DOUBLE OR NOTHING: PATTERNS OF EQUITY FUND HOLDINGS AND TRANSACTIONS*

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Abstract: According to Jorion (1997) well publicized financial losses in Orange County and at Barings, Metallgesellschaft, Showa Shell and Daiwa are a major reason why industry groups and regulators advocate the use of value at risk (VaR). Unless monitored on a continuous trade by trade basis, fund managers subject to a performance review have an adverse incentive to evade VaR controls and engage in zero net investment portfolio overlay 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." We devise a simple procedure to determine whether a given pattern of trading is consistent with informationless investing and apply it to a unique database of daily transactions and holdings of a set of forty successful Australian equity managers. Contrary to Weisman's conjecture, this behavior does not appear to be widespread. However, we find evidence that a minority of managers do engage in a pattern of trading consistent with informationless investing, 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.

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I. Introduction

Recent well publicized rogue trader episodes have focused attention on the risk management function within financial institutions. According to Jorion (1997) financial losses in Orange County and at Barings, Metallgesellschaft, Showa Shell and Daiwa are a major reason why industry groups and regulators advocate the use of value at risk (VaR) metrics. Subsequent events at Long Term Capital Management and more recently at National Australia Bank have been attributed to failures of risk management[1].

Part of the challenge of risk management is the fact that short term performance incentives give traders an adverse incentive to evade VaR controls[2]. This is particularly true in cases where they are not being monitored on a trade by trade basis. Goetzmann et al. (2002) (GISW) show that it is always possible to devise a zero net investment overlay portfolio strategy that can artificially augment the trader's reported Sharpe (1966) ratio, at the expense of increasing downside risk.

[1]For a discussion of Long Term Capital Management, see Lowenstein (2000) and for National Australia Bank, see Brown (2004).

[2]It is important to distinguish between incentive fee arrangements and manager incentive compensation arrangements. Incentive fee arrangements are limited in nature and scope for US mutual funds (for a discussion see Elton, Gruber and Blake 2003). We are referring here to manager incentive compensation arrangements. This distinction blurs when individual managers own and operate their own funds.

They further show that by leveraging this portfolio, the trader can increase the reported Jensen (1968) alpha without limit. Weisman describes this as "informationless investing" and argues that it can produce the appearance of return enhancement without necessarily providing any value to an investor. Such strategies include but are not limited to the short volatility strategies considered by GISW. Another example of informationless investing is doubling where the investor increases his or her position on a loss to be recovered on a gain[3]. Weisman argues that these strategies have the interesting characteristic that the higher is the reported performance, the greater the probability of ruin.

Excessive concentration on observable short term performance arises because long term performance is difficult to measure. Holmstrom and Milgrom (1991) consider a linear multi-tasking agency model where the principal is risk neutral and the agent is risk averse. In the present case, the principal would be the long term investor and the agent, the money manager. In this model, the agent is rewarded for performance on two tasks which we might identify in this context as short term performance and long term performance. Since long term performance is hard to measure or observe, the principal would prefer to sell the business to the agent. However, the limited liability and limited wealth of the agent together with risk aversion rule this out. As Anderson and Schmittlein (1984) point out in the context of the decision to utilize an in-house sales force, it is the inability to reward independent agents appropriately which leads to the use

[3]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 gambler 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).

of employee-managers.

Given that the principal wishes to ensure long-term performance and survival, excessive risk-taking targeting short-term bonus payments is likely to be incompatible with this objective. Rewards to short-term performance will divert attention away from the crucial but unobservable and unrewarded task of long-term performance. As Holmstrom and Milgrom (1991) point out, there are two possible responses to this conundrum: reduce or remove the direct incentive for the observable and rewarded goal or redesign tasks such that one class of agent, investment traders, are provided with the single task of optimizing short-term trading profits while their superiors with low-powered incentives are given the task of monitoring traders to ensuring long-term survival. Of course, in many organizations this does not occur. An example in point is the 2004 National Australia Bank fiasco when large losses were incurred on foreign exchange option trades[4], the traders had just received bonuses of around $A200,000 each while their superior received a bonus of $A500,000. What could cause this failure of managerial oversight?

Prospect theory (Kahneman and Tversky 1979) provides one explanation. 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 portfolio overlay

[4]These losses were attributed to doubling trades on the part of four option traders that led to losses currently estimated to be in the region of $A360 Million. See Brown (2004).

strategies imply concave portfolio payoffs, prospect theory would tend to explain why agents might choose extreme doubling strategies that do not lead to increased Sharpe ratios *a priori*.

Whatever its motivation, it remains true that informationless investing can be dangerous to one's financial health. How prevalent is it? 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[5]. But by then it is too late.

By contrast, the Australian case is interesting not only because public funds there are free to use and in fact do 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 develop procedures that might be used to develop early warning systems to identify patterns of trading consistent with informationless investing before it is too late, and a major loss occurs.

The paper is organized as follows. Section 2 describes patterns of informationless investing and

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

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.

2. Informationless investing

"Informationless investing" is a term used by Weisman (2002) to describe any zero net investment or self financing portfolio strategy designed to yield a Sharpe ratio in excess of the benchmark using only public information. It can be considered an overlay position on an otherwise informed portfolio. Such a position can be established 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 investing include, but are not limited to, unhedged short volatility trades, covered call writing programs and St. Petersburg investing, otherwise known as doubling[6].

The fact that an active trader may resort to such an overlay portfolio strategy does not imply that the underlying portfolio choices are uninformed. An informed trader might use an informationless investing overlay portfolio to provide a short term boost to performance numbers. It is possible that portfolio holdings and transactions may result from informed portfolio decisions, and yet appear to an outside observer to be indistinguishable from unhedged

[6]Many so-called "rogue trader" incidents involving doubling only come to light when after the fact it is discovered that the trading strategy was not in fact self financing, and where funds were obtained by evading credit limits, or through fraud or embezzlement.

short volatility or doubling. Since unhedged short volatility and doubling both limit return as the benchmark rises and cause substantial losses as the benchmark falls, the burden of proof would be on the manager to show the information basis of these portfolio positions.

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 μ=15%, σ=.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.[7] 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[8]. In other words, in a regression of the form

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

where β_i is positive we should expect that γ_i should be positive consistent with market timing ability.

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[7]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.

[8]Agarwal and Naik (2004) show that many hedge fund returns can be characterized by benchmark positions supplemented by short positions in out of the money options.

However, this is at best a very weak test of whether managers use informationless investing. On the one hand, while concave informationless investing 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 investing, 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[9], fund managers and pension fund trustees typically have more information on holdings and transactions and are not typically restricted to examining the series of fund returns. In the present case, we have higher frequency holdings data and daily transactions, as well as options, futures and other exchange traded derivatives not generally reported in the US mutual fund quarterly holdings data.

Access to data on holdings and transactions would allow more powerful tests of whether traders appear to be engaging in strategies consistent with informationless investing. One simple test would be to examine whether any derivative positions held by the trader are concavity increasing

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[9]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).

or decreasing. Obviously, a short 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)[10].

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[10]"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 Δ_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 investing 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 δ_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 $\mathrm{b}_1 = \frac{1}{u - (1 + r_f)} > 0$, $b_2 = -\frac{u}{u - (1 + r_f)} < 0$, 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 ϵ 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[11].

In summary, while concave payoff distributions are consistent with informationless investing, 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 investing. 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) 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. The data, provided under strict conditions of confidentiality, contains the periodic portfolio holdings and daily trade information of either the largest (and where relevant, second largest) investment products in Australian equities offered to institutional investors (i.e. pension funds).

The database was constructed with the support of Mercer Investment Consulting, whereby

[11]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.

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. The decision to request only the largest funds was a compromise designed to maximize the chance of cooperation with the manager. This allowed us to acquire data not otherwise available. In addition, 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[12].

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 institutional assets in the industry.[13] 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. Our study also relies on stock

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

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

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[14].

[14]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 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.

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.

Our study also includes other qualitative information relating to the fund managers as a means of better understanding how patterns in trading and portfolio holdings might be related to specific manager characteristics. For each institution in our sample we obtain data describing the size of the investment institution, the ownership structure of the funds' management operation and the equity incentives available to investment staff, whether the firm has an affiliation with either a bank or life-office firm, the compensation arrangements that apply to the employees of the investment management entity (i.e. whether an annual bonus is available where certain performance targets are achieved), and whether the firm is domestic owned. This data was obtained from a number of sources, including investment manager questionnaires compiled by the Investment and Financial Services Association (IFSA) Limited, various public information sources, data provided by Mercer Investment Consulting, as well as from private correspondence with the individual fund managers. In many cases, our data could easily be verified from a number of sources.

4. Results

4.1 Return based measures of informationless investing

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 outliers, notably funds 1 and 31. Fund 1 is a very active trader, while fund 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[15], and in half of the cases these measures are statistically significant on a daily or weekly return measurement interval[16]. On the other hand almost all of

[15]The All Ordinaries Accumulation Index is the important benchmark for all funds (except the small-cap fund). The ASX and S&P revised the indices and the All Ordinaries Index was amended to become a 500 stock index from the first trading day in April 2000. Results were almost identical using a four factor alpha incorporating Australian domestic market, size, book to market and momentum factors.

[16]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. This is a well known issue with Australian funds reporting, and is a particular issue given the large open option positions with stale or otherwise unreliable reported option values. We follow Pinnuck (2003) in determining returns to

the funds exhibit negative skewness on either measurement interval. This is not surprising as the benchmark All Ordinaries index exhibited similar skewness over the same measurement interval.

We obtain some interesting results computing the Treynor Mazuy measures for funds in our sample[17]. In Table 4 we report that the largest degree of negative skewness is to be found in the first 'Growth at a reasonable price' (GARP) investment style. It is not surprising that funds corresponding to this investment style have a large and significant negative Treynor Mazuy coefficient consistent with the application of concave portfolio strategies. Of some greater interest however is the fact that it is the largest fund managers, not the small boutique managers that appear to have the most negative Treynor Mazuy measures. Firms are more likely to encourage managers to engage in informationless overlay portfolio strategies when they provide short term performance incentives in the form of annual bonus payments as opposed to long term incentives in the form of equity ownership stakes. It is interesting then to find that the funds which emphasize short term incentives have the most negative Treynor Mazuy measures.

We verified this result using a modification of the Henriksson and Merton (1981) model where instead of regressing excess return on the excess return of 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

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option positions using the ratio of underlying stock value to Black Scholes values (calls) and Binomial values (puts) appropriately adjusted for dividends, multiplied by the option delta and SEATS recorded return on the underlying.

[17]The Treynor Mazuy measure was computed by regressing the weekly holding period excess return on each fund within the given fund classification on the All Ordinaries benchmark excess return and the benchmark excess return squared, allowing a fund specific intercept and slope coefficient.

informationless investing 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 overlay strategies to boost reported performance numbers. 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 high frequency fund returns implies that the resulting coefficients should be interpreted with care. In this context, it is difficult to claim that the returns-based evidence supports the conjecture that many or most funds resort to informationless investing to augment reported performance statistics. The simple returns-based measures of informationless investing are simply not powerful enough to draw such a conclusion.

4.2 Derivatives positions consistent with informationless investing

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 option and each holding date in the sample, we calculated the number of options held relative to the number of underlying securities and a measure of moneyness given as the exercise price expressed as a ratio of the underlying security price. Table 5 reports the median values of these statistics for each fund reporting options in their

[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.

portfolios. Very few options were held by funds either long or short where there was not also a position in the underlying asset.

While this table shows that a number of funds are on average short in their option positions, it is perhaps of greater interest to note that 62 percent of month-end option positions were in fact concavity increasing in character[19]. In particular almost all of the open option positions maintained by the enhanced index products were in fact concavity increasing. In addition, a majority of the option positions held by growth funds are concavity increasing in character. The fact that so many 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 enhancement appears to be short volatility trading. However, it is important to note that 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 unhedged short volatility trades at the individual security level, it is not necessarily consistent with informationless investing at the level of the aggregate fund.

4.3 Patterns of trading consistent with informationless investing

[19] "Concavity increasing" positions are defined in Table 5 as circumstances where the number of puts is less than or equal the negative of the number of calls on the same underlying security at month end. 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.

Table 6 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]. For most of the funds there is no statistically significant relationship between trades and the value of positions held, or the cost basis of those positions. However, fifteen percent of the funds [1,2,3,16,27 and 36] that have the greatest ex post measures of performance show a pattern of trading indistinguishable from doubling. More than half of the funds increase their position on a loss with the amount of the trade larger as the value of the position falls. This pattern of trading is highly correlated with the *ex post* Sharpe ratio measured on the basis of weekly holding period returns[22]. 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 several cases this pattern is particularly striking as the funds liquidate almost dollar for dollar with any gain above the high water mark[23].

[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.

[22]The cross sectional correlation between *ex post* Sharpe ratios given on Table 1 and the significance of this pattern of trading given by the t-value of the value of position on a loss (Table 6) is -0.4023.

[23]A benign explanation for this empirically observed pattern is that the funds in question are simply following a very conservative policy of rebalancing the portfolio in the event that individual securities rise or fall in value, causing the portfolio weight to rise or fall beyond the portfolio manager's target. We examined this hypothesis by constructing a monthly moving average of portfolio position weights. The discrepancy in value between the most current portfolio and this average portfolio position did not explain a significant fraction of observed transactions, and in fact the coefficients on positive and negative discrepancies were rarely of the

What are the correlates of this behavior? As shown in Table 1, the funds that show a pattern of trading indistinguishable from doubling have greater than average turnover, and some of them are very active traders with an exceptionally high annual average turnover (particularly fund 1). Closer analysis reveals that all of these funds share the common characteristic that managers are compensated on the basis of an annual performance based incentive, and in no case do they have a significant equity stake in the fund itself. This is quite remarkable, as managers do have an equity stake in half of the remaining funds in our sample. Consistent with the results reported in Table 4, this suggests that doubling occurs in funds where there is a conflict between the short term interest of the manager and the longer term interest of the fund and its investors. As we note, 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.

Further analysis reveals that to the extent it occurs, doubling is more likely in funds that have a more decentralized form of ownership. Five of the six funds with patterns of trading indistinguishable from doubling are wholly owned by bank or life insurance companies, and four of the six are owned by overseas financial institutions. These characteristics are shared by fewer than half of the remaining funds. The 10 largest funds in Australia by capitalization include three of the six funds.

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correct sign. We thank Matthew Richardson for this observation.

4.4 Behavioral explanations of results

Incentives are not everything. There are a number of large, decentralized funds in our sample with similar compensation arrangements that show no evidence of doubling in their trading patterns. But this is not conclusive. Managers could be using informationless overlay strategies but the pattern of trading is obscured by informed trades in the underlying portfolio. On the other hand, the incentive story would argue for doubling at the level of the aggregate fund. In the case of derivative security holdings, we see evidence in Table 5 of informationless investing 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. The evidence we have of doubling in Table 6 is at the security level, 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, an anti-momentum strategy. However, this is contradicted by evidence of momentum trading others have found using a subset of the active equity funds included in this study[24].

How do we explain the evidence of doubling at the individual security level? Almost all of the funds in the study are managed in a decentralized fashion, where individual managers form part

[24]See Gallagher and Looi (2003), and in our sample the large decentralized management funds 6 and 14 appear to follow momentum strategies based on results reported in Table 6. Using our dataset, we found that there is little evidence of doubling in terms of equity allocations. However, equity allocations do not vary greatly in our sample.

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[25]. In addition, bonus payments tied to specialist manager performance may explain why we seem to see doubling at the level of individual equity trading. 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 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[26]. An important recent paper by

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

[26] “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

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 portfolio overlay strategies that have the unfortunate attribute that they can expose the fund investor to significant downside risk. 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. We find evidence that a minority of managers do in fact engage in a pattern of trading consistent with their use of informationless overlay strategies, 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 evidence is suggestive but by no means conclusive. Further research is needed to identify with greater precision what management structures are more likely to generate such trading behavior, and the trigger events if any that may lead a

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doubling down provides the necessary market pressure to move the market in the desired direction. We are indebted to Jeffrey Wurgler for this reference. For further evidence of gaming performance statistics around reporting dates, see Carhart, Kaniel, Musto and Reed (2002).

manager to commence such a program of trading. Nevertheless, the result is not surprising and is consistent with both the principal agent literature as well as the recent behavioral literature.

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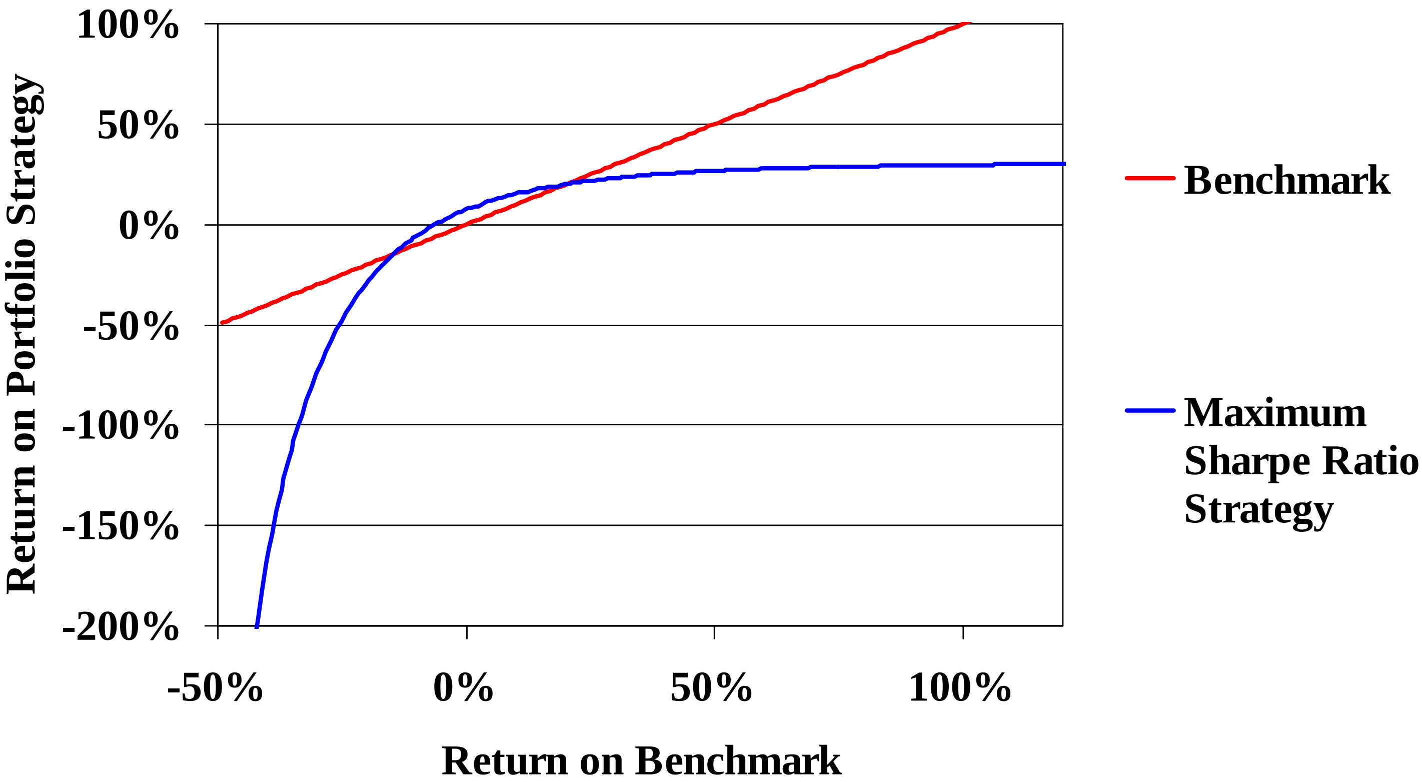
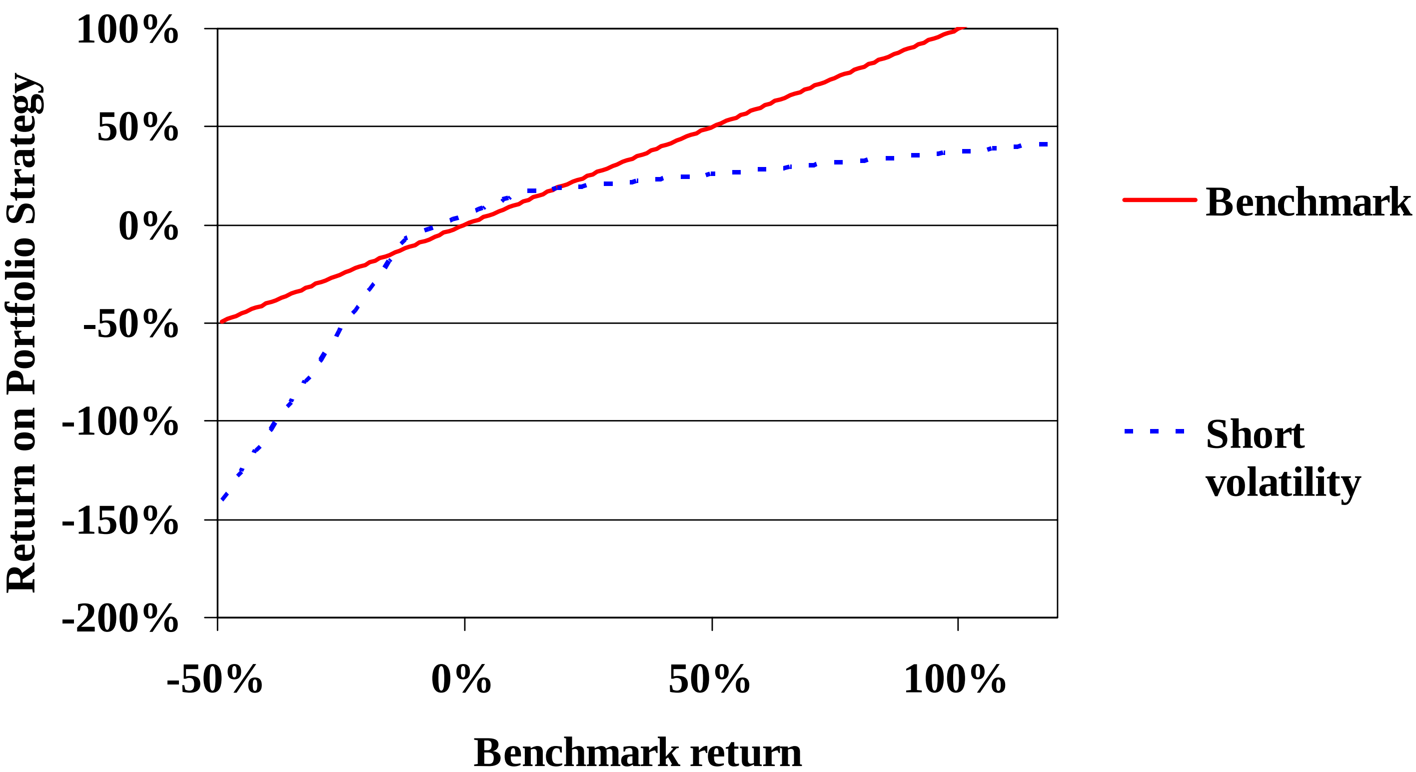
Figure 1: Sharpe ratio Maximizing Portfolio Strategy for a LogNormal Benchmark



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

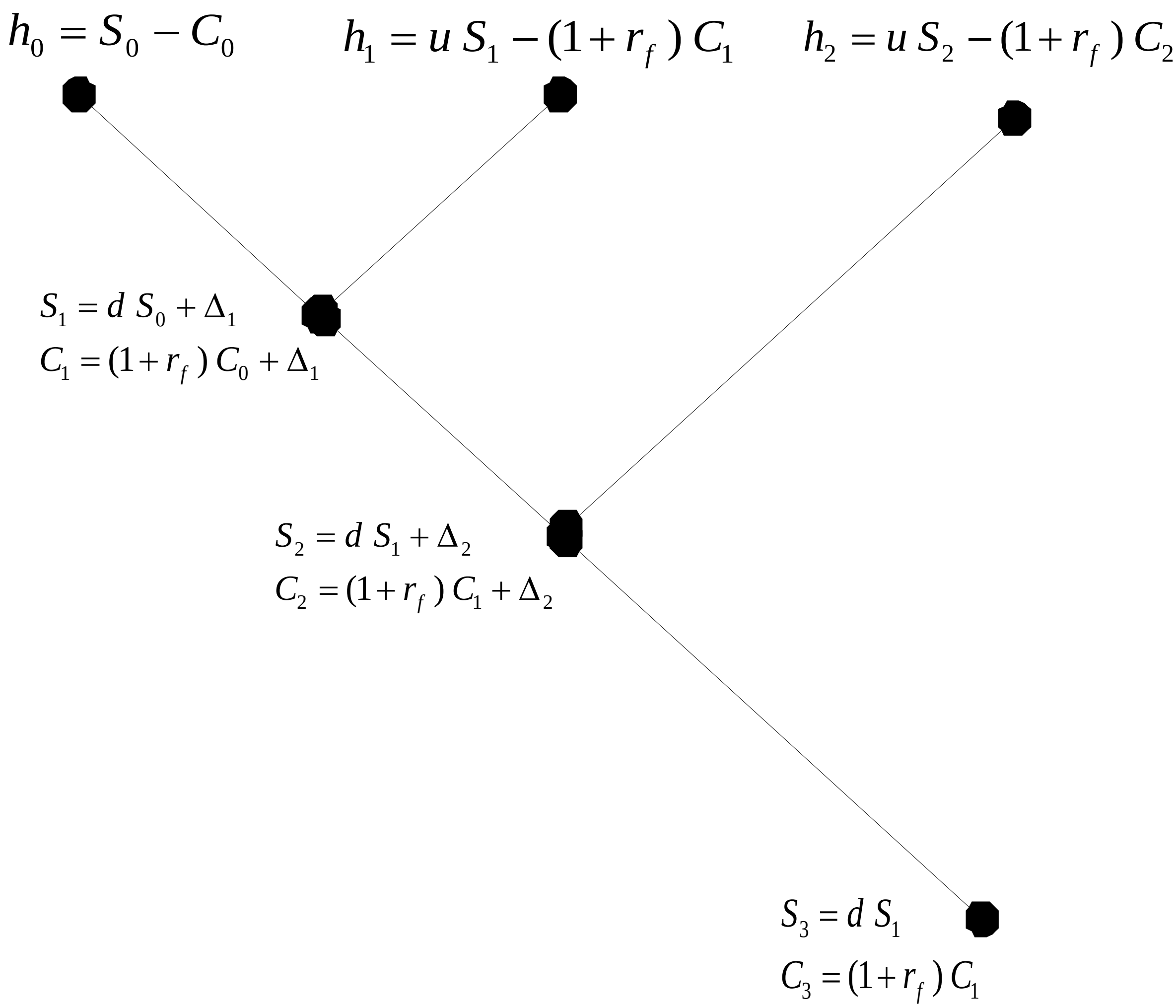


Figure 4 Returns to informationless investing

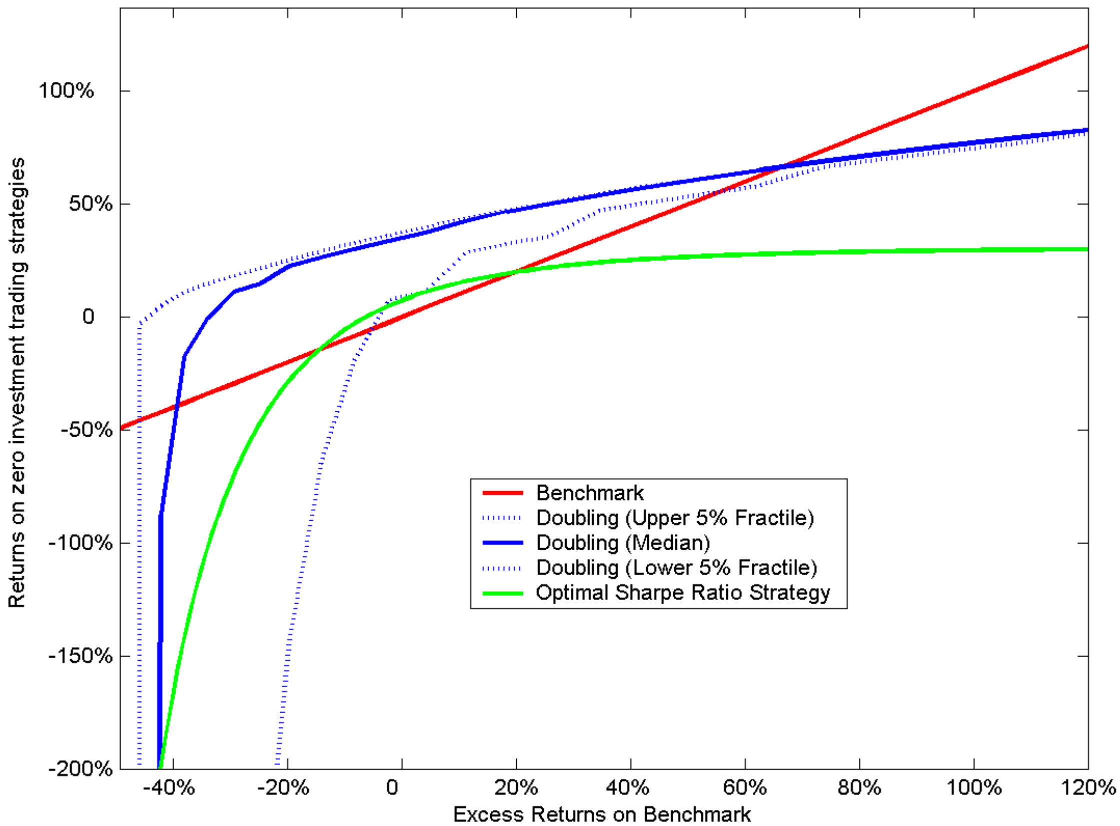


Table 1: Descriptive statistics of funds studied

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
GARP	1	0.03%	0.77%	0.0437	0.02%	0.02%	0.82	-1.2782	15.4184
					(2.00)	(2.28)			
	2	0.06%	0.93%	0.0645	0.03%	0.04%	1.06	-0.4151	7.4946
					(6.40)	(6.59)			
	3	0.06%	0.95%	0.0679	0.04%	0.04%	1.05	0.0402	11.9261
					(4.57)	(4.94)			
	4	0.06%	0.88%	0.0649	0.04%	0.05%	0.95	0.2564	7.4729
					(2.61)	(2.87)			
	5	0.01%	0.81%	0.0171	-0.01%	0.00%	0.89	-0.5415	12.8658
					(-0.92)	(-0.24)			
	6	0.05%	0.87%	0.0520	0.03%	0.03%	0.90	-0.8433	10.8784
					(1.68)	(1.84)			
	7	0.02%	0.77%	0.0317	0.01%	0.00%	0.96	-0.8974	8.3266
					(0.73)	(-0.10)			
	8	0.02%	0.87%	0.0257	0.01%	0.00%	1.05	-1.0562	9.2690
					(1.44)	(0.62)			
	9	0.02%	0.77%	0.0318	0.01%	0.00%	0.96	-0.9060	8.3788
					(0.73)	(-0.09)			
	10	0.02%	1.12%	0.0182	-0.01%	-0.01%	1.12	-1.7857	10.7906
					(-0.42)	(-0.46)			
	11	0.02%	0.70%	0.0311	0.01%	0.01%	0.96	-0.8463	8.6248
					(1.01)	(1.23)			
	12	0.02%	0.72%	0.0307	0.01%	0.03%	0.64	-1.9983	19.8858
					(0.53)	(1.27)			
	13	0.04%	0.92%	0.0382	0.01%	0.02%	0.91	-0.0203	17.9927
					(0.83)	(1.10)			
Growth	14	0.03%	0.89%	0.0380	0.01%	0.01%	1.01	-0.4868	6.4288
					(1.99)	(1.78)			
	15	0.04%	0.88%	0.0407	0.01%	0.02%	1.01	-0.4545	8.8300
					(2.20)	(2.60)			
	16	0.04%	0.84%	0.0466	0.02%	0.02%	0.94	-0.5375	10.2463
					(2.69)	(3.04)			
	17	0.02%	0.84%	0.0293	0.00%	0.01%	1.00	-0.6639	9.8774
					(0.54)	(1.13)			
	18	0.06%	0.96%	0.0598	0.04%	0.04%	1.08	-0.4754	8.4632
					(6.09)	(6.35)			
Neutral	19	0.04%	0.86%	0.0480	0.02%	0.02%	1.01	-0.4380	5.6757
					(4.27)	(4.18)			
	20	0.07%	0.85%	0.0778	0.05%	0.05%	1.02	-0.5125	6.0375
					(7.40)	(7.46)			
	21	0.03%	0.93%	0.0296	0.00%	0.01%	1.06	-0.2416	4.3384
					(0.55)	(0.67)			
	22	0.04%	0.89%	0.0420	0.02%	0.02%	1.03	-0.8584	7.9618
					(1.49)	(1.67)			
	23	0.04%	0.81%	0.0517	0.02%	0.02%	0.95	-0.5893	12.0808
					(3.03)	(3.72)			
	24	0.03%	0.97%	0.0346	0.01%	0.01%	1.05	-0.5066	10.4681
					(1.60)	(1.92)			
Other	25	0.03%	0.86%	0.0405	0.01%	0.01%	0.98	-0.6130	10.6271
					(2.29)	(1.98)			
	26	0.01%	0.82%	0.0085	0.01%	0.01%	1.04	-0.7692	8.0495
					(1.49)	(1.04)			
	27	0.04%	0.84%	0.0488	0.03%	0.03%	1.00	-0.8225	8.0264
					(2.50)	(2.45)			
Value	28	0.02%	0.63%	0.0256	0.00%	0.01%	0.66	-1.0274	14.4896
					(0.68)	(1.41)			
	29	0.03%	0.83%	0.0325	0.02%	0.01%	1.01	-0.3404	5.6805
					(3.74)	(3.62)			
	30	0.01%	0.88%	0.0109	-0.01%	0.00%	0.78	-0.6824	9.9005
					(-0.60)	(-0.31)			
	31	0.06%	0.67%	0.0934	0.05%	0.05%	0.85	-1.2474	12.3272
					(4.47)	(4.05)			

Table 2: Characteristics of fund daily returns (continued)

Fund Investment Style	Fund	Mean	Standard Deviation	Sharpe Ratio	Alpha	FF Alpha	Beta	Skewness	Kurtosis
Value	32	0.06%	0.72%	0.0843	0.06%	0.06%	0.89	-1.0397	9.1625
					(4.01)	(3.85)			
	33	0.04%	0.80%	0.0502	0.02%	0.03%	0.81	-0.1902	4.5167
					(1.57)	(2.26)			
	34	0.03%	0.83%	0.0421	0.02%	0.03%	0.98	-0.2917	5.2957
					(3.80)	(3.95)			
	35	0.08%	0.91%	0.0914	0.07%	0.06%	0.61	-1.3746	19.0879
					(2.69)	(2.04)			
	36	0.07%	0.77%	0.0927	0.06%	0.06%	0.79	-1.5885	11.7621
					(2.24)	(2.31)			
	37	0.02%	0.61%	0.0292	0.00%	0.01%	0.63	-1.2832	14.5898
					(0.70)	(1.34)			
Passive/ Enhanced	38	0.06%	0.83%	0.0728	0.04%	0.04%	1.01	-0.5834	6.5005
					(7.26)	(6.52)			
	39	0.06%	0.87%	0.0664	0.03%	0.03%	1.01	-0.3534	9.6744
					(8.78)	(9.85)			
	40	0.03%	0.83%	0.0327	0.00%	0.00%	1.00	-0.4727	10.0641
					(1.79)	(2.21)			

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). Returns on option positions were estimated from Black Scholes values (calls) and Binomial values (puts). 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 while FF Alpha refers to the Fama French model alpha plus momentum as in Carhart (1997) with factors recomputed for Australian data (t-values computed using the White correction for heteroskedasticity in parentheses).

Table 3: Characteristics of fund weekly returns

Fund Investment Style	Fund	Mean	Standard Deviation	Sharpe Ratio	Alpha	FF Alpha	Beta	Skewness	Kurtosis
GARP	1	0.17%	1.67%	0.1017	0.08%	0.10%	0.90	-0.5209	4.6878
					(2.21)	(2.58)			
	2	0.29%	1.96%	0.1500	0.16%	0.17%	1.11	0.0834	4.2777
					(6.44)	(5.88)			
	3	0.32%	2.05%	0.1559	0.19%	0.20%	1.08	0.7382	7.6540
					(4.09)	(4.36)			
	4	0.26%	2.00%	0.1314	0.20%	0.23%	0.98	0.3098	4.5424
					(2.54)	(2.78)			
	5	0.07%	1.70%	0.0430	-0.02%	-0.01%	0.88	-0.0492	3.2575
					(-0.50)	(-0.35)			
	6	0.22%	1.97%	0.1110	0.15%	0.18%	0.99	-0.4793	3.8615
					(2.19)	(2.64)			
	7	0.13%	1.94%	0.0648	0.04%	-0.03%	0.98	0.0098	4.5978
					(0.67)	(-0.50)			
	8	0.10%	1.98%	0.0499	0.05%	-0.01%	1.02	-0.1824	3.2847
					(1.20)	(-0.20)			
	9	0.13%	1.94%	0.0650	0.04%	-0.03%	0.98	0.0058	4.6106
					(0.67)	(-0.49)			
	10	0.11%	2.88%	0.0391	-0.10%	-0.10%	1.15	-0.6109	3.4018
					(-0.95)	(-1.15)			
	11	0.10%	1.77%	0.0551	0.02%	0.02%	0.96	-0.0770	3.6718
					(0.45)	(0.34)			
	12	0.10%	1.73%	0.0564	0.04%	0.18%	0.67	-0.9569	7.5997
					(0.34)	(1.21)			
	13	0.17%	1.80%	0.0922	0.06%	0.07%	0.91	-0.5071	3.6344
					(1.40)	(1.76)			
Growth	14	0.17%	1.92%	0.0862	0.05%	0.05%	1.07	-0.1288	3.3156
					(1.94)	(1.62)			
	15	0.18%	1.86%	0.0944	0.07%	0.08%	1.04	-0.1838	3.8109
					(2.21)	(2.38)			
	16	0.19%	1.77%	0.1079	0.09%	0.09%	0.96	-0.2558	4.1749
					(2.66)	(2.61)			
	17	0.12%	1.75%	0.0676	0.02%	0.03%	1.02	-0.1120	3.2110
					(0.80)	(1.33)			
	18	0.28%	2.00%	0.1383	0.19%	0.20%	1.10	-0.1946	3.1367
					(5.88)	(5.90)			
Neutral	19	0.20%	1.91%	0.1023	0.08%	0.08%	1.03	-0.0627	3.3199
					(3.20)	(3.08)			
	20	0.32%	1.91%	0.1658	0.24%	0.24%	1.01	0.0355	3.1547
					(6.24)	(6.86)			
	21	0.13%	2.00%	0.0643	0.01%	0.01%	1.05	-0.1430	2.7644
					(0.26)	(0.14)			
	22	0.17%	2.04%	0.0837	0.07%	0.07%	1.08	-0.4663	4.2420
					(1.25)	(1.44)			
	23	0.20%	1.70%	0.1203	0.09%	0.10%	0.97	-0.1277	3.4404
					(3.30)	(3.74)			
	24	0.16%	2.02%	0.0812	0.05%	0.06%	1.06	-0.2275	3.5142
					(1.59)	(1.83)			
Other	25	0.17%	1.72%	0.1013	0.06%	0.06%	0.98	-0.1514	3.1595
					(3.32)	(2.91)			
	26	0.02%	1.84%	0.0097	0.04%	0.02%	1.03	-0.0652	3.1059
					(1.43)	(0.64)			
	27	0.19%	1.91%	0.0977	0.12%	0.11%	1.03	-0.2667	3.4316
					(2.42)	(2.25)			
Value	28	0.08%	1.35%	0.0604	0.03%	0.05%	0.67	-0.2704	4.5473
					(0.74)	(1.49)			
	29	0.12%	1.83%	0.0638	0.07%	0.07%	1.00	-0.0052	3.3586
					(3.50)	(3.65)			
	30	0.04%	1.85%	0.0204	-0.05%	-0.05%	0.76	0.0924	4.2838
					(-0.68)	(-0.73)			
	31	0.29%	1.66%	0.1718	0.25%	0.19%	0.87	-0.4338	4.8583
					(3.98)	(2.95)			

Table 3: Characteristics of fund weekly returns (continued)

Fund Investment Style	Fund	Mean	Standard Deviation	Sharpe Ratio	Alpha	FF Alpha	Beta	Skewness	Kurtosis
Value	32	0.30%	1.86%	0.1640	0.29%	0.31%	0.91	-0.4315	3.0761
					(3.48)	(3.32)			
	33	0.19%	1.78%	0.1094	0.11%	0.14%	0.80	-0.2495	3.5236
					(1.48)	(2.07)			
	34	0.15%	1.82%	0.0839	0.13%	0.14%	0.97	-0.0288	3.6216
					(3.60)	(3.68)			
	35	0.41%	1.99%	0.2060	0.35%	0.34%	0.55	-0.2383	3.7300
					(2.72)	(2.72)			
	36	0.34%	1.89%	0.1814	0.29%	0.31%	0.90	-0.6248	5.1278
					(3.02)	(3.06)			
	37	0.09%	1.28%	0.0693	0.03%	0.04%	0.63	-0.4125	4.4588
					(0.81)	(1.30)			
Passive/ Enhanced	38	0.29%	1.91%	0.1495	0.17%	0.18%	1.04	0.0370	4.5980
					(5.39)	(5.06)			
	39	0.28%	1.79%	0.1593	0.17%	0.17%	1.02	0.0540	3.5891
					(8.04)	(8.97)			
	40	0.13%	1.70%	0.0783	0.02%	0.02%	1.00	-0.0001	3.3446
					(3.08)	(2.69)			

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). Returns on option positions were estimated from Black Scholes values (calls) and Binomial values (puts). 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 while FF Alpha refers to the Fama French model alpha plus momentum as in Carhart (1997) with factors recomputed for Australian data (t-values computed using the White correction for heteroskedasticity in parentheses).

Table 4: Evidence of concavity in weekly holding period returns

	Category	Beta	Treynor Mazuy measure	Modified Henriksson Merton measure	Number of observations
Style	*GARP*	0.96399	-0.01139	-0.09195	2394
			(-2.36)	(-2.57)	
	Growth	1.03670	-0.00708	-0.03762	1899
			(-1.53)	(-1.15)	
	Neutral	1.02830	-0.00110	-0.02092	1313
			(-0.29)	(-0.71)	
	Other	1.00670	-0.00196	0.00676	640
			(-0.53)	(0.21)	
	Value	0.76691	-0.01215	-0.10350	2250
			(-1.93)	(-2.24)	
	Passive/ Enhanced	1.01440	0.00692	0.04593	859
			(1.51)	(1.47)	
Largest 10 Institutional Manager	*No*	0.96269	-0.00645	-0.05037	6100
			(-2.25)	(-2.34)	
	Yes	0.88230	-0.01344	-0.10316	2396
			(-2.66)	(-2.97)	
Boutique firm	*No*	0.93239	-0.01044	-0.07705	5708
			(-3.16)	(-3.26)	
	Yes	0.95555	-0.00452	-0.04184	2788
			(-1.25)	(-1.49)	
Bank or Life office affiliated	*No*	0.86155	-0.00860	-0.07538	3726
			(-2.07)	(-2.48)	
	Yes	1.00180	-0.00819	-0.05685	4770
			(-2.68)	(-2.54)	
Annual Bonus	*No*	0.98187	0.00013	0.01233	308
			(0.03)	(0.35)	
	Yes	0.93875	-0.00867	-0.06779	8188
			(-3.36)	(-3.59)	
Domestic owned	*No*	0.97416	-0.01009	-0.07395	4261
			(-2.84)	(-2.83)	
	Yes	0.90528	-0.00652	-0.05557	4235
			(-1.86)	(-2.18)	
Equity Ownership by senior staff	*No*	0.93239	-0.01044	-0.07705	5708
			(-3.16)	(-3.26)	
	Yes	0.95555	-0.00452	-0.04184	2788
			(-1.25)	(-1.49)	

The Treynor Mazuy measure corresponds to the quadratic term in the Treynor Mazuy (1966) 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. The models are estimated using weekly holding period excess returns allowing for a fund specific intercept and slope with respect to the benchmark excess return (t-values computed using the White correction for heteroskedasticity in parentheses). Fund, benchmark and short interest returns are as given in Table 3

Table 5: Characteristics of options in portfolio:

Fund Investment Style	Fund	Calls Number	Calls Strike	Puts Number	Puts Strike	Month end option positions: Concavity decreasing	Concavity increasing	Total
GARP	1	0.726	1.017	0.395	0.957	100%	0%	80
	2	-0.061	1.050	-0.122	0.904	29%	71%	246
	3	0.099	1.017	0.021	0.952	59%	41%	79
	4	0.041	1.023	0.008	0.944	77%	23%	898
	5	-0.650	1.062	-1.346	0.985	0%	100%	18
	6	0.222	1.076	-	-	100%	0%	11
	11	0.811	0.002	0.950	0.674	100%	0%	8
	13	0.054	1.076	-	-	100%	0%	11
Growth	15	-0.033	1.056	-	-	27%	73%	11
	16	-0.039	1.060	-	-	0%	100%	8
	17	-0.367	1.067	0.107	0.951	35%	65%	83
	18	-0.059	1.023	0.108	0.913	13%	87%	344
Neutral	21	-0.093	1.038	-0.093	0.947	10%	90%	208
	22	0.567	0.984	-	-	100%	0%	10
	24	0.405	0.854	-	-	100%	0%	1
Other	25	0.079	1.147	0.147	0.965	94%	6%	35
Value	33	0.050	0.914	-	-	57%	43%	23
Passive/ Enhanced	38	-0.013	0.948	-0.017	0.955	9%	91%	340
	39	-0.026	1.036	-0.041	0.959	10%	90%	613
-	-	-	-	-	**Total**	**38%**	**62%**	**3027**

This table gives the characteristics and number of option positions in each of the funds. The number of options is the median value of the ratio of number of options to the number of units of underlying stocks held by the fund, while the strike is the exercise price expressed as a ratio of the underlying stock price as of each holding date. The low strike price value of options held by fund 11 is explained by the fact that that fund held only two call options, each one of which had a one cent exercise price feature. "Concavity increasing" positions arise whenever the number of puts is less than or equal the negative of the number of calls on the same underlying security at month end. 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. 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 6: Trade analysis regression - Individual securities

Fund Investment Style	Fund	Constant	Highwater mark on a loss	Value of Holdings on a loss	Cost Basis on a loss	Above Highwater mark?	Value above highwater mark	Rsq	N	Durbin Watson Statistic
GARP	1	-57900	-0.0001	-0.0263	0.0389	15167	-0.0072	0.0084	2106	1.756
		(-0.91)	(-0.04)	(-2.45)	(2.66)	(0.10)	(-0.63)			
	2	20405	0.0275	-0.0378	0.0272	1130995	-0.8899	0.4036	3637	1.815
		(0.25)	(2.34)	(-2.36)	(2.02)	(4.81)	(-9.64)			
	3	154066	0.0323	-0.0429	0.0209	782382	-0.9693	0.5958	4697	1.798
		(1.98)	(2.40)	(-2.74)	(1.54)	(4.16)	(-27.44)			
	4	62285	0.0195	-0.0170	0.0074	-197122	0.0165	0.0166	1689	1.608
		(3.00)	(1.15)	(-0.93)	(0.47)	(-5.55)	(0.59)			
	5	2642	-0.0667	0.0039	-0.0123	4658	-0.4561	0.0173	3589	1.816
		(0.24)	(-2.26)	(0.19)	(-0.88)	(0.19)	(-3.12)			
	6	34627	-0.0885	0.0275	-0.0102	11500	0.2200	0.0719	1200	1.578
		(4.20)	(-2.49)	(3.61)	(-1.84)	(0.70)	(2.70)			
	7	369463	0.0164	-0.1743	0.1452	-156014	0.3031	0.0277	414	1.464
		(2.15)	(0.10)	(-1.40)	(1.34)	(-0.67)	(0.76)			
	8	-36132	-0.0207	0.0135	-0.0185	121407	0.0835	0.0186	758	1.704
		(-0.72)	(-0.47)	(0.49)	(-0.88)	(1.86)	(0.66)			
	9	205092	0.1258	-0.2011	0.1867	-95024	0.2072	0.0141	458	1.492
		(2.07)	(0.95)	(-1.65)	(1.90)	(-0.71)	(0.67)			
	10	156855	0.4176	0.1051	-0.1525	-31180	-0.0564	0.0383	89	1.471
		(0.84)	(1.20)	(0.41)	(-0.62)	(-0.14)	(-0.51)			
	11	-4026	0.1512	-0.0668	0.0669	-11531	-0.1446	0.0300	545	1.721
		(-0.60)	(1.63)	(-0.78)	(0.89)	(-0.86)	(-0.57)			
	12	-4321	-0.2472	0.0850	-0.0428	92410	-0.0976	0.0359	362	1.794
		(-0.16)	(-1.43)	(0.63)	(-0.35)	(2.70)	(-0.87)			
	13	-2446	-0.0136	0.0124	0.0076	8410	0.0128	0.0316	1346	1.662
		(-1.76)	(-0.57)	(0.49)	(0.39)	(4.16)	(0.25)			
Growth	14	159781	-0.0371	0.0325	-0.0198	25312	-0.0756	0.0248	4998	1.663
		(4.77)	(-3.25)	(4.73)	(-3.68)	(0.35)	(-0.98)			
	15	-26852	-9.9139	0.0408	-0.2053	3559690	0.0793	0.0723	126	2.041
		(-0.01)	(-1.33)	(0.13)	(-1.68)	(0.60)	(0.10)			
	16	-4249373	0.4826	-0.7311	0.1165	-1306511	0.1004	0.0779	119	1.974
		(-1.77)	(0.79)	(-2.62)	(1.53)	(-0.27)	(0.24)			
	17	71783	0.0538	0.0100	-0.0221	-19586	-0.9350	0.0214	2150	2.250
		(2.88)	(1.14)	(0.18)	(-0.40)	(-0.44)	(-2.19)			
	18	-1127	0.0047	-0.0135	0.0090	2135	0.0150	0.0011	5687	1.848
		(-0.11)	(0.83)	(-1.45)	(1.62)	(0.09)	(0.48)			
Neutral	19	-4348	0.0064	-0.0075	0.0072	24508	-0.0426	0.0008	6133	1.572
		(-0.50)	(0.81)	(-0.69)	(0.69)	(0.78)	(-0.26)			
	20	-65141	-0.0379	0.0496	-0.0419	-18673	0.0207	0.0024	1012	1.645
		(-1.46)	(-0.52)	(0.66)	(-0.61)	(-0.22)	(0.19)			
	21	24904	-0.0068	-0.0034	-0.0145	-23890	-0.0824	0.0130	1293	1.647
		(0.89)	(-0.61)	(-0.23)	(-1.01)	(-0.33)	(-1.53)			
	22	-28254	0.0504	-0.0687	0.1049	34393	0.0569	0.0286	1724	2.422
		(-1.60)	(0.67)	(-0.58)	(0.89)	(1.51)	(0.65)			
	23	-8004	0.0330	-0.0214	0.0212	25062	-0.5889	0.0336	1059	2.018
		(-2.22)	(0.61)	(-0.32)	(0.33)	(3.51)	(-2.79)			
	24	-23378	0.0244	-0.0360	0.0772	18862	0.0135	0.0588	340	1.806
		(-2.35)	(0.54)	(-1.00)	(2.19)	(1.38)	(0.18)			
Other	25	4033	0.0112	0.0134	-0.0138	-3574	0.2570	0.0077	3726	1.863
		(0.66)	(0.69)	(0.92)	(-0.98)	(-0.28)	(1.74)			
	26	-10509	-0.0331	0.0507	-0.0396	28037	-0.0489	0.0057	1556	1.807
		(-1.11)	(-1.14)	(1.81)	(-1.71)	(1.88)	(-0.92)			
	27	-2376	0.2420	-0.2621	0.1393	16241	-1.0106	0.0428	494	2.181
		(-0.11)	(2.14)	(-2.86)	(2.02)	(0.49)	(-1.77)			
Value	28	12028	0.0071	-0.0158	0.0250	-59607	-0.2035	0.0144	5426	1.689
		(0.90)	(0.39)	(-0.79)	(1.34)	(-1.99)	(-2.54)			
	29	-8632	0.0157	0.0372	-0.0453	49416	-0.1129	0.0108	1450	2.127
		(-0.78)	(0.65)	(1.26)	(-1.42)	(2.52)	(-1.11)			
	30	123472	-0.0603	0.0190	-0.0226	-265100	-0.4379	0.0342	2292	1.783
		(4.94)	(-3.84)	(1.63)	(-3.76)	(-3.10)	(-1.94)			
	31	41328	-0.0920	-0.0215	0.0925	99135	-0.1548	0.0849	301	1.552
		(1.50)	(-1.25)	(-0.53)	(2.54)	(2.05)	(-0.91)			

Table 6: Trade analysis regression - Individual securities (continued)

Fund Investment Style	Fund	Constant	Highwater mark on a loss	Value of Holdings on a loss	Cost Basis on a loss	Above Highwater mark?	Value above highwater mark	Rsq	N	Durbin Watson Statistic
Value	32	74849	-0.0251	0.0244	-0.0513	-88841	-0.5591	0.0247	353	1.619
		(1.09)	(-0.08)	(0.21)	(-0.57)	(-0.74)	(-3.24)			
	33	25949	0.0287	-0.0308	0.0465	25508	0.2663	0.0342	914	1.710
		(3.15)	(0.47)	(-1.13)	(2.22)	(1.78)	(1.38)			
	34	-7466	0.0448	-0.0188	0.0158	35542	-0.6333	0.0116	1631	1.910
		(-1.04)	(1.06)	(-0.35)	(0.32)	(2.79)	(-2.45)			
	35	15067	0.0353	-0.0983	0.1040	27759	-0.0663	0.0281	577	1.769
		(1.43)	(0.90)	(-1.51)	(2.44)	(1.57)	(-1.28)			
	36	29314	0.0677	-0.1181	0.0995	-891	-0.9833	0.1663	285	1.688
		(1.76)	(1.55)	(-2.73)	(2.88)	(-0.03)	(-2.18)			
	37	50075	-0.0018	0.0104	-0.0102	-269062	-0.0541	0.0067	7477	1.752
		(1.10)	(-0.20)	(1.17)	(-1.32)	(-3.15)	(-0.89)			
Passive/ Enhanced	38	121036	0.0818	-0.0925	0.0739	-45854	0.0751	0.0152	4127	1.967
		(1.87)	(1.08)	(-1.15)	(1.22)	(-0.62)	(1.89)			
	39	6412	0.0280	-0.0301	0.0226	-75725	0.0263	0.0032	6061	2.030
		(0.55)	(1.09)	(-0.92)	(0.82)	(-1.37)	(0.12)			
	40	-97081	0.0304	0.0587	-0.0287	335127	-2.0915	0.0085	11823	2.075
		(-2.35)	(0.54)	(0.98)	(-0.58)	(1.21)	(-0.89)			

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 δ_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.