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# INFORMATIONLESS TRADING

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*Abstract:* The recent paper by Goetzmann et al. (2002) suggests that fund managers subject to a performance review have an adverse incentive to engage in portfolio strategies that have the unfortunate attribute that they can expose the fund investor to significant downside risk. Weisman (2002) uses the term "informationless investing" to describe this behavior, and argues that these strategies are "peculiar to the asset management industry in general, and the hedge fund industry in particular" and that these strategies "can produce the appearance of return enhancement without necessarily providing any value to an investor." Just how prevalent are these practices in the fund management business? On the basis of a unique database of daily transactions and holdings of a set of forty successful Australian equity managers, we find evidence that individual managers do engage in this trading behavior, particularly when they form part of a team within a large decentralized money management operation and are compensated in the form of an annual bonus based on performance. This result is broadly consistent with the theoretical and empirical results of the principal agent literature which highlight the adverse consequences for the long term objectives of principals where agents are compensated based on observable short term performance. It is also consistent with recent results from the behavioral finance literature which suggest that agents narrowly focus on individual security gambles independent of overall portfolio value considerations.

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# INFORMATIONLESS TRADING

## I. Introduction

The purpose of developing quantitative measures of investment performance is to assess the extent to which the investment manager can add value over what could be obtained at low cost investing in passive benchmarks. This was the original motivation that Cowles (1933) proposed for using benchmark comparisons. Later work by Jensen (1968) and others refined the procedure to control for differences in risk, and Sharpe (1966) proposed comparing managers on the basis of zero net investment returns per unit of standard deviation risk. While quite a literature has developed to tweak these performance metrics[1], it remains true that most practitioners continue to pay a lot of attention to the simple Jensen alpha and Sharpe ratio measures for investment performance measurement.

In his early work, Cowles (1933) was sensitive to the fact that reliable inferences about relative performance would depend on assumptions about the statistical distribution of performance measures. Indeed it is well understood that these measures are sensitive to the assumption that

[1] A brief sampling of this literature would include Grant (1977), Roll (1978), Mayers and Rice (1979), Jobson and Korkie (1981, 1984), Dybvig and Ross (1985), Admati and Ross (1985), Lehmann and Modest (1987), Elton, Gruber, Das, and Hlvaka (1993), Breen, Jegadeesh and Ofer (1986), Connor and Korajczyk (1986), Grinblatt and Titman (1989) and Chen and Knez (1996). Further references can be found at: http://pages.stern.nyu.edu/~sbrown/performance/bibliography.html

returns are normally distributed. The use of the Sharpe ratio has come under recent scrutiny particularly when used to evaluate hedge fund managers who can create highly non-Normal payoffs by extensive use of derivative instruments[2]. One obvious way to resolve this issue is to consider adjusting the performance measure for the value of the implied option positions[3].

The fact remains however, that the Sharpe ratio and Jensen alpha are still widely used as summary measures of investment performance. In addition, as Busse (1999) points out, they play an important role in managerial compensation because risk-adjusted performance affects fund flows. Gruber (1996) and Sirri and Tufano (1998) document evidence of a performance-flow relation, where fund flows are disproportionately directed to mutual funds exhibiting high past period performance. Sawicki (2000) confirms that similar results follow for Australian managed funds and finds that funds flow on the basis of gross returns or risk adjusted returns. Sirri and Tufano (1998) and Jain and Wu (2000) also identify that the performance-flow effect is related to the marketing effort and media attention received by active mutual funds. Of particular interest is that Del Guercio and Tkac (2002) find important differences in the shape of performance-flow relation between mutual fund (convex) and pension fund (near linear) segments of the market. While Del Guercio and Tkac (2002) find that Jensen's alpha and flow is both significant and positively related, they show that pension fund flow is not as responsive to the magnitude of out-performance for 'winners' (as is the case for mutual funds) but is related to

[2]See, for example, the recent paper by Agarwal and Naik (2003).

[3]See, for example, the work of Jagannathan and Korajczyk (1986) and Glosten and Jagannathan (1994). For an application in the Australian context, see Pinnuck (2003).

whether the manager has actually outperformed the market index *ex-post*. Their research indicates that institutional fund inflow (*ex-ante*) is determined by a manager's ability to deliver positive Jensen's alpha and a low tracking error (*ex-post*).

For actively managed funds, maximizing risk-adjusted performance is an important goal in terms of the incentive structures that operate in the investment industry. In the first instance, given that the profitability of investment complexes is typically determined on the basis of aggregate funds under management, investment managers should therefore be motivated to maximize their asset size. Second, to the extent that performance, flow, risk-shifting behavior, top management turnover and managerial profitability are all intertwined, this raises the possibility that investment managers might attempt to game performance metrics for the purposes of ensuring their own survival.[4] Gaming may arise through the use of derivatives in the case of hedge funds[5], or by active trading where use of derivatives is otherwise restricted. Weisman (2002) identifies such behavior as "informationless investing". Goetzmann et al.(2002) (henceforth GISW) identify the conditions under which such behavior will in fact lead to a Sharpe ratio greater than that of the benchmark. They further show that in a complete market leveraging such a portfolio will lead to an arbitrarily large Jensen alpha measure.

This result would remain an intellectual curiosity but for the fact that as a general rule informationless trading implies significant downside risk for the investor. It also implies

[4]See, for example, Perold and Salomon (1991), Brown, Harlow and Starks (1996), Chevalier and Ellison (1997, 1999), Khorana (1996, 2001), and Busse (2001).

[5]Spurgin (2001).

significant systemic risk for the capital markets in which the investor trades. It is difficult to reconcile such trading with rational behavior on the part of a long term investor[6]. Prospect theory (Kahneman and Tversky 1979) provides one explanation for this behavior. Experiments have confirmed that agents prefer to realize gains and gamble on losses. An implication of this preference is that the agent would choose a portfolio with payout that is concave relative to benchmark. In other words, the agent would sell out on a gain, but increase the position on a loss hoping that the gamble would restore the amount lost. While informationless trading implies concave portfolio strategies, prospect theory would tend to explain why agents might choose extreme doubling strategies that do not lead to increased Sharpe ratios *a priori*.

On the other hand, evaluating the investment performance of a manager who engages in this conduct presupposes that the ruin event has not (yet) taken place. Based on a review of *ex post* investment performance, this manager will appear to be outstanding with high return achieved at relatively low risk. Adverse incentives are created to the extent that managers are compensated for ex post performance either directly in the form of an incentive fee, or indirectly in terms of a fee calculated on an asset base grossed up by the amount of performance-chasing inflow. For this reason informationless trading may be rational in a delegated fund management context where

[6]One example of informationless trading is doubling, where the investor increases his or her position on a loss to be recovered on a gain. A good example of this is the trading behavior of Nicholas Leeson which led to the Barings disaster (see Brown and Steenbeek 2001). This gives rise to the famous St. Petersburg Paradox where the investor will encounter ruin with probability one. Many philosophers, starting with Bernoulli have questioned the rationality of agents who enter this game (for an excellent discussion see Keynes (1952) pp. 316-320). Weisman (2002) points out that short volatility trading (long benchmark, short out of the money calls and puts) has the same attribute, and yet many sophisticated investors have participated in this game, a notable example being Long Term Capital Management (see Lowenstein (2000)).

agents are compensated on the basis of observable short term performance. Whatever its motivation, it remains true that informationless trading can be dangerous to one's financial health.

How prevalent is informationless trading? The Investment Company Act of 1940 limits the ability of US public funds to use leverage and derivative instruments to execute such trades. Similar restrictions in ERISA also apply to private US pension funds. Hedge funds by definition are not limited to the restrictions of the Investment Company Act of 1940. However there is limited disclosure and little reliable information to judge whether or not such methods are employed, except in the case of a blow out, when all is revealed[7]. But by then it is too late.

By contrast, the Australian case is interesting not only because public funds there are free to use derivative instruments (subject to certain constraints), but also because there exists a unique and otherwise inaccessible data set containing daily data on transactions and holdings for many of the largest public equity funds operating in that country. In this paper we examine this data to find out how prevalent informationless trading might be, and develop procedures that might be used to develop early warning systems to identify informationless trading when it occurs. Section 2 of the paper describes patterns of informationless trading and the experimental design used to identify it. Section 3 reviews the database of Australian equity fund holdings and transactions used in this study, while Section 4 presents the results. Section 5 concludes.

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[7]See Brown, Goetzmann and Ibbotson (1999) for a discussion of the institutional environment of hedge funds and their relationship to the 1940 Act.

## 2. Informationless Trading

"Informationless investing" is a term used by Weisman (2002) to describe a zero net investment public information portfolio strategy designed to yield a Sharpe Ratio in excess of the benchmark. Such a strategy can be implemented by borrowing to invest in the benchmark while simultaneously establishing positions in derivative securities written upon the benchmark. Alternatively it can be implemented by active trading that leads to similar payoffs. Examples of informationless trading include, but are not limited to, short volatility trades and St. Petersburg investing, otherwise known as doubling.

In their important paper, GISW establish the properties of zero net investment portfolio strategies that maximize the strategy Sharpe ratio. Figure 1 illustrates the return to such a strategy as a function of the return on the benchmark for the special case where the benchmark is LogNormal with parameters $\mu$=15%, $\sigma$=.15% and short interest rate 5% given an annual holding period. They observe that for this example the Sharpe ratio is .748 as opposed to the Sharpe ratio of the benchmark which is .631.   GISW observe that this portfolio strategy is attainable where there is a continuum of puts and calls traded. However, a close approximation can be made with just one call and one put, as illustrated in Figure 2. This short volatility strategy has a Sharpe ratio of .743.

These results show that a common unhedged short volatility strategy of a type reported to have been used by Long Term Capital Management can generate Sharpe ratios in excess of the benchmark using only public information. One interpretation of this result is the common understanding that one should not use Sharpe ratios where portfolio returns are skewed (in this case, left skewed). However, the same problem afflicts the Jensen alpha measure. GISW show that if there exists an informationless portfolio strategy that maximizes the Sharpe ratio, in a complete market this portfolio can be levered to generate an arbitrarily large Jensen alpha.

From the numerical example provided in GISW one is tempted to conclude that the portfolio that maximizes the Sharpe ratio (and leads to an unbounded Jensen alpha) is a concave strategy. GISW observe that this further result requires that the representative agent has a utility function that displays diminishing absolute risk aversion. This assumption is implicit in applying the Black Scholes formula to price the benchmark options. With this assumption, it is possible to demonstrate a somewhat stronger result. No globally convex informationless portfolio strategy can generate Sharpe ratios in excess of the benchmark.[8] This result suggests a simple empirical procedure based on a variant of the Treynor Mazuy (1966) procedure. If the quadratic term in the Treynor Mazuy regression is positive we cannot attribute a positive alpha or favorable Sharpe ratio to the use of informationless portfolio procedures[9]. In other words, in a regression of the form

$$R_{it} - r_{ft} = \alpha_i + \beta_i \times (R_{mt} - r_{ft}) + \gamma_i \times (R_{mt} - r_{ft})^2 + \epsilon_{it}$$

[8]This result can be demonstrated by showing that no out of the money calls or puts held long will increase the Sharpe ratio over that of a LogNormal benchmark. In particular, implementing portfolio insurance using put replication must lead to a reduction in the Sharpe ratio (details available on request). In private communication, Jon Ingersoll has proved that the same result holds in general assuming complete markets.

[9]Agarwal and Naik (2003) show that many hedge fund returns can be characterized by benchmark positions supplemented by short positions in out of the money options.

where $\beta_i$ is positive we should expect that $\gamma_i$ should be positive consistent with market timing ability.

However, this is at best a very weak test of whether managers use informationless trading. On the one hand, while concave informationless trading strategies generate positive alphas, we cannot rule out the possibility that informed trading may also yield concave strategies and positive alpha. Long Term Capital Management believed that the short volatility strategy was justified because in their view the options they wrote were overvalued, but difficult to hedge (Lowenstein 2000). On the other hand, if a manager were actually in the business of maximizing alpha through informationless trading, we may not observe sufficient tail region observations to estimate the quadratic term in the Treynor Mazuy regressions with sufficient precision to conclude that the trading strategy was in fact concave. This is a limitation that results from only considering return information. Holdings data is generally available for US mutual funds only on a quarterly basis. While some very interesting work has been completed using this data[10], fund managers and pension fund trustees typically have much more information on holdings and transactions and are not typically restricted to examining the series of fund returns.

Access to data on holdings and transactions would allow more powerful tests of whether traders are engaging in informationless trading. One simple test would be to examine whether any derivative positions held by the trader are concavity increasing or decreasing. Obviously, a short

[10]See, for example, Daniel, Grinblatt, Titman and Wermers (1997), Chen, Jegadeesh and Wermers (2000) and Wermers (2000). For an application in the Australian context, see Pinnuck (2003).

volatility position which is simultaneously short unhedged out of the money calls and puts would increase concavity of the pattern of payoffs. More generally, concavity would increase whenever the number of puts held short exceeds the number of calls held long. However, as noted before, we cannot rule out the possibility that the trader is trading on the basis of information. He or she may believe that volatility is about to fall, or may feel that the securities being traded are mispriced in an environment (such as the 1998 Russian bond example) where the derivatives held short are difficult to hedge.

One source of concave payoff distributions that is difficult to attribute to informed trading is the familiar doubling or St. Petersburg trading example. Such a trading pattern is characterized by increasing investment in the risky security on a loss so as to recoup past losses on a favorable market outcome. All investors who follow this strategy will face ruin in the long term, and we must resort to behavioral arguments to explain this behavior. Nevertheless, on a short term basis it gives the appearance of superior performance. The evidence suggests that this pattern of trading is descriptive of the behavior of Nicholas Leeson at Barings (Brown and Steenbeek 2001)[11].

[11]"I felt no elation at this success. I was determined to win back the losses. And as the spring wore on, I traded harder and harder, risking more and more. I was well down, but increasingly sure that my doubling up and doubling up would pay off ... I redoubled my exposure. The risk was that the market could crumble down, but on this occasion it carried on upwards ... As the market soared in July [1993] my position translated from a £6 million loss back into glorious profit. I was so happy that night I didn't think I'd ever go through that kind of tension again. I'd pulled back a large position simply by holding my nerve ... but first thing on Monday morning I found that I had to use the 88888 account again ... it became an addiction." (Leeson, 1996, pp.63-64). Such behavior might be rational in a context where the trader believes their trades are sufficiently large to move the markets in the desired direction. Leeson (1996) certainly believed this was the case, but maintains that the strategy failed through frontrunning.

To illustrate this point, consider the simple binomial process depicted in Figure 3. The initial investment of $S_0$ is financed by a loan equal to $C_0$, and an initial hurdle or highwatermark $h_0$ of zero. After one period, should the market fall, the net worth of the investor falls to $dS_0 - (1+r_f)\,C_0$ which is less than the period 1 highwatermark $h_1 \geq h_0$. To recoup this loss, the trader increases the investment in the risky security by borrowing an amount equal to $\Delta_1$ and investing the proceeds. With each loss, the investment in the risky security rises, until finally the market rises, allowing the trader to achieve the target return. At that point the trader liquidates the position and settles the margin account, reestablishing his initial position $S_0$.

It is easy to see that on any loss, a doubler will trade an amount equal to

$$\Delta_i = \frac{h_i - u\,d\,S_{i-1} + (1+r_f)^2\,C_{i-1}}{u - (1+r_f)} + S_0$$

where the first term accounts for past losses, and the second term reestablishes his position in the security. So long as the margin account is settled, the strategy has low risk and a return in excess of cash. Of course the positions grow exponentially with each trading loss and with probability one will exceed any finite capital limitation as the number of trading cycles becomes large. It is this aspect of doubling strategies that is most troubling.

To give a numerical illustration, consider the previous example from GISW where the value of the benchmark evolves as a lognormal process with instantaneous mean $\mu = .15$ per annum, volatility $\sigma = .15$ per annum and an annualized risk free rate of 5%. Using a 24 period binomial approximation to the annual lognormal distribution of benchmark values, it is possible to determine the distribution of terminal wealth for doubling and for other informationless trading strategies. Since the doubling strategy is path dependent, there will be a range of terminal wealth for any given benchmark return. In Figure 4 we show the relationship between annual returns to the doubling strategy and the corresponding returns to the benchmark. While there is a range of possible returns to a doubling strategy, these returns are a concave function of benchmark returns and there is the chance of significant losses. The magnitude of the losses depress the Sharpe ratio considerably, so that the doubling strategy for this example has a Sharpe ratio of only .0463, relative to an annual holding period Sharpe ratio of .6983. It might appear that maximizing the Sharpe ratio cannot be a motivation for doubling. However, most fund managers who achieve a return of less than -200% of their initial position would be fired immediately. Managers who survive (and 99.61% of them do in this example on an annual basis), achieve a much higher Sharpe ratio of 1.9622 (the Sharpe ratio of the benchmark is .7062 given those market conditions that allow the doubler to survive).

The challenge is to devise early warning signals that will alert investors and fund managers to patterns of doubling trading that might otherwise be obscured by the substantial alphas and Sharpe ratios that appear to be generated by such trading. The model of doubling trades is captured by the expression

$$\Delta_i = a + b_1(1 - \delta_i) h_i + b_2 V_i + b_3 B_i + b_4 \delta_i + b_5 G_i + \epsilon_i$$

where $\delta_i$ is a dummy variable indicating whether the highwatermark has been reached ($\delta_i = 1$ when $h_i > S_i - C_i$, zero otherwise) , $V_i = (1 - \delta_i) d S_{i-1}$ is the value of the security position on a loss, $B_i = (1 - \delta_i)(1 + r_f) C_{i-1}$ is the basis in that security position, and $G_i = \delta_i (S_i - C_i - h_i)$ is a measure of the gain once the highwatermark is reached. In the empirical work, we assume that the highwatermark evolves as $h_i = h_{i-1} + G_i$ with $h_0 = 0$.

The coefficients $b_1 = \frac{1}{u - (1 + r_f)} > 0$, $b_2 = -\frac{u}{u - (1 + r_f)} < 0$, and $b_3 = \frac{1 + r_f}{u - (1 + r_f)} > 0$,

given the trading model described above, whereas $b_5 \approx -1.0$ if we assume that the trader sells off any trading gains. The constants $a$ and $b_4$ and error term $\epsilon$ account for the average initial position of the trader, and any non-doubling trading patterns.

It is important to note that this empirical representation of trading is consistent with the predictions of prospect theory (Kahneman and Tversky 1979) which would have agents gambling on losses by increasing position size when losses occur and the value of the position is under the highwatermark, while at the same time realizing gains when above this target ( $b_5 = -1.0$). It is weakly consistent with the disposition effect (Odean 1998) which while predicting that agents realize gains, suggests that agents simply hold positions on a loss[12].

In summary, while concave payoff distributions are consistent with informationless trading, such evidence is not dispositive. Informed trading can also generate concave payoff distributions. Net short positions in out of the money calls and puts are equally consistent with informed trading where the underlying contracts are difficult or impossible to hedge. However, concave strategies when combined with trading patterns consistent with St. Petersburg trading would increase the concern that the trader is in fact engaging in informationless trading. The question is how widespread this pattern of trading really is among active traders.

## 3. Data

This study uses a unique database of daily transactions and periodic holdings of 40 (includes 1 small cap fund) actively managed institutional Australian equity funds in the period 2 January 1995 to 28 June 2002 (subject to data availability for particular funds). The data is sourced from the Portfolio Analytics Database, and the sample excludes passive equity funds (index and enhanced) and small-cap equity funds benchmarked. The data, provided under strict conditions of confidentiality, contains the daily portfolio holdings and trade information of either the largest (and where relevant) second largest investment products in Australian equities offered to institutional investors (i.e. pension funds). While the database includes all transactions in equity stocks, futures contracts and options securities, this study provides an evaluation of trading

[12] Frino, Johnstone and Zheng (2004) replicate Odean's (1998) methodology and find evidence consistent with the disposition hypothesis explaining the pattern of trading in the Sydney Futures Exchange.

performance related to equity securities.

The database was constructed with the support of Mercer Investment Consulting, whereby individual requests for data were sent electronically to all the major investment managers who operated in Australia between September and November 2001. Invitations were sent to 45 fund managers, and the total number of participating institutions who provided data was 37 (as at 30 June 2002). Managers were requested to provide information for their largest pooled active Australian equity funds (where appropriate) open to institutional investors. The term 'largest' was defined as the marked-to-market valuation of assets under management as at 31 December 2001, and was used as an indicative means of identifying portfolios that were truly representative of the investment manager. Given the data request procedure employed, and also that this information is not generally available to any organization, the decision to request only the largest equity fund represented a trade-off between maximizing the chances of cooperation from the manager, as well a consideration that the number of pooled institutional pooled funds per asset class is very small, and in a number of cases there is only one product available to wholesale investors. The resulting sample is a representative selection of some of the most successful equity funds in Australia[13].

For this study we examine managed Australian equity funds. Accordingly, the number of participating managers employed in this sample provides coverage of 26 individual investment organizations, where these firms (in aggregate) manage more than 60 percent of total

[13] "Most successful" in terms of assets under management (as of December 2001).

institutional assets in the industry.[14] The remaining 11 managers not included in the sample are removed due to either the back-office systems of the managers not permitting a complete extraction of both the relevant holdings and transactions data, or due to the managers offering exclusive index fund management services. Our study also relies on stock price information that is sourced from the ASX Stock Exchange Automated Trading System (SEATS) as an independent source of stock holding valuations which permitted cross-checking across the managers. The ASX SEATS data was provided by SIRCA, and includes all trade information for stocks listed on the ASX.

Due to the nature of the collection procedure, several data issues are likely to arise - survivorship and selection bias. Survivorship bias occurs when a sample only contains data from funds that have continued to exist through until the collection date of this sample period. As a consequence, if data from failed funds are not included in the sample, conclusions drawn from the pool of "successful" funds having survived the sample period will overstate overall performance. The second form of bias in managed fund studies is selection bias. This occurs when the fund sample contains data that has been selected for inclusion based on specific criteria. In this case, it is possible that managers managing multiple funds may present information for their most successful funds, skewing the sample as a result. Since the focus of this paper is on the trading behavior of the “most successful” Australian equity funds, we do not believe this represents a significant issue for our study[15].

[14] Sourced from market statistics provided by Rainmaker Information.

[15]In another study using the same database, Gallagher and Looi (2003) gain insight into the extent of the survivorship and selection bias by comparing the performance of the data

In terms of market representation by funds under management (at 31 December 2001), the sample includes the largest 10 managers, 8 from the next 10, 6 from the managers ranked 21-30, and the remaining managers are outside the largest 30 managers. In terms of investment style, the equity funds are partitioned based on the manager's self-reported style that is specific to the Australian market. These style classifications are 'value', 'growth', 'growth-at-a-reasonable price' (GARP), 'style neutral' and 'other'. The latter style classification includes managers that do not emphasize a specific investment style (excluding style neutral). In terms of the style representation across the sample, most funds operate using GARP (13) and value styles (10), and five and six funds follow growth and style neutral strategies, respectively. We also include three index/enhanced index style funds. Overall, our sample is highly representative of the Australian investment management industry in terms of manager size, the number of institutions operating in the financial services industry, and on the basis of investment style.

## 4. Results

### 4.1 Return based measures of informationless trading

In Table 1 we present the summary statistics of the funds. Within this group there is a considerable variation in size, number of stocks held and turnover, with some significant

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sample against that of the population of investment managers which also includes non-surviving funds. Over the entire sample window, the average outperformance of the average manager over the ASX/S&P 200 index is 1.78 percent with a standard deviation of 1.39 percent. For our sample the mean manager outperformed the average manager, weighted by manager years, by 0.34 percent per annum. While this indicates that the sample outperforms the industry, the magnitude of the outperformance is low compared to the dispersion of performance across management firms.

outliers, notably funds 1 and 31. Fund 1 is a very active trader, while find 31 does very little trading.

Tables 2 and 3 presents the results of this trading activity over the period of data for each of the funds. Almost every fund records positive Jensen alpha measures relative to the Australian All Ordinaries accumulation market index[16], and in more than half of the cases these measures are statistically significant on a daily or weekly return measurement interval[17]. In addition five out of the 40 funds (in the case of daily return measures) or one fund (in the case of weekly return measures) showed some evidence of successful market timing. In these cases the quadratic term in the Treynor Mazuy regression was positive and statistically significant.

On the other hand, almost all of the funds exhibit negative skewness, and in more than half of the cases, the Treynor Mazuy coefficient was negative. In fact, there were more cases of statistically significantly negative coefficients than of significant positive coefficients on a daily or a weekly return measurement interval. There are a number of possible interpretations of this result. Perhaps these funds are market timers who can't? If that is so, it is hard to explain the positive alphas and Sharpe ratios that are large relative to the corresponding All Ordinaries benchmark. Perhaps the results are an artefact of the Treynor Mazuy measure?

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[16]Results were almost identical using a four factor alpha incorporating Australian domestic market, size, book to market and momentum factors.

[17]One caveat to these results is the fact that Australian equity funds did not customarily report daily unit values until two years ago. The daily and weekly returns were therefore computed indirectly from records of daily holdings accounting for transactions matched up to total returns as computed in the SEATS database.

We verified this result using a modification of the Henriksson and Merton (1981) where instead of regressing excess return on excess return on the market index and the payoff of an at-the-money call, we incorporate the payoff of an at-the-money put, to capture the attribute of informationless trading that leads to negative skew and extreme left tail outcomes. In each case, the results matched the results obtained from inspection of the Treynor Mazuy coefficients.

It is tempting to conclude from this evidence that a minority of successful Australian equity funds use informationless trading to boost reported performance measures. However, these results are equally consistent with the alternative explanation that the results are simply due to chance. Bollen and Busse (2001) suggest that the non-Normality of daily returns implies that the resulting coefficients should be interpreted with care. Since the test statistics are fat tailed, we should not be surprised that we can reject the null hypothesis of zero nonlinear terms at about twice the size of the test. In addition, the results may simply be an artefact of the well understood stale pricing phenomenon. Since most of the funds studied limit investments to issues traded on the Australian Stock Exchange or on the over the counter market, when losses are realized, they can be relatively large given that many securities are illiquid and trade infrequently. In this context, the return-based evidence does not support the conjecture that many or most funds resort to informationless trading to augment reported performance statistics. The simple return based measures of informationless trading are simply not powerful enough to draw such a conclusion.

### 4.2 Derivatives positions consistent with informationless trading

While Australian managed funds are permitted to take positions in derivative securities, less than half of the funds in our sample established significant option positions and only two funds held significant positions in futures contracts[18]. For each holding date in the sample, we counted the number of positions classified as short volatility (out of the money calls and puts held short), long volatility (out of the money calls and puts held long), and various other short and long put and call positions[19]. We also classified the positions according to the extent to which they increased or decreased the concavity of a trading strategy based on the underlying security. Very few options were held by funds either long or short where there was not also a position in the underlying asset.

In Table 4 we show that while only a minority of option positions outstanding at month end could be characterized as short volatility of the underlying security, 72 percent of the option positions had the effect of increasing concavity. Of particular interest is the fact that almost all of the open month end option positions maintained by the enhanced index products were in fact concavity increasing. The fact that most of the option positions are unhedged short positions suggests that the funds are in fact attempting to improve reported performance numbers by informationless trades. This is particularly the case for the enhanced index products, where the

[18]While only funds 17 and 31 recorded any futures contracts in month end security holdings, in each case the futures positions constituted a little more than half of the fund asset value.

[19]Unfortunately, our database does not include complete option pricing details, so it is not possible to compute accurate value weights of the various option positions

enhancement appears to be short volatility trading. However, these positions represent a portfolio of options each one an option on an individual security. Only fund 4 held index options or options on index futures. This fund had an open short position in one Australian All Ordinaries index call option contract from December 1998 to March 2000. Thus while the evidence is consistent with volatility trades at the individual security level, it is not necessarily consistent with informationless trading at the level of the aggregate fund.

### 4.3 Patterns of trading consistent with informationless trading

Table 5 presents results based on the regression model presented in the previous Section, applied to daily measures of trading in individual stocks[20]. We measure trading as the total value of transactions less a passive apportionment of net fund inflow[21]. In almost of the cases studied, the signs of the coefficients are consistent with an informationless trading hypothesis, and in a quarter of the cases we see statistically significant patterns of doubling or St. Petersburg trading: when funds are currently under the previous high water mark of trading, they trade more the greater the original cost of the security position, and the lower the current market value of the position. In ten percent of the cases studied, the level of trading by the funds that are underwater

[20]Here we make the simplifying assumption that the parameters of the model dependent on measures of daily risk free rate and expected return are constant through the estimation period.

[21]We attempt to control for involuntary liquidation of fund assets and net fund inflow by excluding from daily transactions the total net inflow to the fund apportioned according to the percentage of the fund invested in each asset as of the previous month end holding period. The results were not sensitive to this adjustment, and were almost identical using the raw value of transactions as the dependent variable.

is significantly affected by the level of the high watermark. On the other hand these funds purchase to re-establish their position once above the high water mark, but any gains beyond the high water mark are promptly liquidated. In many cases this pattern is particularly striking as the funds liquidate almost dollar for dollar with any gain above the high water mark.

### 4.4 Informationless trading at the security level and fund level

In the case of derivative security holdings, we see evidence of informationless trading at the level of individual securities, but not at the level of the aggregate fund. There is no evidence that funds systematically use index options to artificially augment performance numbers, contrary to the conjecture of GISW. The evidence on security trading is similar. There is evidence of doubling at the security level but not at the fund level. If the doubling were the result of a conscious decision on the part of management to augment performance statistics in the hope of attracting new fund inflow, we should see doubling at the aggregate fund level. In other words we should expect to see the fund increasing the equity allocation as the value of the fund falls below the benchmark determined by the past maximum equity value. The results in Table 6 show that there is very little evidence of doubling once the high water mark is defined in terms of aggregate fund performance. In fact, the allocation of funds to the equity sector is strongly associated with fund value, which is consistent with momentum trading rather than the anti-momentum trades[22] typical in doubling situations.

[22] See Gallagher and Looi (2003)

How do we reconcile this evidence? Almost all of the funds in the study are managed in a decentralized fashion, where individual managers form part of a team that is compensated in the form of an annual bonus based on performance. Part of the explanation may lie in this delegation of fund management responsibility[23]. Once we aggregate according to style and management characteristics (Table 7) there is strong evidence that certain fund characteristics are associated with doubling behaviors. For example, we see that the evidence of doubling is concentrated in one fund style of management (GARP) and in funds that are large either in terms of assets under management or in terms of number of securities held. It is more prevalent where there is decentralized ownership by banks or insurance companies, where senior staff do not hold significant ownership positions and where these staff are compensated instead in the form of an annual bonus. This result is broadly consistent with the theoretical and empirical results of Holmstrom and Milgrom (1991) and Anderson and Schmittlein (1984) which highlight the adverse  consequences for the long term objectives of principals where agents are compensated based on observable short term performance.

However, this cannot be a complete explanation for these results. While fund management in Australia is typically 'team oriented', the head of equities as the leader of the team, bears ultimate responsibility. The extent to which the results are team driven or individually driven obviously depends on unobservable (to us) factors including the head's personality and the firm's internal management processes. In fact, the results are also consistent with simple behavioral explanations. Note for example that where the evidence of doubling is strongest, the funds tend

[23]See Elton and Gruber (2004) for a discussion of this issue.

to liquidate gains on a dollar for dollar basis (the coefficient is indistinguishable from -1.0). This is strongly consistent with both the prospect theory (Kahneman and Tversky 1979) and disposition (Odean 1998) hypotheses. In fact, there may be an alternative behavioral explanation for the fact that doubling occurs at the individual security level but not at the aggregate fund level. Tversky and Kahneman (1981) document that decision makers narrowly frame decisions under uncertainty to one gamble at a time, where in this case each gamble represents a position taken on an individual security or security derivative contract. This might explain an observed tendency of fund managers to double on individual stocks in an attempt to window dress the portfolio on quarterly review dates[24]. An important recent paper by Barberis, Huang and Thaler (2003) suggests that this narrow framing behavior is sufficient to explain limited equity market participation and the scale of the observed equity premium. In this context the evidence for doubling in large and decentralized decision making environments might be consistent with looser management controls in this organizational setting.

## 5. Conclusion

The recent paper by Goetzmann et al. (2002) suggests that fund managers subject to a performance review have an adverse incentive to engage in informationless trades that have the unfortunate attribute that they can expose the fund investor to significant downside risk.

[24] “We decided to redouble our efforts around a few stocks that we knew were loved, just loved by institutions, betting that near the end of the quarter they would come and embrace their favorites and 'walk them up,' or take them higher in order to magnify performance. Pretty much everyone in the business knows that there are some funds that live for the end of the quarter. They know they can 'juice' their performance by taking up big slugs of stock in the last few days of a quarter” Cramer (2002) p. 147. In context, like other doublers, Cramer believes that doubling down provides the necessary market pressure to move the market in the desired direction. We are indebted to Jeffrey Wurgler for this reference.

Weismann suggests that this behavior is endemic in managed investment funds and particularly in hedge funds. We examine this conjecture using a unique database of daily transactions and holdings by a set of forty successful Australian equity managers. High frequency holdings and transaction data is not typically available to academic observers, and our results suggest that greater transparency might be an important objective for both regulators and fund management. In particular, we find that while there is only limited return-based evidence of informationless trading, holdings and transactions data reveal that the funds are indeed trading in an informationless manner. Interestingly enough this evidence comes from holdings and transactions of individual securities within each fund, rather than the holdings and transactions of the fund taken as a whole. We observe that this result is consistent with both the principal agent literature as well as the recent behavioral literature.

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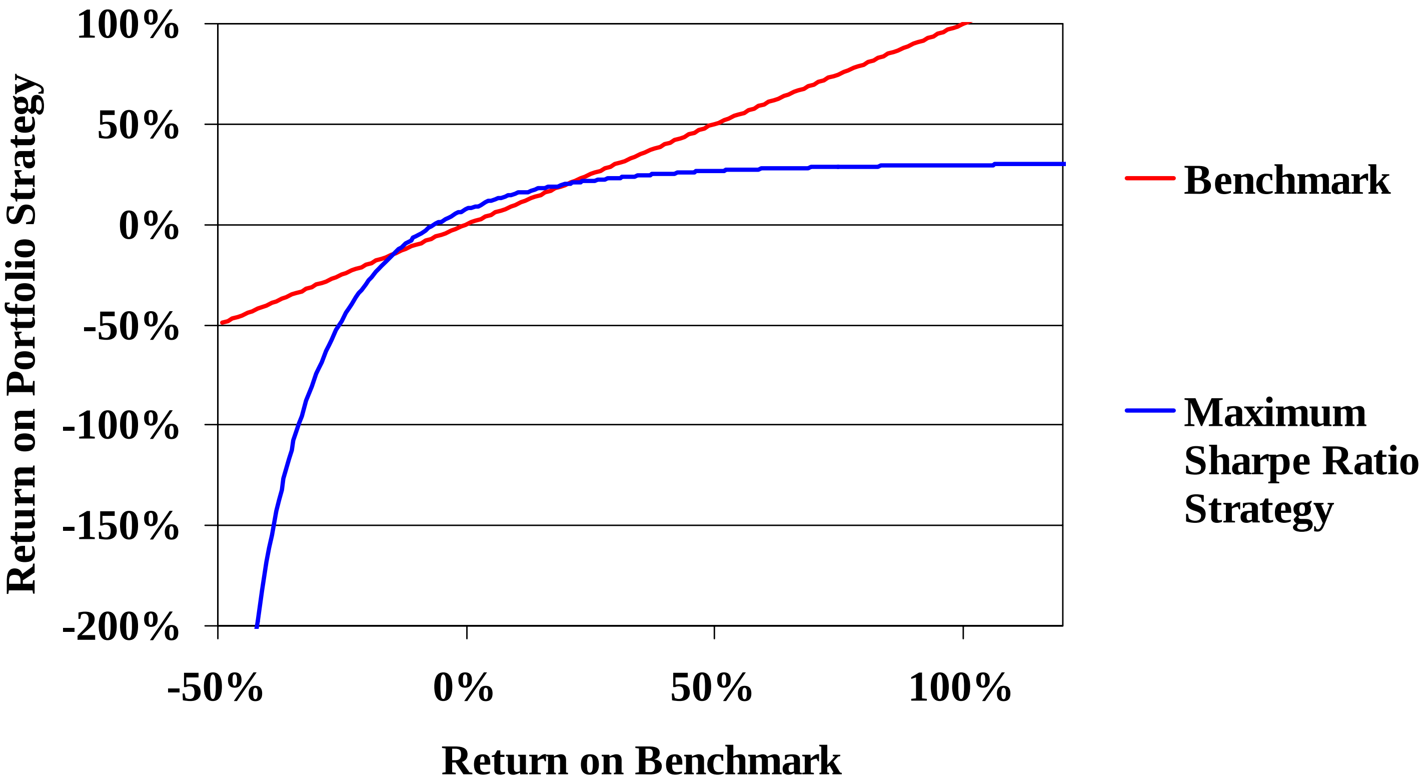
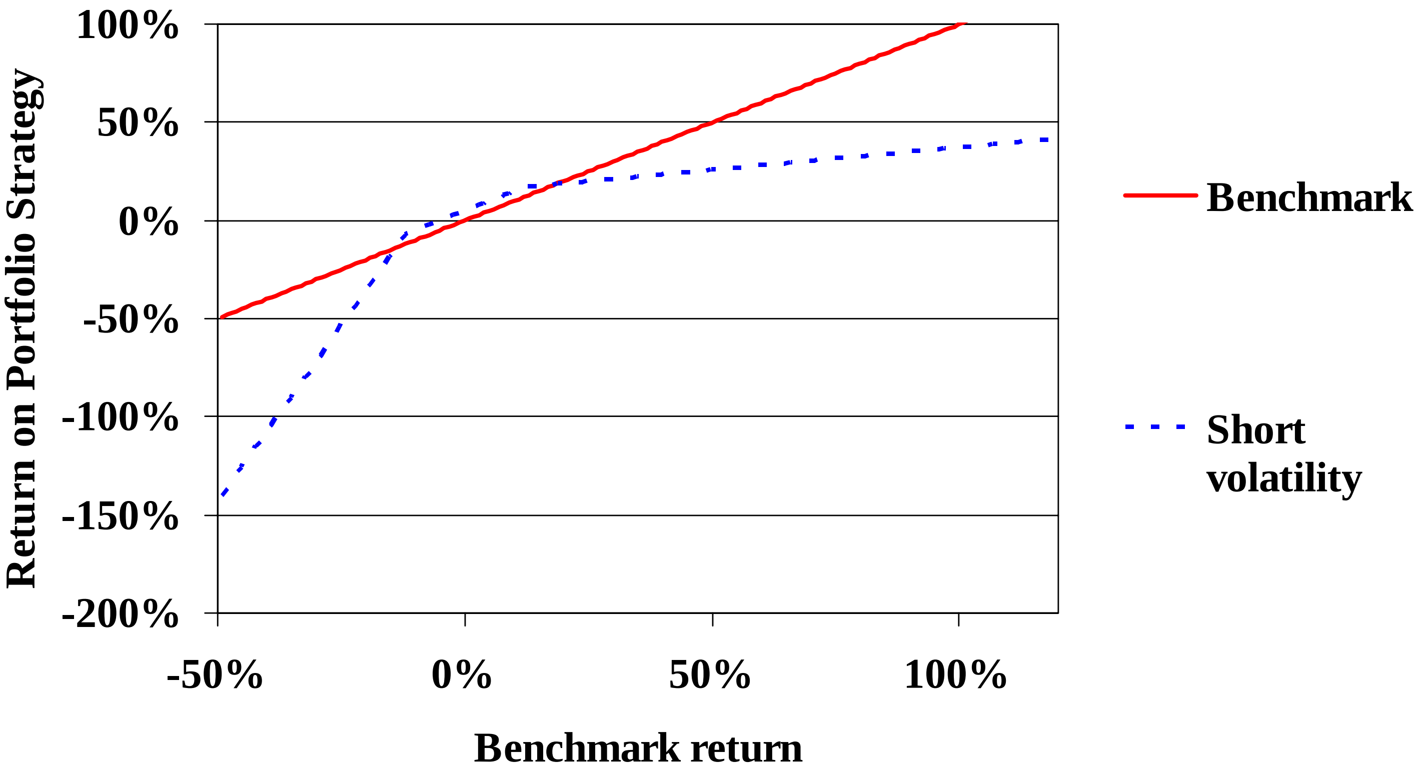
Figure 1: Sharpe Ratio Maximizing Portfolio Strategy for a LogNormal Benchmark




This figure gives the return on a maximum Sharpe Ratio portfolio strategy as a function of the return on the benchmark, assuming that the benchmark is distributed as LogNormal with parameters μ=15%, σ=.15% and short interest rate 5% given an annual holding period. The Sharpe Ratio of this strategy is .748 as opposed to the Sharpe Ratio of the benchmark which is .631. This figure is taken from Goetzmann et al.(2002).

Figure 2: Short Volatility Strategy for a LogNormal Benchmark




This figure gives the return on a short volatility strategy constructed by holding 100 units of the benchmark, short 258 out of the money puts at a strike of 0.88 and short 77 out of the money calls at a strike of 1.12, as a function of the return on the benchmark. The benchmark is distributed as LogNormal with parameters μ=15%, σ=.15% and short interest rate 5% given an annual holding period. The Sharpe Ratio of this strategy is .743 as opposed to the Sharpe Ratio of the benchmark which is .631. These results are taken from Goetzmann et al.(2002).

Figure 3:Illustration of doubling trading

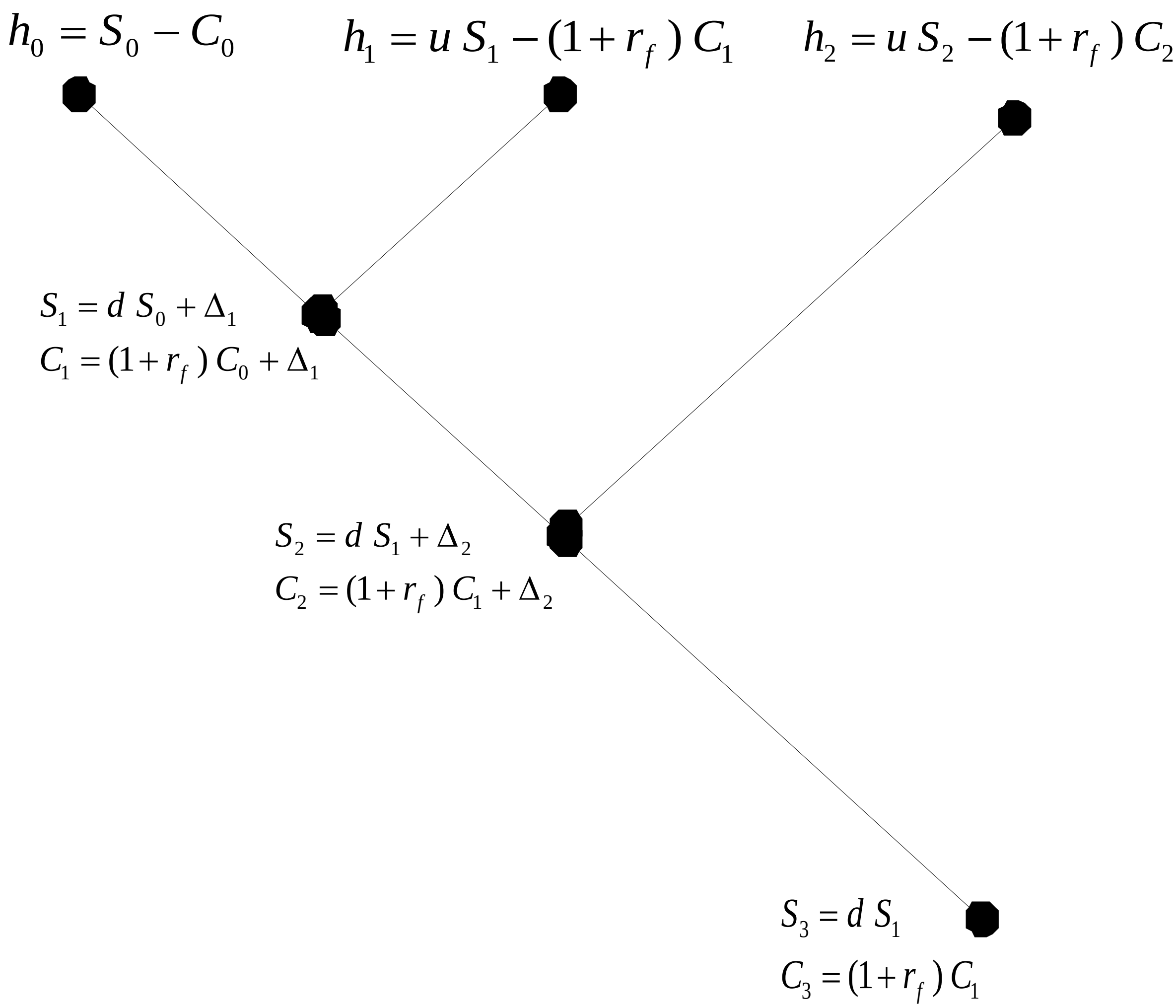


Figure 4 Informationless trading strategy returns

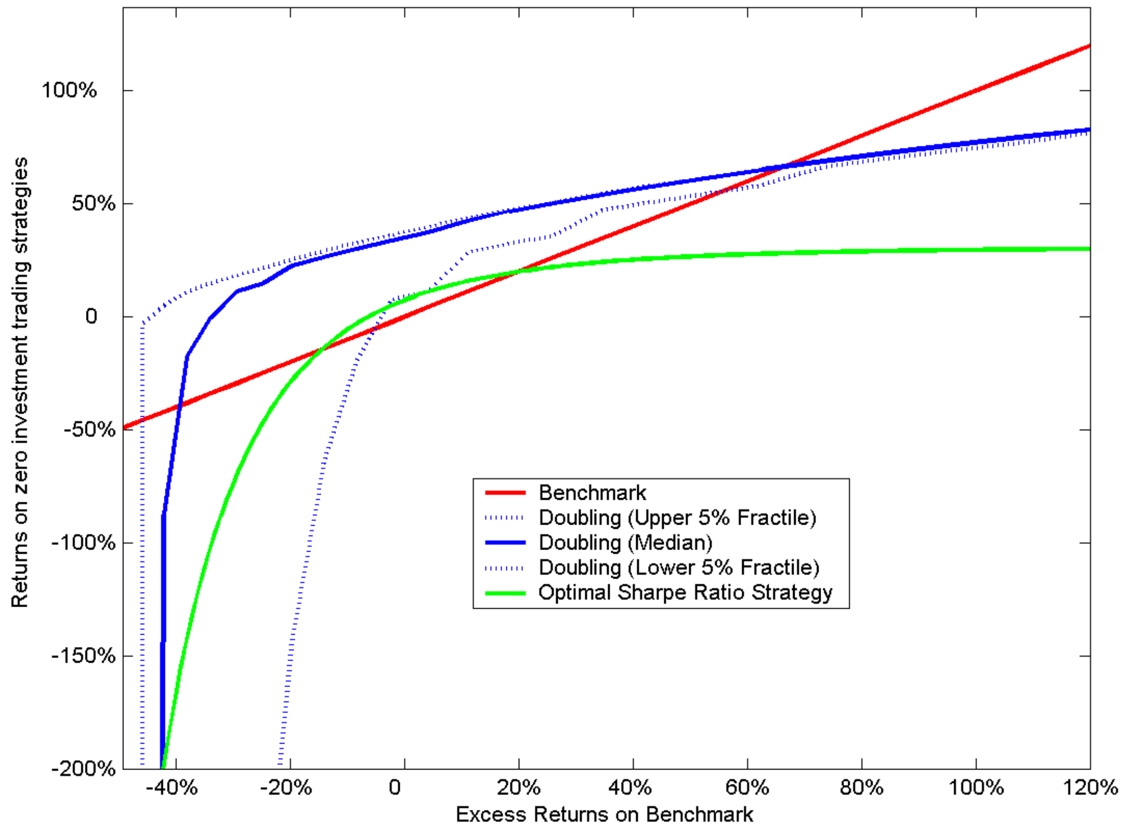


**Table 1: Descriptive statistics of funds studied**

| Fund Investment Style | Fund | Number of observations | Average number of securities held | Average number of trades per month | Average annual turnover |
|---|---|---|---|---|---|
| **GARP** | 1 | 427 | 108 | 66.1 | 20.69 |
| | 2 | 1515 | 78 | 161.6 | 0.79 |
| | 3 | 1514 | 66 | 280 | 1.18 |
| | 4 | 859 | 231 | 294.3 | 1.07 |
| | 5 | 1897 | 104 | 150.9 | 0.87 |
| | 6 | 633 | 54 | 109.4 | 0.42 |
| | 7 | 425 | 47 | 114.2 | 1.39 |
| | 8 | 464 | 48 | 68.5 | 0.65 |
| | 9 | 425 | 49 | 118.5 | 1.39 |
| | 10 | 107 | 30 | 31 | 1.62 |
| | 11 | 505 | 112 | 117.3 | 1.44 |
| | 12 | 107 | 47 | 67.2 | 0.86 |
| | 13 | 887 | 87 | 82.6 | 0.16 |
| **Growth** | 14 | 427 | 31 | 90.8 | 0.35 |
| | 15 | 1954 | 38 | 3.9 | 0.26 |
| | 16 | 1954 | 35 | 8.2 | 0.34 |
| | 17 | 1931 | 50 | 41.4 | 0.85 |
| | 18 | 1339 | 51 | 365.7 | 6.4 |
| **Neutral** | 19 | 1011 | 126 | 287.1 | 0.64 |
| | 20 | 632 | 62 | 97.3 | 2 |
| | 21 | 1009 | 45 | 43.2 | 6.8 |
| | 22 | 777 | 31 | 76.7 | 0.99 |
| | 23 | 1887 | 40 | 22.4 | 0.51 |
| | 24 | 1092 | 37 | 21.6 | 0.49 |
| **Other** | 25 | 1506 | 100 | 122.2 | 0.69 |
| | 26 | 797 | 68 | 71.1 | 0.84 |
| | 27 | 837 | 27 | 36 | 1.27 |
| **Value** | 28 | 2020 | 87 | 170.6 | 0.91 |
| | 29 | 1029 | 96 | 76.3 | 0.5 |
| | 30 | 1836 | 74 | 71.6 | 1.68 |
| | 31 | 528 | 41 | 22.4 | 0.09 |
| | 32 | 365 | 56 | 45.8 | 0.92 |
| | 33 | 884 | 36 | 39.3 | 0.61 |
| | 34 | 1049 | 72 | 87.2 | 0.81 |
| | 35 | 884 | 32 | 32 | 0.59 |
| | 36 | 272 | 31 | 26.3 | 0.62 |
| | 37 | 428 | 61 | 296.1 | 0.02 |
| **Passive/ Enhanced** | 38 | 778 | 271 | 231.3 | 0.34 |
| | 39 | 1515 | 308 | 187 | 0.33 |
| | 40 | 1897 | 340 | 227.6 | 0.23 |

**Table 2: Characteristics of fund daily returns**

| Fund Investment Style | Fund | Mean | Standard Deviation | Sharpe Ratio | Alpha | FF Alpha | Beta | Skewness | Kurtosis | Curvature | Adjusted Henriksson Merton |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **GARP** | 1 | 0.03% | 0.77% | 0.0388 | 0.02% | 0.02% | 0.82 | -1.2404 | 14.9989 | -0.02714 | -0.15502 |
| | | | | | (1.97) | (2.25) | | | | (-2.84) | (-5.42) |
| | 2 | 0.06% | 0.92% | 0.0644 | 0.03% | 0.03% | 1.06 | -0.4130 | 7.4423 | 0.00623 | 0.05635 |
| | | | | | (7.03) | (7.51) | | | | (0.65) | (3.49) |
| | 3 | 0.06% | 0.92% | 0.0607 | 0.03% | 0.03% | 1.04 | -0.5023 | 9.1313 | 0.00119 | 0.02735 |
| | | | | | (5.10) | (5.40) | | | | (0.19) | (1.37) |
| | 4 | 0.03% | 0.78% | 0.0447 | 0.02% | 0.02% | 0.96 | -0.4222 | 5.7012 | 0.02392 | 0.09717 |
| | | | | | (2.80) | (3.38) | | | | (2.39) | (3.50) |
| | 5 | 0.01% | 0.82% | 0.0146 | -0.01% | 0.00% | 0.90 | -0.5076 | 12.5909 | -0.00326 | -0.02140 |
| | | | | | (-1.17) | (-0.52) | | | | (-0.21) | (-0.73) |
| | 6 | 0.05% | 0.87% | 0.0520 | 0.03% | 0.03% | 0.90 | -0.8433 | 10.8784 | -0.01296 | -0.09292 |
| | | | | | (1.68) | (1.84) | | | | (-0.43) | (-1.36) |
| | 7 | 0.02% | 0.77% | 0.0310 | 0.01% | 0.00% | 0.96 | -0.8997 | 8.3456 | -0.01130 | -0.02385 |
| | | | | | (0.68) | (-0.12) | | | | (-1.68) | (-0.50) |
| | 8 | 0.02% | 0.88% | 0.0262 | 0.00012 | 5.12E-05 | 1.06 | -1.0570 | 9.1225 | 0.01140 | 0.04749 |
| | | | | | (1.49) | (0.65) | | | | (1.11) | (1.67) |
| | 9 | 0.02% | 0.77% | 0.0310 | 0.01% | 0.00% | 0.96 | -0.9085 | 8.3978 | -0.01196 | -0.02694 |
| | | | | | (0.68) | (-0.11) | | | | (-1.78) | (-0.56) |
| | 10 | 0.02% | 1.09% | 0.0152 | -0.01% | -0.01% | 1.09 | -1.7335 | 10.4898 | -0.00867 | -0.02349 |
| | | | | | (-0.56) | (-0.60) | | | | (-0.53) | (-0.32) |
| | 11 | 0.02% | 0.70% | 0.0312 | 0.01% | 0.01% | 0.96 | -0.8464 | 8.6271 | -0.00039 | 0.04418 |
| | | | | | (1.02) | (1.23) | | | | (-0.07) | (1.18) |
| | 12 | 0.04% | 0.72% | 0.0580 | 0.03% | 0.05% | 0.63 | -1.9786 | 19.5896 | -0.14020 | -0.51645 |
| | | | | | (1.30) | (1.81) | | | | (-5.42) | (-4.97) |
| | 13 | 0.04% | 0.92% | 0.0382 | 0.01% | 0.02% | 0.91 | -0.0203 | 17.9927 | 0.00837 | -0.00143 |
| | | | | | (0.83) | (1.10) | | | | (0.35) | (-0.02) |
| **Growth** | 14 | 0.03% | 0.89% | 0.0376 | 0.01% | 0.01% | 1.01 | -0.4834 | 6.4289 | -0.00277 | -0.01507 |
| | | | | | (1.93) | (1.77) | | | | (-0.24) | (-0.73) |
| | 15 | 0.03% | 0.89% | 0.0386 | 0.01% | 0.02% | 1.01 | -0.3788 | 9.0964 | -0.00240 | -0.01227 |
| | | | | | (1.85) | (2.22) | | | | (-0.53) | (-0.51) |
| | 16 | 0.04% | 0.84% | 0.0457 | 0.02% | 0.02% | 0.94 | -0.4793 | 10.3912 | -0.00856 | -0.04705 |
| | | | | | (2.50) | (2.73) | | | | (-1.34) | (-1.81) |
| | 17 | 0.03% | 0.84% | 0.0319 | 0.00% | 0.01% | 1.00 | -0.6617 | 9.9290 | -0.00981 | -0.05632 |
| | | | | | (1.03) | (1.59) | | | | (-5.48) | (-3.46) |
| | 18 | 0.06% | 0.96% | 0.0595 | 0.00038 | 0.000392 | 1.08 | -0.4794 | 8.3978 | 0.00306 | 0.03200 |
| | | | | | (6.00) | (6.22) | | | | (0.53) | (1.49) |
| **Neutral** | 19 | 0.04% | 0.86% | 0.0436 | 0.02% | 0.02% | 1.01 | -0.4056 | 5.5247 | 0.00849 | 0.03571 |
| | | | | | (3.61) | (3.66) | | | | (3.22) | (2.24) |
| | 20 | 0.07% | 0.86% | 0.0767 | 0.05% | 0.05% | 1.03 | -0.5000 | 5.9904 | 0.02841 | 0.13189 |
| | | | | | (7.21) | (7.26) | | | | (7.17) | (5.10) |
| | 21 | 0.03% | 0.93% | 0.0305 | 0.00% | 0.01% | 1.07 | -0.3073 | 4.6229 | 0.01645 | 0.03026 |
| | | | | | (0.67) | (0.80) | | | | (2.03) | (1.10) |
| | 22 | 0.04% | 0.88% | 0.0465 | 0.02% | 0.02% | 1.01 | -0.9458 | 8.3384 | -0.01060 | -0.05741 |
| | | | | | (1.79) | (2.02) | | | | (-0.75) | (-1.36) |
| | 23 | 0.05% | 0.81% | 0.0571 | 0.02% | 0.03% | 0.95 | -0.5645 | 11.5717 | -0.00518 | -0.03806 |
| | | | | | (3.83) | (4.58) | | | | (-0.74) | (-1.88) |
| | 24 | 0.04% | 0.97% | 0.0418 | 0.02% | 0.02% | 1.04 | -0.4575 | 8.2892 | 0.00291 | 0.00184 |
| | | | | | (2.60) | (2.81) | | | | (0.45) | (0.08) |
| **Other** | 25 | 0.03% | 0.86% | 0.0405 | 0.00011 | 9.84E-05 | 0.98 | -0.6130 | 10.6272 | -0.00271 | -0.01078 |
| | | | | | (2.29) | (1.98) | | | | (-0.99) | (-0.62) |
| | 26 | 0.01% | 0.82% | 0.0105 | 0.01% | 0.01% | 1.03 | -0.8378 | 8.3886 | -0.00136 | 0.00166 |
| | | | | | (1.80) | (1.45) | | | | (-0.30) | (0.08) |
| | 27 | 0.04% | 0.84% | 0.0484 | 0.02% | 0.02% | 1.00 | -0.8225 | 8.0211 | -0.01241 | -0.06778 |
| | | | | | (2.47) | (2.42) | | | | (-2.26) | (-1.71) |
| **Value** | 28 | 0.02% | 0.63% | 0.0256 | 4.8E-05 | 9.96E-05 | 0.66 | -1.0274 | 14.4896 | -0.00002 | -0.00306 |
| | | | | | (0.68) | (1.41) | | | | (0.00) | (-0.12) |
| | 29 | 0.03% | 0.83% | 0.0329 | 0.02% | 0.01% | 1.01 | -0.3649 | 5.8822 | 0.00873 | 0.03656 |
| | | | | | (3.64) | (3.45) | | | | (3.07) | (2.30) |
| | 30 | 0.01% | 0.87% | 0.0096 | -0.01% | -0.01% | 0.78 | -0.6887 | 9.9624 | -0.00760 | -0.08714 |
| | | | | | (-0.69) | (-0.41) | | | | (-0.49) | (-1.73) |
| | 31 | 0.06% | 0.67% | 0.0934 | 0.05% | 0.05% | 0.85 | -1.2474 | 12.3272 | -0.04023 | -0.08921 |
| | | | | | (4.47) | (4.05) | | | | (-2.60) | (-1.79) |

**Table 2: Characteristics of fund daily returns (continued)**

| Fund Investment Style | Fund | Mean | Standard Deviation | Sharpe Ratio | Alpha | FF Alpha | Beta | Skewness | Kurtosis | Curvature | Adjusted Henriksson Merton |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Value** | 32 | 0.07% | 0.73% | 0.0897 | 0.06% | 0.06% | 0.89 | -1.0073 | 9.0071 | -0.01428 | -0.00860 |
| | | | | | (4.17) | (4.00) | | | | (-1.60) | (-0.14) |
| | 33 | 0.05% | 0.80% | 0.0566 | 0.03% | 0.04% | 0.82 | -0.1878 | 4.6342 | 0.02126 | 0.08129 |
| | | | | | (2.09) | (2.86) | | | | (1.25) | (1.58) |
| | 34 | 0.04% | 0.83% | 0.0431 | 0.03% | 0.03% | 0.98 | -0.2947 | 5.2878 | 0.01246 | 0.03890 |
| | | | | | (3.84) | (3.96) | | | | (2.18) | (1.53) |
| | 35 | 0.10% | 0.96% | 0.1044 | 0.09% | 0.08% | 0.60 | -0.9203 | 18.6309 | -0.11822 | -0.44607 |
| | | | | | (3.20) | (2.55) | | | | (-4.09) | (-4.48) |
| | 36 | 0.07% | 0.77% | 0.0928 | 0.00062 | 0.000648 | 0.79 | -1.5887 | 11.7619 | 0.03455 | 0.15352 |
| | | | | | (2.24) | (2.31) | | | | (0.53) | (1.47) |
| | 37 | 0.02% | 0.61% | 0.0292 | 0.00% | 0.01% | 0.63 | -1.2832 | 14.5898 | -0.01127 | -0.07527 |
| | | | | | (0.70) | (1.34) | | | | (-1.80) | (-3.00) |
| Passive/ Enhanced | 38 | 0.06% | 0.82% | 0.0756 | 0.04% | 0.04% | 1.01 | -0.5575 | 6.1699 | 0.02026 | 0.09232 |
| | | | | | (12.73) | (11.75) | | | | (5.80) | (7.76) |
| | 39 | 0.05% | 0.86% | 0.0621 | 0.03% | 0.03% | 1.00 | -0.4548 | 9.5136 | 0.00567 | 0.04460 |
| | | | | | (10.45) | (11.28) | | | | (1.61) | (4.77) |
| | 40 | 0.02% | 0.78% | 0.0217 | 0.00% | 0.00% | 0.84 | -0.4789 | 14.1571 | -0.00077 | -0.01551 |
| | | | | | (-0.32) | (0.21) | | | | (-0.04) | (-0.53) |

Mean, Standard Deviation and Sharpe ratio are calculated on the basis of total daily fund returns. These data were constructed from records of daily holdings and transactions matched against the total returns recorded in the SEATS database, or as reported by the manager (typically for the last year of our sample), with short interest rate given by the holding period returns on 30 Day Treasury Notes (data from Reserve Bank of Australia). Alpha and beta are calculated relative to the corresponding ASX All Ordinaries index in excess of the short interest rate, expressed in percentage daily terms (t-values computed using the White correction for heteroskedasticity in parentheses). The curvature term corresponds to the quadratic term in the Treynor Mazuy model, while the Adjusted Henriksson Merton term corresponds to the coefficient on a put payoff (instead of the more usual call payoff) in the Henriksson Merton (1981) model

**Table 3: Characteristics of fund weekly returns**

| Fund Investment Style | Fund | Mean | Standard Deviation | Sharpe Ratio | Alpha | FF Alpha | Beta | Skewness | Kurtosis | Curvature | Adjusted Henriksson Merton |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **GARP** | 1 | 0.19% | 1.69% | 0.1130 | 0.10% | 0.10% | 0.90 | -0.4207 | 4.4203 | -0.02116 | -0.17138 |
| | | | | | (2.76) | (2.76) | | | | (-2.69) | (-2.68) |
| | 2 | 0.29% | 1.91% | 0.1527 | 0.16% | 0.17% | 1.08 | -0.0213 | 3.4664 | 0.00924 | 0.07933 |
| | | | | | (7.20) | (6.96) | | | | (1.25) | (1.81) |
| | 3 | 0.27% | 1.87% | 0.1464 | 0.15% | 0.15% | 1.05 | 0.0016 | 3.8560 | 0.01249 | 0.08794 |
| | | | | | (5.33) | (5.39) | | | | (1.29) | (1.65) |
| | 4 | 0.15% | 1.75% | 0.0877 | 0.09% | 0.10% | 0.96 | -0.1678 | 3.1175 | 0.00181 | -0.00905 |
| | | | | | (2.41) | (3.15) | | | | (0.23) | (-0.13) |
| | 5 | 0.06% | 1.73% | 0.0369 | -0.03% | -0.02% | 0.89 | -0.0190 | 3.3010 | -0.00222 | -0.05756 |
| | | | | | (-0.74) | (-0.54) | | | | (-0.17) | (-0.68) |
| | 6 | 0.22% | 1.97% | 0.1110 | 0.15% | 0.15% | 0.99 | -0.4793 | 3.8615 | -0.05217 | -0.36385 |
| | | | | | (2.19) | (2.19) | | | | (-3.84) | (-3.18) |
| | 7 | 0.13% | 1.94% | 0.0663 | 0.05% | 0.05% | 0.97 | 0.0106 | 4.5652 | 0.01087 | 0.07178 |
| | | | | | (0.71) | (0.71) | | | | (0.90) | (0.69) |
| | 8 | 0.10% | 2.02% | 0.0498 | 0.00049 | -8.1E-05 | 1.04 | -0.2767 | 3.4096 | -0.01018 | -0.08058 |
| | | | | | (1.19) | (-0.21) | | | | (-1.26) | (-1.20) |
| | 9 | 0.13% | 1.94% | 0.0660 | 0.04% | 0.04% | 0.97 | 0.0080 | 4.5793 | 0.01068 | 0.07102 |
| | | | | | (0.70) | (0.70) | | | | (0.88) | (0.68) |
| | 10 | 0.30% | 2.68% | 0.1121 | 0.10% | 0.10% | 1.07 | -0.3568 | 2.7624 | -0.00012 | -0.05034 |
| | | | | | (0.97) | (0.97) | | | | (-0.01) | (-0.32) |
| | 11 | 0.06% | 1.76% | 0.0337 | 0.01% | 0.01% | 0.96 | -0.0251 | 3.6446 | -0.00227 | 0.01044 |
| | | | | | (0.36) | (0.36) | | | | (-0.26) | (0.14) |
| | 12 | 0.42% | 1.68% | 0.2481 | 0.39% | 0.39% | 0.63 | -0.7387 | 6.9626 | -0.02586 | -0.23102 |
| | | | | | (3.19) | (3.19) | | | | (-1.06) | (-1.10) |
| | 13 | 0.17% | 1.80% | 0.0921 | 0.06% | 0.06% | 0.91 | -0.5072 | 3.6330 | -0.04303 | -0.32124 |
| | | | | | (1.39) | (1.39) | | | | (-5.48) | (-4.63) |
| **Growth** | 14 | 0.16% | 1.92% | 0.0851 | 0.05% | 0.05% | 1.07 | -0.1255 | 3.3113 | 0.00366 | 0.05627 |
| | | | | | (1.86) | (1.61) | | | | (0.51) | (1.17) |
| | 15 | 0.17% | 1.88% | 0.0893 | 0.06% | 0.07% | 1.04 | -0.0606 | 4.2179 | -0.00362 | -0.01879 |
| | | | | | (1.89) | (2.10) | | | | (-0.26) | (-0.29) |
| | 16 | 0.19% | 1.80% | 0.1053 | 0.09% | 0.09% | 0.97 | -0.1656 | 4.4976 | -0.02009 | -0.13697 |
| | | | | | (2.49) | (2.38) | | | | (-1.36) | (-1.93) |
| | 17 | 0.13% | 1.75% | 0.0738 | 0.03% | 0.04% | 1.02 | -0.1262 | 3.2494 | -0.00367 | -0.03494 |
| | | | | | (1.30) | (1.84) | | | | (-0.55) | (-0.82) |
| | 18 | 0.28% | 2.00% | 0.1379 | 0.00191 | 0.001944 | 1.10 | -0.1965 | 3.1299 | -0.00588 | -0.01714 |
| | | | | | (5.83) | (5.80) | | | | (-0.70) | (-0.28) |
| **Neutral** | 19 | 0.18% | 1.90% | 0.0934 | 0.06% | 0.06% | 1.02 | -0.0622 | 3.4169 | 0.00804 | 0.03433 |
| | | | | | (2.51) | (2.41) | | | | (1.26) | (0.76) |
| | 20 | 0.22% | 2.34% | 0.0927 | 0.14% | 0.14% | 0.97 | -0.0621 | 3.3963 | -0.01806 | -0.26002 |
| | | | | | (1.00) | (1.00) | | | | (-0.65) | (-1.11) |
| | 21 | 0.23% | 2.02% | 0.1148 | 0.12% | 0.12% | 1.01 | -0.0320 | 3.2115 | -0.00134 | -0.02060 |
| | | | | | (2.51) | (2.51) | | | | (-0.12) | (-0.22) |
| | 22 | 0.19% | 2.02% | 0.0928 | 0.09% | 0.10% | 1.07 | -0.4598 | 4.3506 | -0.01612 | -0.09391 |
| | | | | | (1.57) | (1.92) | | | | (-1.04) | (-0.96) |
| | 23 | 0.22% | 1.69% | 0.1329 | 0.11% | 0.13% | 0.97 | -0.1145 | 3.4667 | -0.00327 | -0.05213 |
| | | | | | (4.10) | (4.57) | | | | (-0.52) | (-0.97) |
| | 24 | 0.20% | 2.02% | 0.0978 | 0.08% | 0.09% | 1.06 | -0.2107 | 3.4761 | -0.00865 | -0.06695 |
| | | | | | (2.61) | (2.76) | | | | (-0.90) | (-1.16) |
| **Other** | 25 | 0.17% | 1.72% | 0.1013 | 0.00063 | 0.000603 | 0.98 | -0.1514 | 3.1595 | 0.00013 | 0.01232 |
| | | | | | (3.32) | (2.91) | | | | (0.03) | (0.34) |
| | 26 | 0.23% | 1.83% | 0.1283 | 0.23% | 0.23% | 1.01 | -0.0652 | 3.0798 | -0.00103 | -0.01594 |
| | | | | | (6.61) | (6.61) | | | | (-0.13) | (-0.25) |
| | 27 | 0.19% | 1.91% | 0.1011 | 0.11% | 0.11% | 1.03 | -0.2781 | 3.4311 | -0.01209 | -0.03784 |
| | | | | | (2.38) | (2.38) | | | | (-1.11) | (-0.43) |
| **Value** | 28 | 0.08% | 1.35% | 0.0604 | 0.00026 | 0.000498 | 0.67 | -0.2704 | 4.5473 | -0.00875 | -0.08471 |
| | | | | | (0.74) | (1.49) | | | | (-0.80) | (-1.27) |
| | 29 | 0.27% | 1.83% | 0.1479 | 0.22% | 0.22% | 1.00 | 0.0624 | 3.4488 | 0.01061 | 0.07278 |
| | | | | | (9.93) | (9.93) | | | | (2.24) | (1.80) |
| | 30 | 0.05% | 1.84% | 0.0252 | -0.04% | -0.04% | 0.76 | 0.0740 | 4.2876 | -0.02096 | -0.19050 |
| | | | | | (-0.57) | (-0.57) | | | | (-1.25) | (-1.42) |
| | 31 | 0.29% | 1.66% | 0.1718 | 0.25% | 0.19% | 0.87 | -0.4338 | 4.8583 | -0.01832 | -0.12174 |
| | | | | | (3.98) | (2.95) | | | | (-1.19) | (-1.14) |

**Table 3: Characteristics of fund weekly returns (continued)**

| Fund Investment Style | Fund | Mean | Standard Deviation | Sharpe Ratio | Alpha | FF Alpha | Beta | Skewness | Kurtosis | Curvature | Adjusted Henriksson Merton |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Value** | 32 | 0.33% | 1.83% | 0.1775 | 0.31% | 0.32% | 0.90 | -0.4401 | 3.1850 | -0.01866 | -0.14292 |
| | | | | | (4.01) | (3.51) | | | | (-1.75) | (-1.06) |
| | 33 | 0.37% | 1.83% | 0.2044 | 0.28% | 0.28% | 0.79 | -0.0611 | 4.2555 | -0.02440 | -0.17048 |
| | | | | | (3.53) | (3.53) | | | | (-1.52) | (-1.23) |
| | 34 | 0.29% | 1.83% | 0.1582 | 0.25% | 0.25% | 0.98 | 0.0923 | 3.7466 | 0.01121 | 0.06200 |
| | | | | | (7.54) | (7.54) | | | | (1.55) | (1.01) |
| | 35 | 0.88% | 2.39% | 0.3686 | 0.83% | 0.83% | 0.43 | 1.2235 | 10.2456 | -0.00605 | 0.10501 |
| | | | | | (4.81) | (4.81) | | | | (-0.18) | (0.36) |
| | 36 | 0.34% | 1.89% | 0.1815 | 0.29% | 0.31% | 0.90 | -0.6252 | 5.1276 | -0.02198 | -0.18672 |
| | | | | | (3.02) | (3.07) | | | | (-0.86) | (-1.13) |
| | 37 | 0.09% | 1.28% | 0.0693 | 0.00026 | 0.000442 | 0.63 | -0.4125 | 4.4588 | -0.02025 | -0.14773 |
| | | | | | (0.81) | (1.30) | | | | (-1.35) | (-2.37) |
| **Passive/ Enhanced** | 38 | 0.29% | 1.81% | 0.1621 | 0.18% | 0.19% | 1.00 | -0.1799 | 3.0805 | 0.00456 | 0.02232 |
| | | | | | (7.75) | (8.21) | | | | (0.91) | (0.50) |
| | 39 | 0.26% | 1.75% | 0.1499 | 0.14% | 0.15% | 1.01 | -0.0252 | 3.4723 | 0.00987 | 0.06758 |
| | | | | | (11.21) | (11.73) | | | | (1.64) | (2.71) |
| | 40 | 0.09% | 1.65% | 0.0534 | 0.00% | 0.01% | 0.84 | -0.0712 | 3.6454 | -0.00522 | -0.07595 |
| | | | | | (-0.07) | (0.25) | | | | (-0.39) | (-0.93) |

Mean, Standard Deviation and Sharpe ratio are calculated on the basis of total week by week fund returns. These data were constructed from records of daily holdings and transactions matched against the total returns recorded in the SEATS database, or as reported by the manager (typically for the last year of our sample), with short interest rate given by the holding period returns on 30 Day Treasury Notes (data from Reserve Bank of Australia). Alpha and beta are calculated relative to the corresponding ASX All Ordinaries index in excess of the short interest rate, expressed in percentage daily terms (t-values computed using the White correction for heteroskedasticity in parentheses). The curvature term corresponds to the quadratic term in the Treynor Mazuy model, while the Adjusted Henriksson Merton term corresponds to the coefficient on a put payoff (instead of the more usual call payoff) in the Henriksson Merton (1981) model

**Table 4: Fraction of open option positions by security**

| Fund Investment Style | Fund | Short volatility | Long put Short call | Short put Long call | Long volatility | Short put | Long put | Short call | Long call | Concavity increasing | Concavity decreasing | Concavity neutral | N |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **GARP** | 1 | | | | 15.00% | | 61.67% | | 23.33% | | 100.00% | | 60 |
| | 2 | 2.73% | 2.50% | 5.00% | 1.36% | 18.18% | 10.23% | 37.95% | 22.05% | 61.14% | 36.36% | 2.50% | 440 |
| | 3 | | | 3.64% | | 10.91% | 12.73% | 22.73% | 50.00% | 33.64% | 62.73% | 3.64% | 110 |
| | 4 | 4.52% | 1.69% | 17.23% | 13.84% | 7.91% | 3.95% | 12.71% | 38.14% | 29.38% | 70.62% | | 354 |
| | 5 | 17.65% | | | | 35.29% | | 47.06% | | 100.00% | | | 17 |
| | 6 | | | | | | | | 100.00% | | 100.00% | | 11 |
| | 11 | | | | | | 50.00% | | 50.00% | | 100.00% | | 6 |
| | 13 | | | | | | | | 100.00% | | 100.00% | | 11 |
| **Growth** | 15 | | | | | | | 60.00% | 40.00% | 60.00% | 40.00% | | 5 |
| | 16 | | | | | | | 100.00% | | 100.00% | | | 3 |
| | 17 | 1.45% | 1.45% | | | 2.90% | 13.04% | 59.42% | 21.74% | 65.22% | 34.78% | | 69 |
| **Neutral** | 21 | 45.89% | 2.74% | 2.05% | | 16.44% | | 32.19% | 0.68% | 95.89% | 0.68% | 3.42% | 146 |
| | 22 | | | | | | | | 100.00% | | 100.00% | | 10 |
| | 24 | | | | | | | | 100.00% | | 100.00% | | 1 |
| **Value** | 31 | | 15.14% | | | 0.69% | 0.92% | 75.46% | 7.80% | 83.72% | 14.45% | 1.83% | 436 |
| | 33 | | | | | | | 35.00% | 65.00% | 35.00% | 65.00% | | 20 |
| **Passive/** | 38 | 11.27% | 0.23% | 1.88% | | 16.90% | | 64.32% | 5.40% | 94.37% | 5.63% | | 426 |
| **Enhanced** | 39 | 29.35% | 2.55% | 4.06% | | 27.49% | 0.35% | 29.47% | 6.73% | 88.05% | 9.40% | 2.55% | 862 |
| **Total** | | 13.39% | 3.72% | 4.45% | 2.14% | 15.53% | 4.32% | 40.27% | 16.17% | 72.01% | 26.31% | 1.67% | 2987 |

In this table we count the total number of open option positions at each end of month holding date recorded in the Portfolio Analytics Database, where the underlying security is also held by the fund. Short volatility refers to positions where there are short puts and calls outstanding, whereas long volatility refers to positions where there are long puts and calls held. "Concavity increasing" positions arise whenever the number of puts is less than the negative of the number of calls. An example is short volatility, where both options are held in negative amounts. "Concavity decreasing positions arise where the number of puts is greater than the negative of the number of calls. "Concavity neutral" positions arise where the number of puts equals the negative of the number of calls.

Only fund 4 held index options or options on index futures. This fund had an open short position in one Australian All Ordinaries index call option contract from December 1998 to March 2000.

**Table 5: Trade analysis regression - Individual securities**

| Fund Investment Style | Fund | Constant | Highwater mark | Value of Holdings | Cost Basis | Above Highwater mark? | Value above highwater | Rsq | N | Durbin Watson Statistic |
|---|---|---|---|---|---|---|---|---|---|---|
| **GARP** | 1 | 147549 | 0.1817 | -0.1721 | 0.1383 | -565440 | -0.1325 | 0.0346 | 2496 | 2.313 |
| | | (0.87) | (2.55) | (-2.39) | (2.18) | (-1.97) | (-1.15) | | | |
| | 2 | 67323 | 0.0167 | -0.0240 | 0.0169 | 1115909 | -1.0445 | 0.9313 | 5735 | 2.089 |
| | | (1.31) | (2.08) | (-2.35) | (2.06) | (8.23) | (-66.46) | | | |
| | 3 | 102972 | 0.0201 | -0.0215 | 0.0077 | 512267 | -0.9916 | 0.8601 | 9383 | 1.719 |
| | | (2.78) | (3.02) | (-2.85) | (1.16) | (6.68) | (-118.02) | | | |
| | 4 | 44670 | 0.0630 | -0.0186 | 0.0104 | -119797 | 0.0293 | 0.0154 | 2053 | 1.874 |
| | | (1.70) | (1.74) | (-0.66) | (0.42) | (-2.65) | (0.78) | | | |
| | 5 | 19925 | -0.0458 | 0.0128 | -0.0239 | 3604 | -0.4825 | 0.0225 | 4187 | 1.846 |
| | | (2.23) | (-2.87) | (0.93) | (-2.28) | (0.19) | (-8.17) | | | |
| | 6 | 85789 | 0.0576 | -0.0370 | 0.0504 | 54438 | 0.4459 | 0.0834 | 1798 | 1.636 |
| | | (5.39) | (0.70) | (-0.74) | (1.28) | (1.97) | (4.21) | | | |
| | 7 | -176151 | 0.3133 | -0.4331 | 0.3374 | -12560 | 0.3592 | 0.0884 | 751 | 1.713 |
| | | (-4.46) | (1.94) | (-3.11) | (2.85) | (-0.14) | (1.23) | | | |
| | 8 | -111215 | 0.0392 | -0.0379 | 0.0348 | 228645 | 0.1263 | 0.0357 | 954 | 1.937 |
| | | (-3.58) | (0.49) | (-0.66) | (0.79) | (5.46) | (0.86) | | | |
| | 9 | -151972 | 0.2515 | -0.2923 | 0.2319 | 21050 | 0.2807 | 0.0393 | 775 | 1.794 |
| | | (-4.56) | (1.48) | (-2.01) | (1.90) | (0.30) | (0.99) | | | |
| | 10 | 70629 | 0.1807 | 0.1058 | -0.1261 | 40457 | 0.0598 | 0.0324 | 113 | 1.231 |
| | | (0.65) | (0.67) | (0.69) | (-0.87) | (0.28) | (0.76) | | | |
| | 11 | -7872 | 0.1197 | -0.0727 | 0.0739 | 9299 | -0.2268 | 0.0198 | 798 | 1.813 |
| | | (-1.79) | (1.14) | (-0.70) | (0.80) | (1.08) | (-1.16) | | | |
| | 12 | 24081 | -0.1370 | -0.0267 | 0.0463 | 83078 | -0.1522 | 0.0315 | 577 | 1.966 |
| | | (1.39) | (-1.04) | (-0.27) | (0.52) | (3.04) | (-1.29) | | | |
| | 13 | 2466 | 0.0821 | -0.0741 | 0.0682 | 21148 | -0.9636 | 0.7315 | 1701 | 1.858 |
| | | (1.99) | (1.68) | (-1.36) | (1.45) | (8.65) | (-39.87) | | | |
| **Growth** | 14 | 65744 | -0.0062 | 0.0021 | 0.0017 | 24462 | -0.0201 | 0.0033 | 6005 | 1.803 |
| | | (2.77) | (-0.37) | (0.14) | (0.14) | (0.59) | (-0.47) | | | |
| | 15 | -921788 | -0.3179 | -0.8574 | 0.1934 | -5527047 | -1.0838 | 0.4764 | 127 | 2.059 |
| | | (-1.33) | (-0.11) | (-11.12) | (6.00) | (-1.82) | (-1.04) | | | |
| | 16 | -653660 | 0.5128 | -0.7699 | 0.2659 | -4683619 | -0.7729 | 0.2007 | 120 | 2.045 |
| | | (-0.41) | (1.15) | (-2.92) | (2.62) | (-2.09) | (-1.53) | | | |
| | 17 | 14762 | 0.0750 | -0.0324 | 0.0285 | 18329 | -0.5298 | 0.0136 | 1638 | 2.277 |
| | | (0.70) | (1.25) | (-0.43) | (0.39) | (0.40) | (-0.95) | | | |
| | 18 | -6422 | 0.0050 | -0.0053 | 0.0040 | 8105 | 0.0286 | 0.0002 | 7674 | 1.968 |
| | | (-0.80) | (0.86) | (-0.70) | (0.89) | (0.39) | (0.54) | | | |
| **Neutral** | 19 | -9178 | 0.0021 | -0.0076 | 0.0118 | 54078 | 0.0094 | 0.0072 | 7605 | 1.813 |
| | | (-1.08) | (0.29) | (-0.69) | (1.13) | (2.05) | (0.09) | | | |
| | 20 | -44091 | -0.0440 | 0.0468 | -0.0387 | 23420 | -0.0707 | 0.0030 | 1510 | 1.598 |
| | | (-1.50) | (-0.67) | (0.69) | (-0.63) | (0.41) | (-0.54) | | | |
| | 21 | 20961 | 0.0124 | -0.0304 | 0.0185 | -3138 | -0.1364 | 0.0156 | 1768 | 1.723 |
| | | (1.10) | (0.77) | (-1.48) | (1.00) | (-0.06) | (-1.54) | | | |
| | 22 | -5410 | 0.0045 | -0.0478 | 0.0566 | 10471 | -0.0004 | 0.0276 | 2150 | 1.716 |
| | | (-1.37) | (0.31) | (-2.15) | (2.47) | (1.43) | (-0.01) | | | |
| | 23 | -9104 | 0.1483 | -0.1265 | 0.1089 | 21150 | -0.5877 | 0.0326 | 836 | 1.998 |
| | | (-2.09) | (1.55) | (-1.12) | (1.12) | (2.66) | (-1.79) | | | |
| | 24 | 14587 | 0.3488 | -0.0430 | -0.0256 | -12967 | 0.4650 | 0.0359 | 453 | 2.590 |
| | | (0.70) | (2.02) | (-0.35) | (-0.27) | (-0.49) | (1.88) | | | |
| **Other** | 25 | 2832 | 0.0261 | -0.0182 | 0.0168 | -998 | 0.1515 | 0.0070 | 5187 | 1.841 |
| | | (0.63) | (1.53) | (-0.75) | (0.72) | (-0.13) | (1.66) | | | |
| | 26 | -28998 | -0.0461 | 0.0401 | -0.0203 | 52553 | -0.0856 | 0.0085 | 1531 | 1.797 |
| | | (-3.59) | (-2.01) | (2.20) | (-1.55) | (2.34) | (-1.21) | | | |
| | 27 | -23387 | 0.1922 | -0.2382 | 0.1585 | 47191 | -1.1412 | 0.0549 | 580 | 1.977 |
| | | (-2.04) | (1.69) | (-2.72) | (2.48) | (2.21) | (-2.18) | | | |
| **Value** | 28 | 5333 | 0.0079 | 0.0054 | -0.0050 | -33877 | -0.2755 | 0.0068 | 7703 | 1.953 |
| | | (0.38) | (0.29) | (0.23) | (-0.22) | (-1.15) | (-2.06) | | | |
| | 29 | 36854 | 0.1000 | 0.0259 | -0.0618 | 22266 | -0.2567 | 0.0105 | 1321 | 1.740 |
| | | (1.94) | (0.47) | (0.60) | (-0.80) | (0.52) | (-1.67) | | | |
| | 30 | 104882 | -0.0155 | -0.0136 | 0.0010 | -66402 | -0.9418 | 0.0685 | 2912 | 2.069 |
| | | (5.67) | (-1.13) | (-0.80) | (0.09) | (-1.22) | (-6.21) | | | |
| | 31 | 20415 | 0.0845 | -0.1992 | 0.2428 | 142560 | -0.2567 | 0.0999 | 384 | 1.618 |
| | | (0.77) | (0.38) | (-1.26) | (1.76) | (2.75) | (-1.37) | | | |

**Table 5: Trade analysis regression - Individual securities (continued)**

| Fund Investment Style | Fund | Constant | Highwater mark | Value of Holdings | Cost Basis | Above Highwater mark? | Value above highwater mark | Rsq | N | Durbin Watson Statistic |
|---|---|---|---|---|---|---|---|---|---|---|
| Value | 32 | 127096 | 0.0764 | -0.1026 | 0.0569 | -15492 | -1.3006 | 0.0919 | 531 | 1.662 |
| | | (2.71) | (0.28) | (-1.02) | (0.74) | (-0.19) | (-15.23) | | | |
| | 33 | 39709 | 0.5788 | -0.2719 | 0.1895 | 12601 | 0.0227 | 0.0536 | 946 | 2.502 |
| | | (2.42) | (1.74) | (-1.14) | (0.91) | (0.53) | (0.07) | | | |
| | 34 | 188 | 0.0060 | 0.0438 | -0.0453 | 32431 | -0.7870 | 0.0231 | 1319 | 1.934 |
| | | (0.02) | (0.09) | (0.50) | (-0.60) | (2.11) | (-4.12) | | | |
| | 35 | 25024 | 0.0330 | -0.0813 | 0.0798 | 23780 | -0.2567 | 0.0761 | 724 | 1.849 |
| | | (2.76) | (1.26) | (-1.74) | (2.49) | (1.29) | (-3.74) | | | |
| | 36 | 36265 | 0.1262 | -0.2301 | 0.1899 | -3328 | -0.7448 | 0.1322 | 327 | 1.492 |
| | | (1.76) | (1.76) | (-2.39) | (2.52) | (-0.10) | (-1.93) | | | |
| | 37 | 26974 | 0.0025 | 0.0011 | -0.0017 | -77054 | -0.1706 | 0.0030 | 13146 | 1.901 |
| | | (1.02) | (0.48) | (0.23) | (-0.48) | (-1.12) | (-2.91) | | | |
| **Passive/ Enhanced** | 38 | 150863 | 0.1232 | -0.0979 | 0.0705 | -120898 | 0.0573 | 0.0156 | 5096 | 2.637 |
| | | (2.16) | (1.50) | (-1.35) | (1.29) | (-1.51) | (1.43) | | | |
| | 39 | 9842 | 0.0259 | -0.0268 | 0.0189 | 38262 | -0.2609 | 0.0146 | 7189 | 2.614 |
| | | (1.00) | (1.22) | (-1.03) | (0.87) | (0.65) | (-1.99) | | | |
| | 40 | 97808 | 0.1031 | -0.2722 | 0.2084 | 79714 | -1.8362 | 0.0059 | 13325 | 2.098 |
| | | (0.92) | (1.01) | (-0.95) | (0.87) | (0.32) | (-1.12) | | | |

This table gives results regressing the value of trading on trade date i, on three variables defined in the event of a loss: an estimate of the highwatermark, given as the previous highest value of holdings in excess of cost, on the current value of holdings prior to any new purchases or sales on that trade date, and on the cost basis of those holdings. In addition, we include a dummy variable $\delta i$ equal to one if the net value of the position exceeds the current highwatermark, and a measure of the extent to which the net value of the fund exceeds the current highwatermark. The value of trading is defined as the change in net position valued at the close of day price less passive fund flow defined as total net fund inflow apportioned to each security relative to percentage holdings at the end of the preceding month. t-statistics in parentheses are based on White heteroskedasticity consistent estimates of the standard error of each coefficient.

**Table 6: Trade analysis regression - Equity Allocation**

| Fund Investment Style | Fund | Constant | Highwater mark | Value of Holdings | Cost Basis | Above Highwater mark? | Value above highwater | Rsq | N | Durbin Watson Statistic |
|---|---|---|---|---|---|---|---|---|---|---|
| **GARP** | 1 | 917229 | 0.0017 | 0.8177 | -0.8876 | 103684979 | 1.2329 | 0.9577 | 1722 | 1.558 |
| | | (2.19) | (4.33) | (37.18) | (-27.58) | (3.39) | (103.71) | | | |
| | 2 | -363561 | 0.0004 | -0.0061 | -0.0121 | 2512263 | -0.0411 | 0.0042 | 1392 | 1.953 |
| | | (-0.55) | (0.19) | (-1.01) | (-1.43) | (1.68) | (-1.66) | | | |
| | 3 | -4592820 | 0.0037 | 0.0953 | -0.0464 | 5119733 | 0.0539 | 0.1539 | 1440 | 1.657 |
| | | (-4.43) | (1.54) | (7.89) | (-3.34) | (1.70) | (8.39) | | | |
| | 4 | -209190 | 0.0152 | 0.5626 | -0.5631 | -5765604 | 1.2650 | 0.6798 | 741 | 1.604 |
| | | (-0.73) | (3.43) | (5.85) | (-5.05) | (-1.69) | (9.15) | | | |
| | 5 | -293957 | 0.0011 | 0.9440 | -0.8280 | 45384829 | 1.4097 | 0.9351 | 1615 | 1.698 |
| | | (-4.78) | (1.40) | (82.04) | (-33.60) | (3.44) | (15.50) | | | |
| | 6 | -181582 | 0.0132 | 0.6415 | -0.5601 | 167587 | 1.9731 | 0.8400 | 527 | 1.497 |
| | | (-4.03) | (3.08) | (16.97) | (-13.48) | (0.20) | (5.26) | | | |
| | 7 | -1088889 | 0.0347 | 0.6537 | -0.6553 | 5533107 | 0.6528 | 0.5977 | 243 | 1.507 |
| | | (-3.92) | (2.63) | (7.27) | (-7.45) | (1.36) | (1.94) | | | |
| | 8 | -262772 | 0.0193 | 0.2911 | -0.2579 | 2015387 | 0.2223 | 0.4900 | 356 | 1.329 |
| | | (-2.17) | (5.58) | (4.86) | (-3.62) | (0.85) | (2.76) | | | |
| | 9 | -907592 | 0.0372 | 0.6161 | -0.6254 | 8197659 | 0.5563 | 0.5751 | 241 | 1.752 |
| | | (-5.01) | (4.71) | (7.20) | (-7.51) | (1.16) | (1.19) | | | |
| | 10 | 160732 | -0.0362 | 0.5284 | -0.5068 | 512488 | 0.2936 | 0.5507 | 55 | 1.628 |
| | | (1.31) | (-2.41) | (7.60) | (-6.87) | (0.82) | (2.68) | | | |
| | 11 | -20191 | 0.0154 | 0.3068 | -0.2950 | 239839 | 0.8235 | 0.3814 | 226 | 1.798 |
| | | (-0.85) | (0.97) | (4.48) | (-4.20) | (2.30) | (1.22) | | | |
| | 12 | 90240 | 0.0107 | 0.4285 | -0.4491 | 759678 | 0.8457 | 0.5337 | 185 | 1.445 |
| | | (2.47) | (0.70) | (4.93) | (-4.60) | (2.77) | (5.24) | | | |
| | 13 | -6000 | 0.0067 | 0.1799 | -0.1548 | 452249 | 0.3092 | 0.4944 | 597 | 1.826 |
| | | (-1.16) | (2.10) | (7.58) | (-5.43) | (2.05) | (6.08) | | | |
| **Growth** | 14 | -3898377 | 0.0197 | 0.7274 | -0.6907 | 48292636 | 4.4856 | 0.8431 | 1472 | 1.598 |
| | | (-8.37) | (3.51) | (23.08) | (-17.06) | (2.20) | (8.37) | | | |
| | 15 | -636798 | -0.0002 | 0.5419 | -0.5427 | 26432746 | -0.0879 | 0.3973 | 183 | 1.599 |
| | | (-0.49) | (0.00) | (2.33) | (-2.92) | (10.90) | (-11.72) | | | |
| | 16 | 9021113 | -0.3169 | 2.0745 | -1.7561 | 9074908 | -0.0864 | 0.5878 | 208 | 1.933 |
| | | (3.75) | (-1.82) | (6.24) | (-4.67) | (0.50) | (-0.14) | | | |
| | 17 | -141170 | 0.0045 | 0.9158 | -0.8812 | 4879554 | 1.7001 | 0.9348 | 870 | 1.807 |
| | | (-3.36) | (4.36) | (40.94) | (-29.39) | (2.40) | (17.00) | | | |
| | 18 | -480725 | 0.0173 | 0.5229 | -0.5203 | 15065411 | -1.0975 | 0.7261 | 1132 | 2.028 |
| | | (-2.37) | (3.43) | (22.35) | (-11.94) | (4.12) | (-0.87) | | | |
| **Neutral** | 19 | -8102503 | 0.0655 | 0.8416 | -0.9141 | 33626445 | 3.7045 | 0.8366 | 439 | 1.626 |
| | | (-6.34) | (6.49) | (20.49) | (-17.10) | (1.91) | (5.46) | | | |
| | 20 | -133745 | 0.0332 | 0.7479 | -0.7198 | 9518295 | 2.5213 | 0.7868 | 448 | 1.684 |
| | | (-0.58) | (2.87) | (23.40) | (-21.29) | (3.22) | (2.60) | | | |
| | 21 | 888695 | -0.0122 | 0.3200 | -0.3682 | -706272 | 0.5821 | 0.4548 | 677 | 1.570 |
| | | (4.47) | (-3.19) | (10.55) | (-11.19) | (-0.72) | (2.56) | | | |
| | 22 | -279281 | 0.0126 | 0.4497 | -0.4116 | 4973898 | 0.1922 | 0.7243 | 586 | 1.821 |
| | | (-6.74) | (3.24) | (5.40) | (-4.08) | (1.29) | (4.73) | | | |
| | 23 | -9384 | -0.0024 | 0.8472 | -0.7943 | 1126855 | 1.0080 | 0.8791 | 738 | 1.195 |
| | | (-1.58) | (-2.29) | (31.31) | (-12.03) | (1.46) | (2.91) | | | |
| | 24 | -159265 | 0.0276 | 0.8100 | -0.6703 | 23601 | 1.8757 | 0.8689 | 305 | 2.105 |
| | | (-4.66) | (2.58) | (11.48) | (-8.55) | (0.16) | (5.08) | | | |
| **Other** | 25 | -294300 | 0.0206 | 0.6449 | -0.6544 | 166909 | 0.4632 | 0.8523 | 1441 | 1.367 |
| | | (-7.02) | (10.91) | (17.78) | (-13.94) | (0.53) | (75.84) | | | |
| | 26 | -151628 | 0.0172 | 0.4491 | -0.3593 | 1310217 | 0.6969 | 0.7104 | 587 | 1.924 |
| | | (-3.00) | (4.87) | (12.01) | (-8.16) | (1.14) | (3.46) | | | |
| | 27 | -45911 | 0.0127 | 0.8189 | -0.6708 | 1296457 | 1.0411 | 0.8784 | 346 | 2.015 |
| | | (-2.53) | (4.17) | (38.41) | (-19.59) | (1.33) | (9.65) | | | |
| **Value** | 28 | 726075 | -0.0006 | 0.9365 | -1.0641 | 51029474 | 3.0266 | 0.9219 | 1992 | 1.910 |
| | | (6.81) | (-0.36) | (125.16) | (-44.05) | (3.38) | (5.38) | | | |
| | 29 | -76807 | 0.0072 | 0.5664 | -0.5817 | -71306 | 1.0152 | 0.8450 | 361 | 1.893 |
| | | (-1.29) | (3.60) | (4.22) | (-3.66) | (-0.07) | (79.35) | | | |
| | 30 | -2124627 | 0.0481 | 0.7946 | -0.4989 | 9073063 | 2.7575 | 0.8891 | 1463 | 1.386 |
| | | (-12.70) | (15.48) | (76.34) | (-34.62) | (2.22) | (11.24) | | | |
| | 31 | -7073 | 0.0110 | 0.2802 | -0.2538 | 748255 | 0.3916 | 0.3947 | 243 | 1.929 |
| | | (-0.12) | (0.87) | (3.72) | (-2.80) | (1.84) | (2.39) | | | |

**Table 6: Trade analysis regression - Equity Allocation (continued)**

| Fund Investment Style | Fund | Constant | Highwater mark | Value of Holdings | Cost Basis | Above Highwater mark? | Value above highwater mark | Rsq | N | Durbin Watson Statistic |
|---|---|---|---|---|---|---|---|---|---|---|
| **Value** | 32 | 9055067 | -0.3961 | 0.3286 | -0.2595 | * | * | 0.6775 | 199 | 1.645 |
| | | (5.75) | (-5.74) | (6.21) | (-5.98) | | | | | |
| | 33 | 12240 | 0.0030 | 0.7228 | -0.7447 | 178222 | 0.7746 | 0.7069 | 548 | 1.661 |
| | | (0.93) | (0.68) | (14.71) | (-13.08) | (1.74) | (37.23) | | | |
| | 34 | -326129 | 0.0141 | 0.9234 | -0.9435 | 1693518 | 0.8933 | 0.9928 | 344 | 1.946 |
| | | (-7.25) | (6.18) | (38.02) | (-22.88) | (2.19) | (30.60) | | | |
| | 35 | 11453 | -0.0105 | 0.5256 | -0.4395 | 152844 | 0.6532 | 0.4907 | 559 | 1.705 |
| | | (0.88) | (-0.96) | (9.23) | (-8.40) | (1.73) | (1.27) | | | |
| | 36 | -31414 | 0.0138 | 0.0516 | -0.0459 | 125280 | 0.3651 | 0.4562 | 75 | 2.122 |
| | | (-0.94) | (1.57) | (1.12) | (-0.98) | (1.80) | (28.57) | | | |
| | 37 | 11998927 | -0.0015 | 0.8447 | -0.9926 | 175982127 | 5.2571 | 0.9361 | 2937 | 1.402 |
| | | (14.34) | (-0.35) | (84.18) | (-46.52) | (2.88) | (3.70) | | | |
| **Passive/ Enhanced** | 38 | -38577 | 0.0017 | 0.1472 | -0.1570 | -6901802 | 1.1976 | 0.6451 | 742 | 1.985 |
| | | (-0.21) | (1.43) | (1.90) | (-1.93) | (-1.10) | (4.34) | | | |
| | 39 | 165407 | 0.0015 | 0.0471 | -0.0627 | 2295272 | -0.0131 | 0.0739 | 1405 | 1.890 |
| | | (0.83) | (1.14) | (1.17) | (-1.76) | (1.92) | (-2.19) | | | |
| | 40 | -937852 | 0.0055 | -0.1452 | 0.1703 | 34988355 | 0.8117 | 0.0064 | 1621 | 1.987 |
| | | (-0.78) | (0.40) | (-0.21) | (0.23) | (1.26) | (0.94) | | | |

This table gives results regressing the change in equity allocation on trade date i, on three variables defined in the event of a loss: an estimate of the highwatermark, given as the previous highest value of holdings in excess of cost, on the current value of holdings prior to any new purchases or sales on that trade date, and on the cost basis of those holdings. In addition, we include a dummy variable $\delta i$ equal to one if the net value of the position exceeds the current highwatermark, and a measure of the extent to which the net value of the fund exceeds the current highwatermark. The change in equity allocation is defined as the change in equity position valued at the close of day price less passive fund flow defined as total net fund inflow apportioned to equity according to the percentage invested in equity at the end of the preceding month. t-statistics in parentheses are based on White heteroskedasticity consistent estimates of the standard error of each coefficient.

* There were only two trading days in the sample where fund 32 traded above its highwatermark. Hence it was not possible to separately estimate the coefficients on the highwatermark dummy variable and the fund value above highwatermark in this case.

**Table 7: Trade analysis regression - Individual securities by fund category**

| | Category | Highwatermark | Value of Holdings | Cost Basis | Value above highwatermark | Rsq | N | DW |
|---|---|---|---|---|---|---|---|---|
| **Style** | *GARP* | 0.03349 | -0.04208 | 0.03119 | -1.01786 | 0.8089 | 31321 | 2.12 |
| | | (3.18) | (-3.27) | (2.90) | (-37.36) | | | |
| | *Growth* | 0.04222 | -0.00588 | -0.00792 | -0.65049 | 0.1456 | 15564 | 1.96 |
| | | (1.35) | (-0.29) | (-0.49) | (-2.01) | | | |
| | *Neutral* | 0.00194 | -0.00770 | 0.01160 | -0.05636 | 0.0070 | 14322 | 1.76 |
| | | (0.28) | (-0.74) | (1.19) | (-0.86) | | | |
| | *Other* | 0.01676 | -0.00993 | 0.01124 | 0.07829 | 0.0068 | 7298 | 1.84 |
| | | (1.13) | (-0.49) | (0.59) | (1.09) | | | |
| | *Value* | 0.00234 | 0.00122 | -0.00191 | -0.20505 | 0.0038 | 29313 | 1.90 |
| | | (0.47) | (0.29) | (-0.56) | (-3.39) | | | |
| | *Passive/* | 0.08228 | -0.13338 | 0.09827 | -0.24295 | 0.0026 | 25610 | 2.12 |
| | *Enhanced* | (1.96) | (-1.43) | (1.38) | (-1.31) | | | |
| **Size of fund** | *Small* | 0.17745 | -0.16480 | 0.07870 | -0.61851 | 0.0216 | 18668 | 2.09 |
| | | (1.69) | (-1.30) | (0.72) | (-2.14) | | | |
| | *Large* | 0.01282 | -0.01232 | 0.01039 | -1.00998 | 0.7284 | 104760 | 2.05 |
| | | (2.50) | (-2.15) | (2.03) | (-32.18) | | | |
| **Number of** | *Few* | 0.17745 | -0.16480 | 0.07870 | -0.61851 | 0.0216 | 18668 | 2.09 |
| **Securities** | | (1.69) | (-1.30) | (0.72) | (-2.14) | | | |
| | *Many* | 0.01282 | -0.01232 | 0.01039 | -1.00998 | 0.7284 | 104760 | 2.05 |
| | | (2.50) | (-2.15) | (2.03) | (-32.18) | | | |
| **Number of** | *Small* | 0.03831 | -0.00611 | -0.00660 | -0.61980 | 0.1421 | 28700 | 1.95 |
| **Transactions** | | (1.30) | (-0.30) | (-0.41) | (-2.04) | | | |
| | *Large* | 0.01985 | -0.02077 | 0.01686 | -1.00942 | 0.4060 | 94728 | 2.10 |
| | | (3.60) | (-3.23) | (3.01) | (-31.85) | | | |
| **Largest 10** | *No* | 0.02254 | -0.01857 | 0.00635 | -0.67955 | 0.0175 | 61576 | 2.07 |
| **Institutional** | | (0.64) | (-0.86) | (0.33) | (-2.32) | | | |
| **Manager** | *Yes* | 0.01889 | -0.01905 | 0.01606 | -1.00930 | 0.7228 | 61852 | 2.14 |
| | | (3.32) | (-2.97) | (2.77) | (-31.75) | | | |
| **Boutique firm** | *No* | 0.01573 | -0.01566 | 0.01147 | -1.00661 | 0.3919 | 106393 | 2.09 |
| | | (2.62) | (-2.26) | (1.91) | (-30.34) | | | |
| | *Yes* | 0.04169 | -0.02241 | 0.01686 | -0.04305 | 0.0199 | 17035 | 1.82 |
| | | (1.80) | (-1.13) | (0.96) | (-0.78) | | | |
| **Bank or Life** | *No* | 0.00285 | 0.00072 | -0.00147 | -0.18755 | 0.0045 | 39160 | 1.90 |
| **office affiliated** | | (0.58) | (0.17) | (-0.43) | (-3.41) | | | |
| | *Yes* | 0.02517 | -0.03210 | 0.02198 | -1.00985 | 0.4064 | 84268 | 2.10 |
| | | (2.79) | (-2.65) | (2.37) | (-32.10) | | | |
| **Annual Bonus** | *No* | 0.02606 | -0.01823 | 0.01679 | 0.15146 | 0.0070 | 5187 | 1.84 |
| | | (1.53) | (-0.75) | (0.72) | (1.66) | | | |
| | *Yes* | 0.01577 | -0.01570 | 0.01150 | -1.00618 | 0.3910 | 118241 | 2.09 |
| | | (2.64) | (-2.27) | (1.92) | (-30.12) | | | |
| **Domestic** | *No* | 0.04889 | -0.02895 | 0.01437 | -0.34534 | 0.0748 | 41118 | 2.12 |
| **owned** | | (2.34) | (-1.59) | (0.96) | (-2.14) | | | |
| | *Yes* | 0.01148 | -0.01167 | 0.00925 | -1.01934 | 0.4320 | 82310 | 2.08 |
| | | (2.98) | (-2.47) | (2.41) | (-39.38) | | | |
| **Equity** | *No* | 0.01573 | -0.01566 | 0.01147 | -1.00661 | 0.3919 | 106393 | 2.09 |
| **Ownership by** | | (2.62) | (-2.26) | (1.91) | (-30.34) | | | |
| **senior staff** | *Yes* | 0.04169 | -0.02241 | 0.01686 | -0.04305 | 0.0199 | 17035 | 1.82 |
| | | (1.80) | (-1.13) | (0.96) | (-0.78) | | | |