li**	O	M	**Li**	O	M	**Li**	O	M	**Li**	O	M	**Li**	O
1 (L)	5.0	**3.7**	0.4	9.5	**6.1**	1.1	14.1	**8.0**	1.6	18.2	**9.6**	2.1	21.9	**11.3**	2.6
2	5.7	**1.0**	0.4	11.3	**2.2**	0.7	16.0	**3.4**	0.9	20.0	**4.5**	1.3	24.2	**5.5**	1.6
3	4.6	**0.6**	0.3	9.4	**1.7**	0.5	14.1	**2.3**	0.7	18.5	**2.8**	1.0	22.3	**3.8**	1.3
4	4.9	**0.5**	0.3	10.1	**1.3**	0.6	15.0	**1.8**	0.9	18.7	**2.4**	1.3	22.2	**2.8**	1.5
5	4.8	**0.5**	0.1	9.7	**0.9**	0.4	14.2	**1.5**	0.6	18.7	**2.0**	0.8	22.4	**2.6**	1.1
6	4.8	**0.4**	0.1	9.7	**0.7**	0.2	14.1	**1.3**	0.4	18.8	**1.8**	0.5	22.4	**2.3**	0.8
7	4.5	**0.3**	0.2	8.7	**0.7**	0.4	12.9	**1.2**	0.6	16.8	**1.8**	0.8	20.3	**2.3**	0.9
8	4.0	**0.2**	0.3	8.4	**0.7**	0.5	12.5	**1.1**	0.8	16.6	**1.6**	1.0	20.5	**1.9**	1.1
9	4.3	**0.2**	0.3	8.7	**0.7**	0.7	12.3	**1.2**	1.1	15.9	**1.7**	1.4	18.9	**2.0**	1.7
10 (W)	3.8	**0.5**	0.4	7.6	**1.1**	0.9	12.0	**1.8**	1.4	16.0	**2.4**	1.8	19.9	**2.9**	2.1

Table 5. Performance of Loser and Winner Portfolios in Best and Worst Times

Panel A: All the months from January 1960 to December 2002 are divided into four categories: the 50 months when the market index return was at its worst ('W_{50}'); the other 137 months when the market index return was negative ('N_{137}'); the 50 months with the highest market index returns ('B_{50}'); the other 279 months when the value-weighted market portfolio gave a positive return ('P_{279}'). A value-weighted market index comprising all the stocks in the sample is used to measure market returns. At the beginning of January 1960 and all Januaries to 1998 all shares in the sample are allocated to one of ten portfolios on the basis of their prior five-year returns. The monthly returns of the portfolios in each of the subsequent 60 months are observed. The loser portfolio contains the equally weighted lowest ranking shares on prior five-year returns. The winner portfolio contains the equally weighted highest prior five-year return shares. The results presented are the average monthly returns for loser and winner portfolios over the W_{50} , N_{137} , P_{279} and B_{50} months. The t-statistic tests the hypothesis that the difference in returns between the loser and winner portfolios is equal to zero.
Panel B: This is constructed in a similar manner to panel A except that the states are defined in terms of the best and worst quarters for GDP growth. The 172 quarters from January 1960 to December 2002 are divided into 4 sets: the 25 poorest real GDP growth quarters ('W_{25}'); the next 61 lowest real GDP growth quarters ('L_{61}'); the 25 best real GDP growth quarters ('B_{25}'); the next 61 highest real GDP growth quarters ('H_{61}'). The loser portfolio contains the equally weighted lowest ranking shares on prior five-year returns. The winner portfolio contains the equally weighted highest prior five-year return shares. The market portfolio contains all stocks in the sample, which are value weighted in the index. The results presented are the monthly returns for the portfolios over the W_{25} , L_{61} , B_{25} and H_{61} quarters. The t-statistic tests the hypothesis that the difference in returns between the loser and winner portfolios is equal to zero.
Panel C: The analysis is the same as panel B except that the returns on the winner and loser portfolios are matched with the real GDP change one quarter ahead.

Panel A: Portfolio returns across best and worst stock market return months (average monthly returns)

	Loser	Winner	Market index	Loser-Winner	t-Statistic
W_{50}	-0.0716	-0.0828	-0.0870	0.0112	3.020
N_{137}	-0.0048	-0.0135	-0.0217	0.0087	3.833
P_{279}	0.0339	0.0294	0.0293	0.0045	2.310
B_{50}	0.0782	0.0756	0.1021	0.0026	0.5453

Panel B: Portfolio returns across best and worst GDP quarters (average monthly returns)

	Loser	Winner	GDP (change over quarter)	Loser-Winner	t-Statistic
W_{25}	0.0114	0.0060	-0.0097	0.0054	1.800
L_{61}	0.0203	0.0160	0.0028	0.0043	1.952
H_{61}	0.0160	0.0087	0.0097	0.0074	3.090
B_{25}	0.0219	0.0138	0.0218	0.0081	2.062

Panel C: Portfolio returns across best and worst GDP quarters when returns on the winner and loser portfolios are matched with the real GDP change one quarter ahead (average monthly returns).

	Loser	Winner	GDP (change over quarter)	Loser-Winner	t-Statistic
W_{25}	0.0136	0.0094	-0.0097	0.0042	1.335
L_{61}	0.0103	0.0087	0.0027	0.0016	0.7079
H_{61}	0.0237	0.0142	0.0095	0.0095	4.006
B_{25}	0.0254	0.0148	0.0215	0.0106	3.126

Note: a figure of 0.0782 for loser, winner and market means a monthly return of 7.82%, a figure of 0.0218 for GDP means 2.18% change quarter on quarter.

Table 6 Beta and Standard Deviation for Portfolios

All LSE UK listed shares are ranked and allocated to rank period return deciles each January from 1960 to 1998. For the first test period year following portfolio formation we observe the raw returns of the portfolio relative to the Treasury Bill rate and the return on a value-weighted market portfolio relative to the Treasury Bill rate. The regressions are based on all the annual observations for a portfolio, drawing on all 39 portfolio formations. The analysis is repeated for each of the test years. Using the 39 formation periods, we also compute the standard deviation of returns in the year after formation and in each of the other test years. An arbitrage portfolio (L-W) is constructed by subtracting the test period annual return for the winner portfolio from the return on the loser portfolio for that year.

$r_{pt} - r_{ft} = \alpha_p + \beta_p (r_{mt} - r_{ft}) + e_t$ $\quad$ $r_{Lt} - r_{Wt} = \alpha_{L-W} + \beta_{L-W} (r_{mt} - r_{ft}) + e_t$

Test year after formation	Decile	Alpha	Beta	Standard deviation
1	1 (Loser)	0.0479	1.1196	0.2107
1	2	0.0505	1.2780	0.1799
1	3	0.0335	1.2521	0.1754
1	4	0.0348	1.2056	0.1627
1	5	0.0078	1.1827	0.1374
1	6	0.0019	1.1984	0.1384
1	7	-0.0013	1.1461	0.1305
1	8	0.0034	1.0396	0.1307
1	9	-0.0128	1.1110	0.1414
1	10 (Winner)	-0.0114	1.1599	0.1433
1	L-W	0.0593	-0.0403	0.1555
2	1 (loser)	0.0953	1.0990	0.2339
2	2	0.0732	1.3719	0.1738
2	3	0.0444	1.1259	0.1418
2	4	0.0393	1.1090	0.1469
2	5	0.0490	1.1329	0.1490
2	6	0.0439	1.0556	0.1469
2	7	0.0024	1.1419	0.1441
2	8	0.0089	1.1094	0.1488
2	9	-0.0062	1.1922	0.1328
2	10 (Winner)	-0.0219	1.1739	0.1866
2	L-W	0.1172	-0.0749	0.1812
3	1 (Loser)	0.0695	1.1478	0.2258
3	2	0.0430	1.0277	0.2094
3	3	0.0470	1.3087	0.1772
3	4	0.0377	1.0468	0.1506
3	5	0.0163	1.2381	0.1369
3	6	0.0125	1.1295	0.1433
3	7	0.0068	1.1567	0.1291
3	8	0.0082	1.1093	0.1494
3	9	-0.0010	1.1003	0.1415
3	10 (Winner)	-0.0170	1.2897	0.1783
3	L-W	0.0865	-0.1418	0.1808
4	1 (Loser)	0.0498	1.0861	0.2085
4	2	0.0373	1.0807	0.1923
4	3	0.0266	0.9741	0.1866
4	4	0.0205	1.1246	0.1426
4	5	0.0017	1.2070	0.1597
4	6	0.0172	1.1809	0.1358
4	7	0.0328	1.1838	0.1744
4	8	0.0237	1.1267	0.1532
4	9	-0.0015	1.1744	0.1363
4	10 (Winner)	-0.0098	1.1439	0.1639
4	L-W	0.0597	-0.0578	0.1312
5	1 (Loser)	0.0565	1.0910	0.1916
5	2	0.0413	1.1491	0.1717
5	3	0.0427	1.0195	0.1798
5	4	0.0280	1.0721	0.1593
5	5	0.0276	1.1403	0.1511
5	6	0.0225	1.0661	0.1377
5	7	0.0235	0.9388	0.1596
5	8	0.0217	1.1604	0.1605
5	9	0.0241	1.0995	0.1482
5	10 (Winner)	0.0045	1.0471	0.1604
5	L-W	0.0520	0.0439	0.1371

An alpha return of 0.0479 should be interpreted as 4.79% per year

Table 7 Three factor time series regressions for portfolios

All LSE UK listed shares are ranked and allocated to rank period return deciles each January from 1960 to 1998. For the first test period year following portfolio formation we observe the value-weighted returns of the portfolio relative to the Treasury Bill rate and the return on a value-weighted market portfolio relative to the Treasury Bill rate. The difference in monthly return between small market capitalization firms and large firms (SMB) is taken from Dimson, Nagel and Quigley (2003) based on the method of Fama and French (1993, 1996). The difference in monthly return for high book-to-market ratio companies and low book-to-market ratio companies (HML) is taken from Dimson, Nagel and Quigley (2003). The regressions are based on all the monthly observations for a portfolio, drawing on all 39 portfolio formations. For the remaining four regressions (for post-formation years 2 to 5), we regress monthly excess returns on the portfolio in the year on the contemporaneous excess return on the market factor and on the HML and SMB factors created in the first test period year. An arbitrage portfolio (L-W) is constructed by subtracting the test period monthly return for the winner portfolio from the return on the loser portfolio for that month.

$r_p - r_f = \alpha_p + b_p (r_m - r_f) + s_p(SMB) + h_p(HML) + \epsilon_p$

year 1-5	decile	alpha	se	p-value	b_p	s_p	h_p	sigma	Rsq
1	1 (Loser)	0.0005	0.0016	0.381004	1.1460	1.0690	0.6407	0.0333	0.74
1	2	0.0034	0.0011	0.001146	1.0056	0.7330	0.3882	0.0229	0.82
1	9	-0.0005	0.0008	0.755975	0.9499	0.6741	-0.0151	0.0163	0.89
1	10(Winner)	0.0001	0.0010	0.473967	0.9519	0.6943	-0.0771	0.0199	0.84
1	L-W	0.0004	0.0019	0.411228	0.1941	0.3748	0.7179	0.0392	0.17
2	1(Loser)	0.0088	0.0021	0.000018	0.7757	0.0345	0.0915	0.0441	0.47
2	2	0.0087	0.0018	0.000001	0.8127	0.0915	-0.0528	0.0380	0.57
2	9	0.0013	0.0012	0.142589	0.7975	-0.0238	-0.0394	0.0255	0.74
2	10(Winner)	0.0002	0.0014	0.444854	0.8006	0.0334	-0.1116	0.0300	0.67
2	L-W	0.0086	0.0019	0.000004	-0.0249	0.0011	0.2031	0.0399	0.01
3	1(Loser)	0.0074	0.0021	0.000266	0.7474	0.0159	0.0729	0.0444	0.45
3	2	0.0041	0.0019	0.016055	0.7860	-0.0508	0.1640	0.0395	0.54
3	9	0.0020	0.0015	0.086217	0.7659	0.0116	-0.0917	0.0303	0.65
3	10(Winner)	0.0010	0.0015	0.266894	0.8726	0.0593	-0.0779	0.0323	0.68
3	L-W	0.0065	0.0018	0.000261	-0.1253	-0.0434	0.1508	0.0386	0.03
4	1(Loser)	0.0052	0.0020	0.005514	0.7620	-0.1039	0.0899	0.0424	0.49
4	2	0.0045	0.0017	0.004460	0.7518	-0.0741	-0.0002	0.0362	0.56
4	9	0.0014	0.0013	0.146630	0.8283	-0.0754	-0.0040	0.0277	0.72
4	10(Winner)	-0.0004	0.0017	0.590565	0.8726	-0.0248	0.1580	0.0352	0.65
4	L-W	0.0056	0.0019	0.001934	-0.1106	-0.0791	-0.0681	0.0400	0.03
5	1(Loser)	0.0049	0.0021	0.008962	0.7732	-0.0420	0.2192	0.0431	0.49
5	2	0.0048	0.0017	0.003201	0.7679	-0.0180	0.0157	0.0364	0.57
5	9	0.0032	0.0014	0.009226	0.8176	-0.0066	-0.0388	0.0287	0.71
5	10(Winner)	0.0010	0.0018	0.293463	0.8714	-0.0146	0.0255	0.0368	0.63
5	L-W	0.0039	0.0019	0.019516	-0.0982	-0.0274	0.1936	0.0398	0.03

An alpha return of 0.0049 should be interpreted as 0.49% per month

Table 8
Percentage of firms within each size decile falling in each rank period return decile

At each formation date, 1960-98, all LSE listed UK shares in the sample are sorted according to size and allocated to one of ten portfolios. Shares are also sorted on the basis of the rank period buy-and-hold returns. The numbers shown are the percentage of each size-based decile independently allocated to each rank period buy-and-hold return decile when the 39 test periods are aggregated.

	Size Decile									
Deciles defined by rank period returns	1	2	3	4	5	6	7	8	9	10
1	24.5	15.4	10.8	9.0	8.3	6.3	6.6	6.6	6.3	6.3
2	16.7	13.5	12.1	9.9	8.8	8.7	8.5	7.9	7.1	6.9
3	14.2	12.4	10.9	10.5	9.6	8.6	8.9	8.2	8.6	8.2
4	10.5	10.6	11.0	10.4	9.6	9.2	9.4	9.8	9.5	9.8
5	9.6	10.6	9.7	9.2	10.5	10.2	9.5	9.3	10.0	11.6
6	7.6	8.3	10.2	9.8	9.3	11.1	9.4	11.0	11.1	12.3
7	5.2	8.0	8.5	10.7	10.2	10.3	10.8	11.0	12.0	13.4
8	5.1	7.9	8.9	9.7	9.4	11.4	11.1	12.0	11.7	12.7
9	4.1	6.8	8.9	9.2	11.0	11.0	12.4	11.8	13.2	11.6
10	2.3	6.3	8.6	11.4	13.3	13.4	13.5	12.7	10.9	7.6

Table 9
Average buy-and-hold test period returns for portfolios defined by size and rank period returns.

For each of the 39 formation years, 1960-98, LSE listed UK stocks are sorted and allocated to deciles by size. They are also (independently) sorted by rank period returns and allocated to deciles. The test period returns are equally weighted raw returns with no adjustment for a market index. Each of the 100 portfolio returns presented is an average over the 39 test periods for a five-year holding period.

Deciles defined by rank period returns, R	Size decile										Average of all the size deciles	R_{S1}-R_{S10}
	R_{S1}	R_{S2}	R_{S3}	R_{S4}	R_{S5}	R_{S6}	R_{S7}	R_{S8}	R_{S9}	R_{S10}		
R_1	2.79	2.35	2.02	1.54	1.66	1.97	1.67	1.65	2.02	1.04	1.87	1.75
R_2	2.20	1.73	1.88	2.24	1.90	1.69	1.77	1.80	1.34	1.33	1.79	0.87
R_3	2.45	2.02	1.63	1.54	1.62	1.52	1.52	1.42	1.71	1.43	1.69	1.02
R_4	2.37	1.98	1.52	1.76	1.90	1.56	1.45	1.44	1.24	1.19	1.64	1.18
R_5	2.37	1.98	1.64	1.73	1.44	1.54	1.15	1.36	1.30	1.02	1.55	1.35
R_6	2.13	1.95	1.46	1.73	1.39	1.56	1.34	1.32	1.15	0.91	1.49	1.22
R_7	1.79	1.66	1.96	1.56	1.20	1.32	1.25	1.39	1.04	1.04	1.42	0.75
R_8	4.44	1.92	1.43	1.51	1.22	1.26	1.19	1.38	1.16	1.00	1.65	3.45
R_9	1.91	1.23	1.56	1.37	1.31	1.32	1.37	1.05	1.07	0.83	1.30	1.08
R_{10}	2.05	1.44	1.71	1.24	1.22	1.24	1.00	0.78	0.88	0.99	1.26	1.06
Average of all the rank period return deciles	2.45	1.83	1.68	1.62	1.49	1.50	1.37	1.36	1.29	1.08		
R_1-R_{10}	0.74	0.92	0.31	0.29	0.43	0.73	0.67	0.87	1.14	0.05		

Note that a figure of, say, 2.79 should be interpreted as a raw return of 279% over 5 years

Table 10
Average five-year test period percentage returns for ten portfolios of firms ranked by their five-year rank period returns, size control portfolios and size-adjusted returns.

For each formation date, 1960-1998, LSE listed UK shares are ranked and allocated to deciles on the basis of five-year rank period returns. They are also ranked and allocated to deciles by market capitalization. Each share in a rank period return decile is identified as also belonging to a size decile. The return in the five-year test period is calculated for each rank period return decile and each size decile (equal weighting of shares within portfolios). Then size control portfolio returns are calculated by substituting the actual test period return on a share in a rank period return decile with the return on the size decile that the stock falls into. Size-adjusted returns are calculated by subtracting the size-control portfolio returns from the actual returns on the rank period return deciles. This procedure is carried out for each of the portfolio formations and the reported numbers are averages over the 39 test periods. The tests are 1-sample t-tests, with 38 degrees of freedom. They are based on the mean return and standard deviation over 39 years (any value whose absolute value exceeds 2.02 makes the t-test significant at the 5% level).

Five-year test period returns

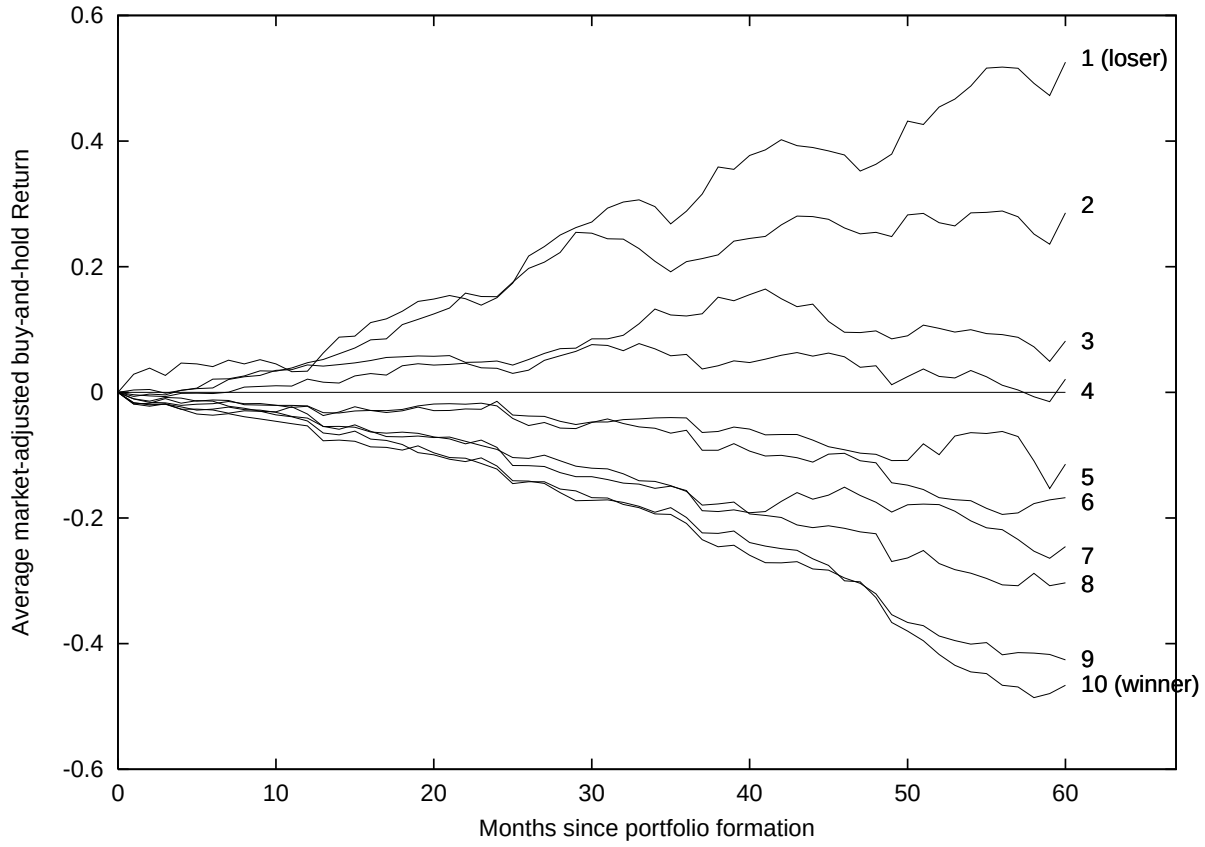
Portfolio	Test period raw returns for portfolios defined by rank period returns (R_p)	Size-control portfolio returns (R_S)	Size-adjusted returns $R_p - R_S$	t-test
1	2.09	1.82	0.28	3.59
2	1.97	1.68	0.28	4.35
3	1.74	1.60	0.14	2.23
4	1.66	1.56	0.10	2.09
5	1.52	1.52	0.00	0.07
6	1.45	1.49	-0.05	-0.83
7	1.39	1.49	-0.10	-2.30
8	1.39	1.50	-0.11	-1.99
9	1.24	1.48	-0.24	-5.41
10	1.18	1.49	-0.31	-4.60
$R_1 - R_{10}$	0.91	0.33	0.58	7.59

Note that a figure of, say, 0.28 in the size-adjusted return column should be interpreted as a 28 % return after adjustment for size.

Fig. 1

Cumulative market-adjusted returns for each decile over a 60 month test period

LSE listed UK stocks are ranked and assigned to deciles annually on the basis of their returns over five year periods to December 1959 and all subsequent Decembers to 1997. Cumulative equally weighted average residual returns for stocks month-by-month in the post-formation period are calculated. An equally weighted market index including all stocks from all deciles is used to adjust returns. All results presented are averages over the 39 rank periods computed for corresponding portfolios.



Note that a figure of, say, 0.20 should be interpreted as a market-adjusted return of 20%

Figure 2. Market-adjusted buy-and-hold five-year test period returns for loser minus winner strategies for each of the thirty nine portfolio formations.

The five-year test period returns for each loser-winner strategy are assigned to the year of formation.

A year of negative real GDP growth is indicated by and arrow ↙ (data sourced from Thompson Datastream)

A year of negative real return on equities is indicated by a square ☐ (data sourced from Barclays Capital Equity Gilt Study 2003)

Figure 2 (a) All sample companies. Loser-winner sixty-month returns. Shares within decile portfolios equally weighted. Market index constituents equally weighted.

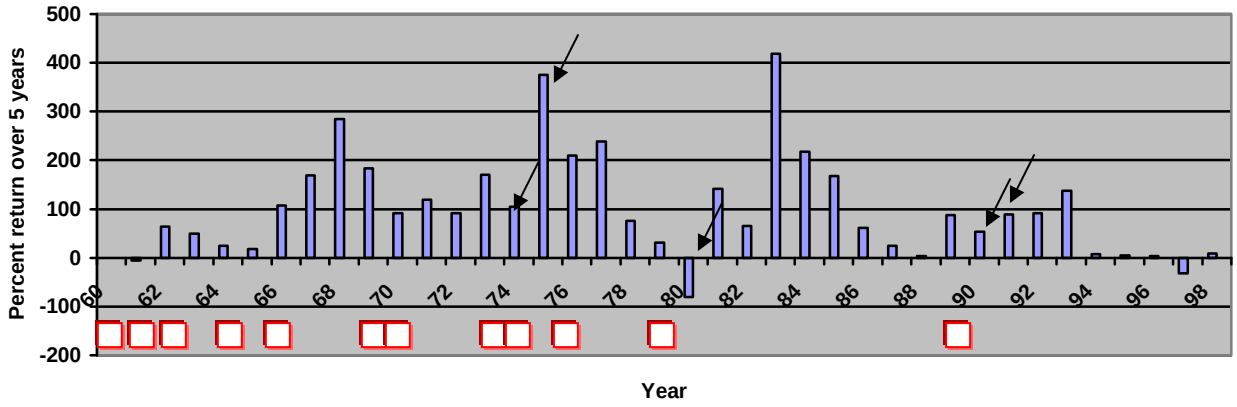


Figure 2 (b) All sample companies. Loser-winner sixty-month returns. Shares within decile portfolios value weighted. Market index constituents value weighted.

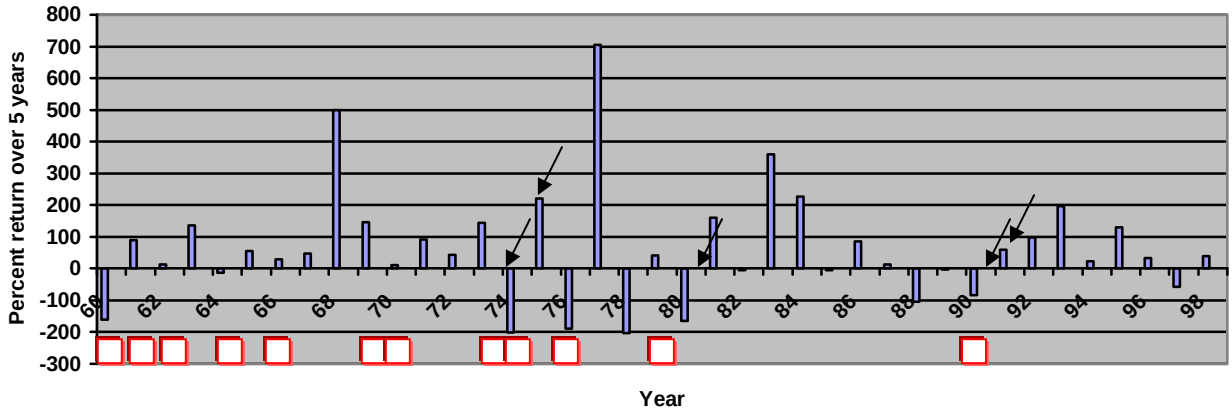
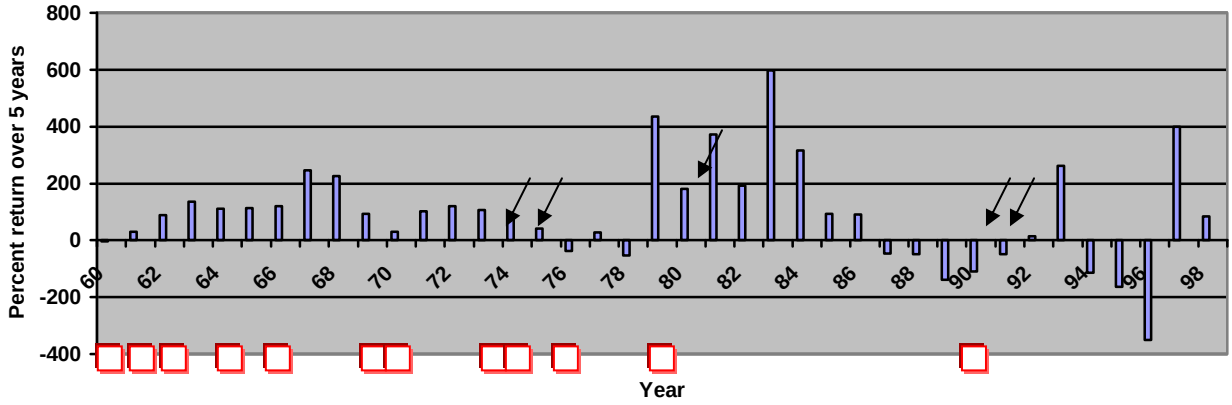


Figure 2 (c) Largest 20% of companies. Loser-winner sixty-month returns. Shares within decile portfolios value weighted. Market index constituents value weighted.



[1] For example: Baytas and Cakici (1999) who found return reversal in six countries, Schiereck, De Bondt and Weber (1999) and Külpman (2002) in German shares, Mun, Vasconcellos and Kish (2000) for Canada and the US, Da Costa, (1994) for Brazil, Ahmad and Hussain (2001) for Malaysia, Fung (1999) for Hong Kong, Wang et al. (2004) for Shanghai and Shenzhen. However, Brailsford (1992) failed to find return reversal and Gaunt (2000) finds only a weak indication of return reversal in the Australian equity market.

[2] The LSPD separately provides data on the 500 largest companies in 1955 and the 200 largest companies in 1972. However, to include these in addition to the one-third random sample would bias the results.

[3] Earlier studies in this field (e.g De Bondt and Thaler, 1985) are restricted to examining non-overlapping test periods. However the costs of this approach are loss of information and the possibility that the contrarian strategy depends upon an economy-wide cyclical factor that coincides with the five-year formation period cycle.

[4] All calculations were completed using a purpose-written programme in Fortran 95.

[5] The buy-and-hold approach has an advantage over the cumulative abnormal return (CAR) approach because it reflects a realistic strategy available to a long term investor who would suffer from the high transaction costs implicitly assumed by the monthly rebalancing in the CAR method. It seems reasonable to judge the success of the contrarian strategy on the basis of the one-off decision to buy or sell stocks on portfolio formation. The CAR method biases the measurement of rank-period returns and thus affects the composition of the winner and loser portfolios (Dissanaike, 1994). Conrad and Kaul (1993) show that CAR is flawed in that it spuriously inflates the return to the arbitrage portfolio, "Apart from being conceptually consistent with the notion of long term overreaction this measure [buy-and-hold] greatly reduces the statistical biases in previous cumulative performance measures" (p. 40). Barber and Lyon (1997) and Schierick *et. al*. (1999) note that buy-and-hold returns avoid biases in test statistics that result from the summation of monthly excess returns . Also, the buy-and-hold method provides a sharper distinction between portfolios when classifying firms (Loughran and Ritter, 1996). It is less prone to the problems created by infrequent trading. However, one disadvantage with the buy-and-hold method is that the weight accorded to securities that have risen by more than the average within the portfolio will, over time, increase; this could reduce diversification. Note that we do not rebalance the portfolio at the end of each test period year thus giving each share an equal weight within the portfolio at the start of each of the five holding years. Rebalancing would incur significant transaction costs.

[6] Share returns can show negative returns of more than 100% if each monthly return is measured relative to the market. For example if the market index rose by 100% when the share (or portfolio) return is zero the market-adjusted return is –100%. If in the next period again the share return is zero and the market rises by 100% the cumulative market-adjusted return becomes –200%.

[7] Using the term 'return' for the loser minus winner (zero-investment or arbitrage portfolio) is a somewhat loose use of language as the return is not actually defined. Perhaps the difference between going long one pound on losers and short one pound on winners should be called profits. Since the profits are the difference in returns on two (pound) portfolios they are measured in units of percent per unit of time.

[8] The relatively poor performance of the loser-winner portfolio in the 1980s parallels the experience in the US as described by Chen and Sauer (1997).

[9] This argument assumes (i) a positive asset beta that does not decrease substantially (ii) the debt of the firm is not changed to fully offset the equity value decline.

[10] Both losers and winners out-perform the market index in most states of the market in this analysis. This is largely because the market index used is value weighted, whereas the decile portfolio shares are equally weighted, giving a greater proportional weight to small companies.

[11] Index 3 in the LSPD database. We averaged the 90-day Treasury bill rate for the year.

[12] Gregory, Harris and Michou (2001) conduct a similar analysis.