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 by engaging in zero net investment portfolio overlay strategies. These strategies 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. While a minority of managers appear to engage in a pattern of trading consistent with informationless investing, this phenomenon is limited to positions taken in individual securities, and seems to be more closely related to both behavioral patterns of trading and seasonal window dressing, rather than as a specific response to adverse incentives of money managers.
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DOUBLE OR NOTHING: PATTERNS OF EQUITY FUND HOLDINGS AND TRANSACTIONS

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 appear to 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. They further show that by leveraging this portfolio, the trader can increase the reported Jensen (1968) alpha without limit. Weisman (2002) describes this as

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

"informationless investing" and argues that it can produce the appearance of return enhancement without necessarily providing any value to an investor[3]. Such strategies include but are not limited to the short volatility (short out of money calls and puts in combination with the benchmark) 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[4]. Weisman argues that funds have a strong incentive to use these techniques to improve measures of risk-adjusted performance in order to boost the flow of money into the fund[5].

Informationless investing increases short term performance measures at the cost of long term performance goals, and under extreme circumstances can lead to ruin. Many philosophers, starting with Bernoulli have questioned the rationality of agents who enter games of this nature[6]. 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

[3]This result arises not from the biases caused by discrete measurement of continuous trading processes (see, for example Goetzmann, Ingersoll and Ivkovic (2000) and Ferson, Henry and Kisgen (2004)) which can cause timing ability to be obscured in the discrete monthly return interval, but rather to trading behavior which leads to option like payoffs and left skew returns relative to benchmark over the relevant holding period.

[4]A good example of this is the trading behavior of Nicholas Leeson which led to the Barings disaster (see Brown and Steenbeek 2001).

[5]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 short term performance. 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. Del Guercio and Tkac (2002) find that Jensen's alpha and flow is both significant and positively related for both mutual funds and pension funds.

[6]For an excellent discussion see Keynes (1952) pp. 316-320. Samuelson (1977) provides a very interesting historical overview of this literature.

preference is that the agent would choose a portfolio exhibiting a 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 it is plausible that traders might engage in short term trading strategies in response to short-term incentives, it is less plausible that their managers – or long term investor clients – would allow them to act in ways inimical to their long-term interests. Yet many of the recent rogue trader incidents have been characterized by management failures. These failures include an inability or unwillingness to control the actions of traders[7]. Excessive concentration on observable short-term performance may arise because long-term performance is difficult to measure and rewards to short-term performance will divert attention away from the crucial but unobservable and unrewarded task of long-term performance[8]. However the failure to provide proper incentives for long run performance is clearly not all of the story. A characteristic of recent incidents appears to be the evasion of clearly established position limits and other constraints on trading, sometimes with the acquiescence of supervisory management. What could

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[7]The issue of management failures is a staple of press accounts of recent rogue trader episodes, and have been well documented in the case of the Barings Bank failure (BoE (1995)), and the problems at National Australia Bank (NAB) (APRA(2004), PwC(2004)).

[8]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, but long-term performance is hard to measure or observe. 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 of employee-managers.

cause this failure of managerial oversight?

A simple explanation might be that managers do not comprehend the risk they are exposed to through the actions of their traders. Either they misperceive the magnitude of the risks themselves, or they believe that the risks are small in the context of the firm taken as a whole.

Informationless investing overlay strategies may lead to large negative returns. This is particularly true of unhedged short volatility and doubling strategies. However, on the presumption that the instruments being traded are fairly priced, they represent zero sum games yielding a normal return. When such games terminate in ruin, the trader would be fired. If the trader is still employed, we might presume that the ruin event has not (yet) occurred. Such a trader would therefore have experienced high *ex post* returns, which may well have been achieved with low risk[9]. Obviously, a short volatility manager whose options are not exercised would appear *ex post* to have achieved extraordinary returns at limited or no risk. By standard quantitative performance measures, the manager would have been identified as a superior manager[10]. Of course, minute examination of holdings and transactions would have revealed the

[9]In the simplest version of the doubling game, where the trader cashes out on a win and remains in cash, there are only two possible outcomes on a finite sequence of trades. The expected return is zero if the game is fair. This situation might characterize the trader faced with a recurring audit date. If he or she survives the audit, the trader will appear to have achieved a high return at zero risk. We are not here referring to the paradox that as we approach the infinite limit the trader must surely win if provided with enough capital (as Nielsen (1999) pp.148-152 notes, the infinite limit will be achieved with continuous trading in any finite period)

[10]This error of perception is referred to as ex-post conditioning bias in Brown, Goetzmann and Ross (1995).

manager to have in fact taken considerable risk to achieve high reported returns.

It is not correct to assert that all informationless trading behavior leads to the possibility of ruin. The policy to precommit a certain fraction of a portfolio's value to risky securities in a long term asset mix guideline setting, is a highly conservative informationless investing strategy that will in fact lead to a Sharpe ratio greater than that of the benchmark[11]. Of course, short volatility trading and doubling strategies are more adventurous and can end up damaging one's financial health. However, even in these cases, there can be mitigating circumstances. 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. 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. Short volatility trades involving security (as opposed to index) options held short, or doubling on the trading behavior of individual stocks, may have a limited effect on aggregate portfolio performance. Indeed, while

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[11]Consider a two period example where in one period the equity can rise to d in the up state and fall to u in the down state with equal probability, while the risk free asset is worth Rf in both states. In the first case the investor borrows $1 and uses the proceeds to invest a fraction y in equity and invests the remainder in the risk free security. At the end of the first period, the investor rebalances the resulting investment to y in equity, and at the end of the second period liquidates the investment and repays the loan. This is a zero net investment informationless strategy. In the second case, the investor borrows $1 to establish a position y in equity with the remainder in the risk free security and does not rebalance at the end of the first period. It is an easy matter to show that the wealth resulting from the first strategy is higher in the intermediate states and lower in the extreme states than that of the buy and hold strategy for $0<d<Rf<u$ and $0<y<1$. This strategy is concave relative to benchmark. It is also possible to show that the Sharpe ratio of the rebalancing strategy always exceeds that of the buy and hold strategy.

there have been many reported instances of large losses attributed to rogue trading, none to our knowledge have involved trading in the context of large and well diversified equity funds.

If Weisman's conjecture is correct and it is found that informationless investing strategies are common, there are serious implications for funds management regardless of whether the net effect of this behavior is mitigated by diversification or the effectiveness of current managerial controls designed to curb patterns of high risk trading. There is an obvious concern when traders from large institutional funds establish themselves as hedge funds managing undiversified positions with limited or non-existent VaR controls[12], or when proprietary trading desks establish large open positions in just one or several related contracts, as was the case at both Barings[13] and the recent scandal at NAB[14].

How prevalent is informationless investing? 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. Public information about fund holdings and transactions are available only on a quarterly basis, although fiduciaries and

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[12]According to Lowenstein (2000) one of the motivating factors for traders who left Salomon Brothers to establish Long Term Capital Management was the excessive controls at Solomon which in their view limited profit opportunities. While LTCM did have extensive VaR controls, in private communication one of the partners explained that these were only implemented on the close of trade Friday.

[13]Leeson traded exclusively in Japanese bond and Nikkei derivatives. Near the end, he expanded Barings long position in Nikkei futures to 49% of the open interest in the March 1995 contract and 24% in the June 1995 contract (BoE, §4.2).

[14]According to both the PwC and APRA reports, the traders involved in the NAB affair traded exclusively in Australian dollar contracts.

fund managers presumably have access to higher frequency data. For this reason, trading associated with informationless investing may not be detected. 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[15]. 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 in light of Weisman's conjecture. Is informationless investing a common pattern among security traders? If so, can we develop early warning systems to identify patterns of trading consistent with informationless investing before it is too late?

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

2. Informationless investing

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

“Informationless investing” is a term used by Weisman (2002) to describe any zero net investment or self financing (in the sense of Harrison and Kreps (1979)) 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)[16].

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 either unhedged 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.

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[16]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. So long as the trades are financed within established credit limits or through authorized portfolio reallocations, there will be no instance of fraud.

In their paper, GISW establish the properties of zero net investment nonlinear 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 nonlinear portfolio strategy 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. 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.[17] This result suggests a simple empirical procedure based on the Treynor Mazuy (1966) measure. 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[18]. 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.

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

[17]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.

[18]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.

(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[19], 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 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

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[19]See, for example, Daniel, Grinblatt, Titman and Wermers (1997), Chen, Jegadeesh and Wermers (2000) and Wermers (2000). Ferson and Khang (2002) develop and apply conditional weight-based measures to US pension funds. For an application in the Australian context, see Pinnuck (2003).

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[20]. Provided the trader has access to unlimited capital, this is a relatively low risk strategy. There is a very small probability of ruin on any given run of trading. However, traders who follow this strategy in a consistent or repeated fashion will face ruin in the long term. We must resort to behavioral arguments to explain this behavior. The evidence suggests that this pattern of repeated doubling is descriptive of the behavior of Nicholas Leeson at Barings (Brown and Steenbeek 2001)[21].

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[20]The optimal portfolio strategy is stationary for a given information signal (Ferson and Siegal (2001)). If he/she is Bayesian, the posterior probability of loss increases with each loss so it is hard to argue that the losses change the information set to favor the lost cause. We cannot exclude the possibility that the trader has increasing absolute risk aversion which causes him or her to increase the position at risk on a loss. This is precisely the prediction of prospect theory.

[21]"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 pattern of repeated doubling, 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. While it is possible that the trader would then remain in cash, particularly if faced with an imminent audit date[22], it seems more reasonable to assume that the trader would reestablish the initial position S_0.

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

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

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

[22]This appears to be the maintained assumption following the discussion in Harrison and Kreps (1979), where the intent is to demonstrate the theoretical result that there exist self financing strategies of this nature which appear to create value out of nothing (see Nielson (1999) p.148-152). In the present equity fund context this assumption appears to be difficult to motivate.

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 repeated doubling 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 given in Equation (1) is captured by the expression

$$\Delta_i = a + b_1 (1 - \delta_i) h_i + b_2 V_i + b_3 B_i + b_4 \delta_i + b_5 G_i + \epsilon_i \qquad (2)$$

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

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[23].

One limitation of the trading model given in Equation (2) applied to actual data is the implied assumption that the target allocation *a* is constant both through time and across securities. As

Ferson and Siegal (2001) show, the optimal allocation will change as the public information set changes. In the spirit of Ferson and Schadt (1996) we can model this to a first approximation as

$$a_t = \alpha_0 + \alpha_1 z_{t-1} V_{t-1} + \eta_t \qquad (3)$$

where z_{t-1} and V_{t-1} represent a vector of instruments and the value of the position as of the prior month end[24].

In summary, while concave payoff distributions are consistent with informationless investing,

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

[24]In the empirical work we follow Ferson and Schadt (1996) in defining the set of instruments to include dividend yield, short term rates, term spread and default spread. We are indebted to Wayne Ferson for this suggestion.

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 active, passive and enhanced passive 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 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 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[25].

The number of participating managers employed in this sample provides coverage of 28 individual investment organizations, where these firms (in aggregate) manage more than 60 percent of total institutional assets in the industry.[26] The remaining nine 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 price information from the ASX Stock Exchange Automated Trading System (SEATS) as an independent source of stock holding valuations to cross-check data provided by 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

[25]"Most successful" in terms of assets under management as of December 2001.

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

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[27]. While survivorship and selection bias is always an issue for performance studies of managed funds, they are of particular concern in a study of this nature, as the selection procedure would naturally exclude funds that experience extreme left tail events or that would otherwise fail due to the trading activities of its managers. In other words, the sample is biased against finding evidence of informationless trading, at least informationless trading that leads to a ruin event[28]. But as we note, informationless trading does not necessarily imply ruin, and the evidence we do find of this pattern of trading is that much stronger as a result.

[27]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.

[28]This is an example of ex-post conditioning bias, which as Brown, Goetzmann and Ross (1995) show causes many specious correlates in patterns of measured returns.

In terms of market representation by funds under management (at 31 December 2001), the sample includes ten funds managed by five of the largest 10 fund management institutions, eight from the next 10, six 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 in terms of style designations specific to the Australian market. These style classifications are 'value', 'growth', 'growth-at-a-reasonable price' (GARP)[29], '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 reasonably 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

[29]GARP is a style of management unique to Australia that can be defined as investing in stocks with good medium-term earnings growth prospects that are inexpensively priced. This description certainly differentiates this style of fund manager from a true growth manager, and the industry certainly recognises the brand is different from growth styles

investment management entity (i.e. whether an annual bonus is available where certain performance targets are achieved), and whether the firm is domestically owned. These data were 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.

Finally, benchmark and other data were obtained or generated from a number of sources. Index returns were obtained from the ASX, and Fama and French (1993) factors and a momentum factor described by Carhart (1997) were constructed from Australian data provided through SEATS. Information set instruments similar to those used by Ferson and Schadt (1996) were constructed for the Australian data as follows. The monthly dividend yield for Australia was as computed by ASX. The interest rate instruments were computed for Australia using International Monetary Fund data obtained through Global Insight. The short term money rate was taken from the average rate on money market instruments expressed on an annual basis, the yield spread was given as the difference between the yield on long term Treasury bonds and the short term money rate, and the credit spread was given as the difference between the maximum overdraft rate and the short term money rate.

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 37 does very little trading. While the median amount of trading in the "Value" style is less than that of the "Growth" and "Growth at a Reasonable Price" (GARP) styles, consistent with the results of Ferson and Khang (2002) for US based funds, the turnover and degree of variability of turnover appears to be greater within styles than is the case in the US.

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[30], and in half of the cases these measures are statistically significant on a daily or weekly return measurement interval[31]. On the other hand almost all of

[30]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 Carhart (1997) style four factor alpha incorporating Australian domestic market, size, book to market and momentum factors.

[31]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 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. The fact that we use constructed rather than reported returns may mitigate some of the problems reported by Edelen (1999), but timing issues are still of concern, and for this reason we emphasize the weekly reported returns over the daily reported numbers.

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[32]. In Table 3 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 one 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 in Table 4. We might anticipate that managers engage in informationless overlay portfolio strategies when they are provided 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. However, this result is only suggestive as the difference is not statistically significant.

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 informationless investing that leads to negative skew and extreme left tail outcomes. In each

[32]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.

case, the results matched the results obtained from inspection of the Treynor Mazuy coefficients. We also examined the Ferson and Schadt (1996) conjecture that significantly negative Treynor Mazuy measures are due to failure to account for secular changes in the information set available to managers. Using the same instruments, constructed using Australian data, made the coefficients reported in Table 4 more statistically significant (negative) than otherwise.

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. Perhaps the concavity is as a result of money chasing performance, dampening performance when funds do well and exacerbating the negative as money flees poor performance[33]. In this context, it is difficult to claim that the return-based evidence unambiguously 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. Given the potentially serious consequences of informationless investing, it is important to look beyond these simple return-based measures.

4.2 Derivatives positions consistent with informationless investing

[33]See Berk and Green (2004). Empirical evidence for this phenomenon can be found in Brown, Goetzmann, Hiraki and Shiraishi (2003).

The Australian Prudential Regulation Authority (APRA) governs the use of derivative securities by Australian fund managers. Overall, APRA requires that funds legally operate within their trust deed, that they avoid leverage and the use of derivatives for speculative purposes, and that funds do not hold uncovered derivative positions within their portfolios. Within these constraints Australian managed funds do indeed take positions in derivative securities. However less than half of the funds in our sample established significant option positions, and only two funds held significant positions in futures contracts[34]. 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 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[35]. In particular almost all of the open option positions maintained by the enhanced index products were in fact concavity increasing. In addition, a

[34]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.

[35] "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.

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 include 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

Table 6 presents results based on Equations (2) and (3) presented in Section 2, applied to daily measures of trading in individual stocks[36]. We measure trading as the total value of transactions less a passive apportionment of net fund inflow[37]. The first and most striking fact about these

[36] In analyzing the trading patterns of these managers there was clear evidence of programs of trades defined as trading in a given security on successive days in the same direction and in similar amounts. As Chan and Lakonishok (1995) observe, this is a common pattern of institutional trading activity, and as in that study we collapse these programs of trades into one trading event presumed to have occurred on the first day of the program of trades.

[37] 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.

results is the evidence of a disposition effect (Odean 1998). In almost every case, funds sell winners, with the amount of the sale dependent on the magnitude of the gain. This evidence is statistically significant in 17 out of the 40 funds. In several cases this pattern is particularly striking as the funds liquidate almost dollar for dollar with any gain above the high water mark.

While we see evidence consistent with the disposition effect implied by Kahneman and Tversky's (1979) prospect theory, do we see the evidence of trading on losses also implied by that theory? Three quarters of the funds increase their position on a loss, with the amount of the trade larger as the value of the position falls. In ten cases this relationship is statistically significant. Selling out on gains and increasing positions on a loss will make the distribution of portfolio returns more concave relative to the benchmark and thereby increase the Sharpe ratio. Indeed, the pattern of trading we observe is significantly correlated with the *ex post* Sharpe ratio measured on the basis of weekly holding period returns[38].

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[39]. In the results reported in Table 6 we address this issue by first

[38]The cross sectional correlation between *ex post* Sharpe ratios given on Table 3 and the significance of this pattern of trading given by the t-value of the value of position on a loss (Table 6) is -0.4950.

[39]Another benign explanation may be the risk management practices in Australian funds that restrict positions in the largest ASX traded stocks to double the current index weighting. This explains why funds may refrain from increasing position on a gain. It does not explain why they liquidate on a gain, since in that event the index weight rises and is therefore not a binding

constructing a two year moving average of past security portfolio weights and including in the set of instruments both the positive and the negative deviations of the most recent portfolio weight from this moving average. 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 correct sign. We must look beyond rebalancing behaviors to explain these trading results.

While trading on losses and locking in gains may be a characteristic of doubling, the results in Table 7 show that this behavior is limited to certain styles of management and certain sectors of equity trading. Table 4 shows that returns realized under the GARP style of management are concave relative to benchmark, and we find on Table 7 that the pattern of trading for this style conforms reasonably closely to the doubling model of Equation (3). On a loss, the higher the benchmark and the smaller the current value of the security, the larger is the position taken. On a gain, the position is liquidated. However, the pattern of trading is not uniform across sectors. The pattern of trading is most pronounced in the health and biotechnology sectors in which, *a priori*, we would expect the greatest degree of information asymmetry. In this sector, the lower the value of the investment and the higher the cost basis the greater is the position taken in the form of new investment.

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constraint.

There is a commonly held view among practitioners that traders tend to double on individual stocks in an attempt to window dress the portfolio on periodic review dates[40]. To examine this hypothesis, we broke down the trades by the period of the year in which they occurred. The results reported in Table 8 are quite striking. For the GARP style of management, for the largest 10 institutional fund management firms and most particularly for those funds owned and controlled by Australian firms, the tendency to double is most pronounced both economically and statistically in the period May through July. This period corresponds to the end of the Australian tax year[41]. The data are certainly consistent with the view that traders are doubling on individual stocks in order to window dress the portfolio. But further study is needed to rule out possible adverse tax incentives for trading over this period[42].

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[40] “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. For further evidence of gaming performance statistics around reporting dates, see Carhart, Kaniel, Musto and Reed (2002).

[41]We chose the May through July quarter definition as there was evidence of spillover at the end of the fiscal year. The seasonal pattern was most pronounced for domestically owned and operated funds for whom this fiscal year is unambiguous. Breaking the pattern down by months, the coefficients were of a similar order of magnitude over the months of April May June and July although somewhat larger in June, with t-statistics of -2.11, -2.14, -1.74 and -2.22 on value trading at a loss for those months, and 1.45, 1.95, 1.00 and 1.93 on cost basis of trades at a loss over the same period. The coefficients were of an order of magnitude smaller for other months and in no case statistically significant.

[42]In a well known study, Brown, Keim, Kleidon and Marsh (1983) argue that tax loss selling can explain abnormal stock returns in Australia over this period. However, results in Table 8 suggest that traders are purchasing on a loss rather than selling on a loss, and were of a similar order of magnitude broken down by individual months in this period.

Contrary to popular perception, there is no evidence that this trading behavior is related to incentives, as there is no systematic evidence that the prevalence of doubling is related to the extent of equity ownership by fund managers or to whether they are compensated on the basis of an annual incentive based bonus payment. On the other hand, there is evidence that this behavior is found in the largest ten institutional funds and in domestic owned funds. These managers do appear to be engaged in a pattern of trading indistinguishable from doubling across most sectors of the equity market. Neither equity ownership nor the fact of an annual bonus appears to make a significant difference in the patterns of trading that we observe in the data.

4.4 Behavioral explanations of results

Incentives are not everything. There is little evidence of an association between doubling behaviors and patterns of compensation. In addition 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. We attempt to control for information trades, allowing simple instruments to proxy for changes in the set of public information. Perhaps we have not entirely succeeded. 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 Tables 6 and 7 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[43].

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 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[44]. 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.

[43]See Gallagher and Looi (2003), and in our sample the large decentralized management funds 8 and 14 appear to follow momentum strategies based on results reported in Table 6, although while reducing positions on a loss do not increase position sizes on a gain. Using our dataset, we found that there is little or no evidence of doubling in terms of equity allocations or sector reallocations. Indeed, there is very little evidence that equity allocations vary greatly in our sample, as most of the funds are fully invested.

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

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). As we note, this is strongly consistent with both the prospect theory (Kahneman and Tversky 1979) and the disposition (Odean 1998) hypothesis which is implied by this theory. 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 the results we find in Table 8 that suggest that traders in some funds double on individual stocks in an attempt to window dress the portfolio around the end of the Australian fiscal year. 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 portfolio overlay strategies that have the unfortunate attribute that they can expose the fund investor to significant downside risk. Weisman 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, and devise some simple statistical procedures which might be used to detect and give early warning of this type of behavior. High frequency holdings and transaction data are not typically available to academic observers, and our results suggest that greater transparency might be an important objective for regulators, fund management, professional advisory firms and custodians who are capable of monitoring such activity with the availability of in-house experts and systems.

We find that the data do not support Weisman's conjecture, as it applies to managed equity funds. While there is evidence that managers working for the largest institutional funds are permitted to trade in this way, the evidence is limited to trades and positions held in individual securities. There is no evidence that this kind of trading takes place at the aggregate fund level, at least within our sample. There is a very simple behavioral hypothesis which would explain the result, and the fact that the trading takes place within large well diversified funds limits its potential impact for both the fund and fund investors. In addition, there is some evidence that the behavior is a response to a desire on the part of managers to window dress their portfolios around the end of the fiscal year.

The results are of some comfort to long term investors in large and well diversified equity funds. However, there is a problem where a manager who behaves in this manner is allowed to manage a large and undiversified portfolio in a proprietary trading context. It would be of great interest to examine whether this behavior is common in hedge funds or commodity trading advisor accounts where there is far less supervision and control over trading activity[45]. It is in this context that informationless investing can be dangerous to your financial health.

[45] Frino, Johnstone and Zheng(2004) finds over a similar period of time and context that Sydney futures traders do indeed lock in their gains and hold their losses, although they do not examine whether they increase their positions on a loss. The same prospect theory that implies that investors lock in their gains also suggests that they will gamble on losses in a manner consistent with doubling. This is a very interesting topic for further study.

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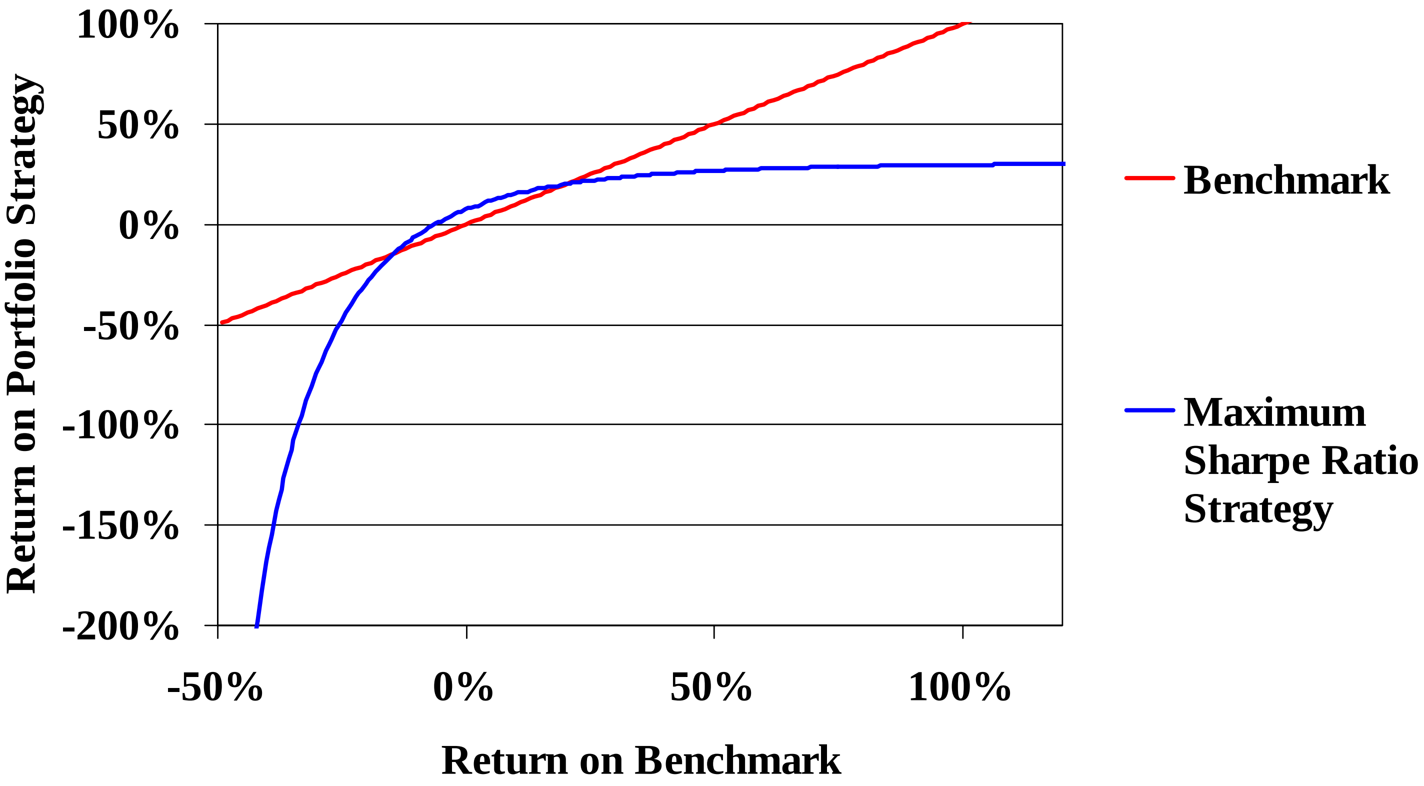
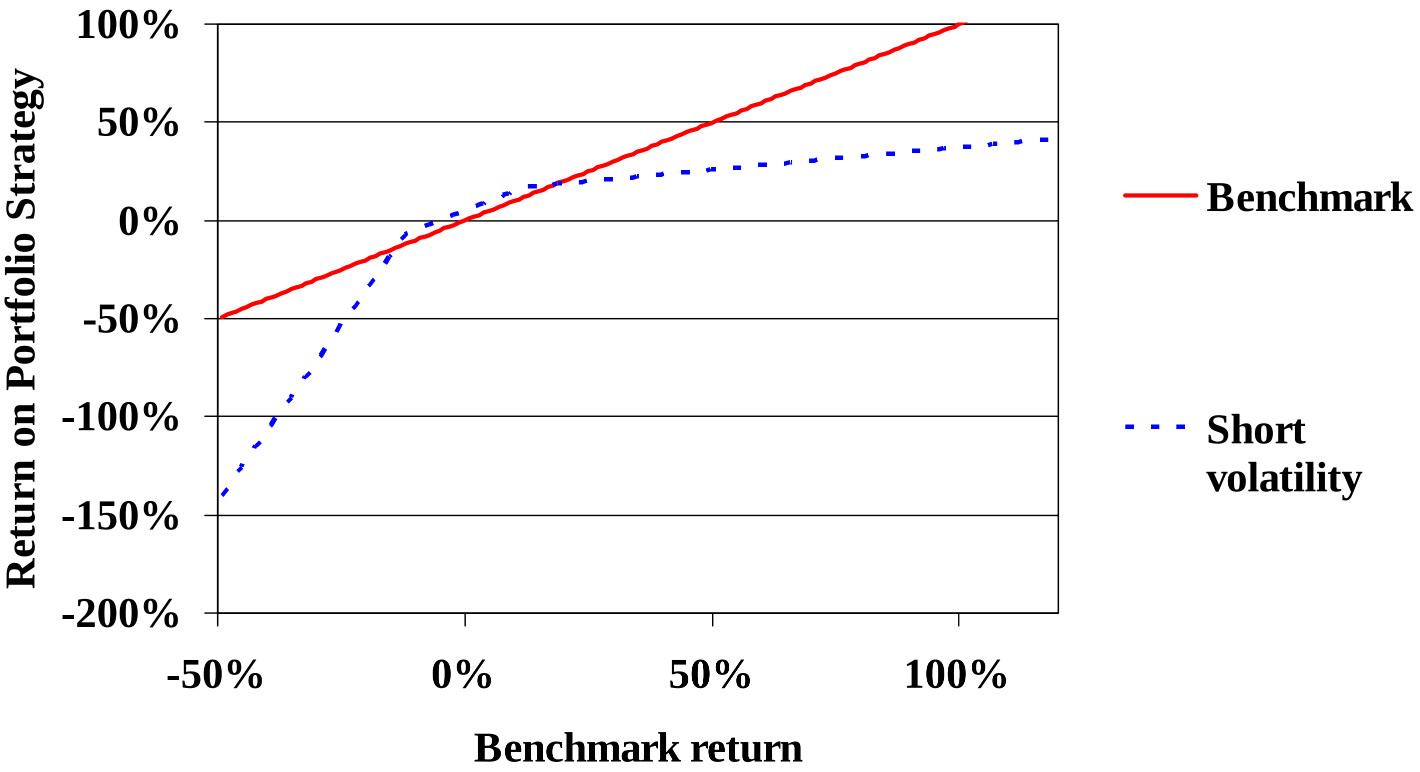
Figure 1: Sharpe ratio Maximizing Portfolio Strategy for a LogNormal Benchmark



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

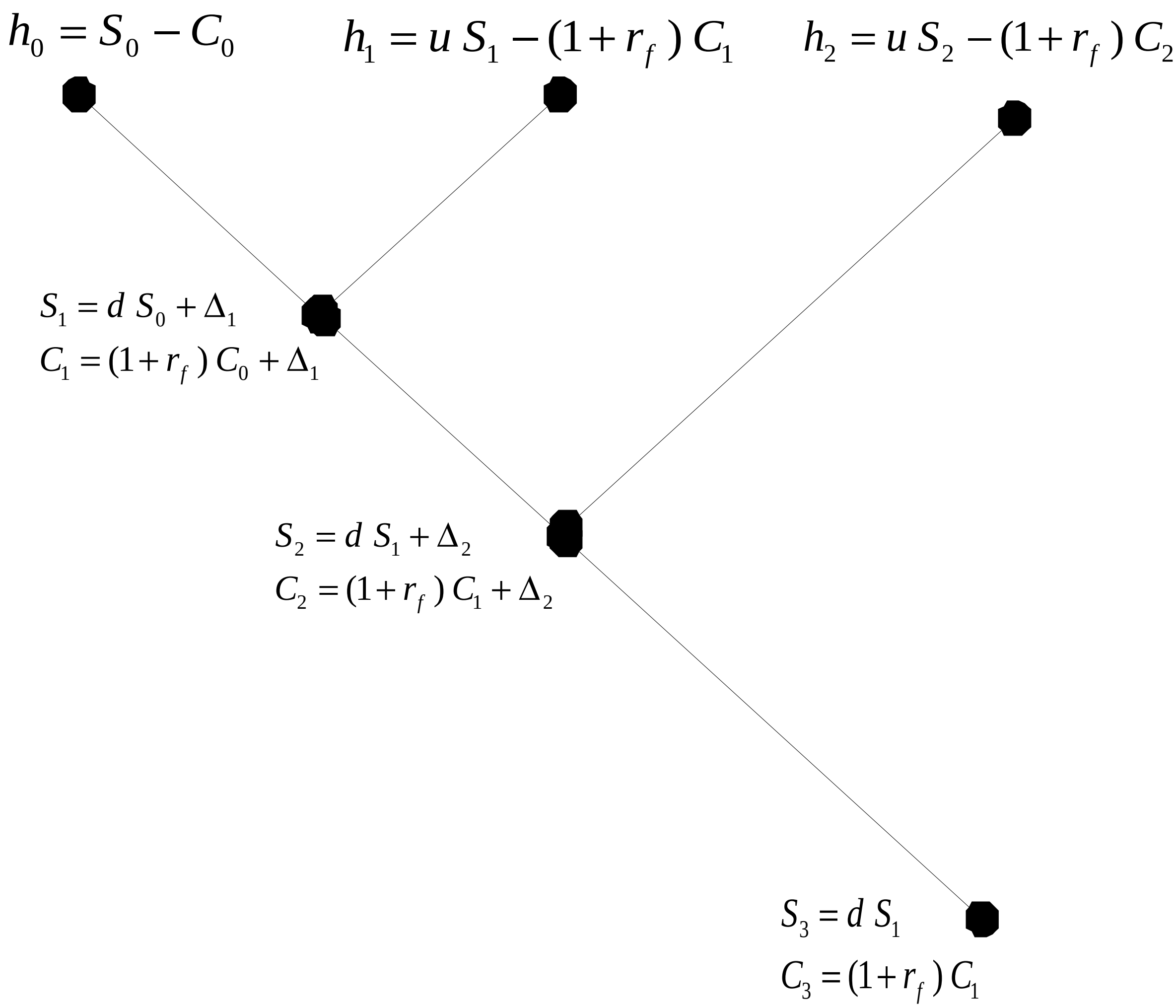


Figure 4 Returns to informationless investing

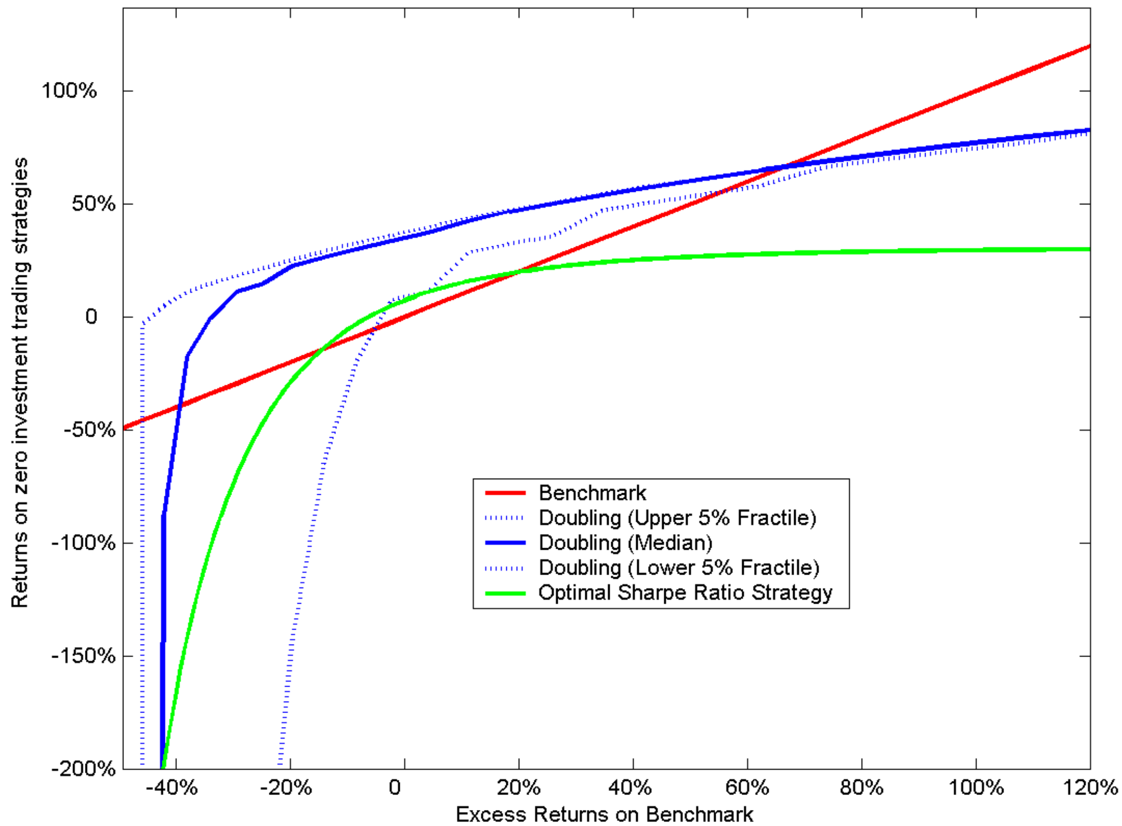


Table 1: Descriptive statistics of funds studied

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

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 (1993) model alpha plus momentum as in Carhart (1997) with factors recomputed for Australian data (t-values computed using the White (1980) 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 (1993) model alpha plus momentum as in Carhart (1997) with factors recomputed for Australian data (t-values computed using the White (1980) 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)	
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 (1980) 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

	Fund	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	0.0003	-0.0254	0.0308	-142291	-0.0119	0.0467	1951	1.811
		(0.20)	(-2.26)	(2.06)	(-1.04)	(-0.86)			
	2	0.0304	-0.1252	0.0257	-714054	-0.8610	0.3927	3658	1.886
		(2.71)	(-6.34)	(2.07)	(-2.83)	(-9.54)			
	3	0.0174	-0.0943	0.0083	-474535	-0.9768	0.6119	4684	1.850
		(1.28)	(-5.27)	(0.58)	(-2.65)	(-32.60)			
	4	0.0100	-0.0259	-0.0007	-261300	-0.0974	0.0348	1507	1.545
		(0.68)	(-1.51)	(-0.04)	(-6.08)	(-1.88)			
	5	-0.1160	0.0370	-0.0782	-26283	-0.6070	0.0559	2323	1.872
		(-2.27)	(0.80)	(-2.03)	(-0.75)	(-3.73)			
	6	-0.0810	0.0091	-0.0058	-21357	0.0894	0.1292	1200	1.689
		(-2.34)	(1.21)	(-1.12)	(-1.30)	(0.81)			
	7	0.0889	-0.1811	0.1210	-238055	-0.0080	0.2315	410	1.661
		(0.48)	(-1.31)	(0.97)	(-1.22)	(-0.02)			
	8	-0.2355	0.0731	-0.1313	-62717	-0.3842	0.1903	710	1.744
		(-4.58)	(2.39)	(-4.95)	(-0.98)	(-2.65)			
	9	0.2525	-0.2822	0.2285	-190826	-0.0506	0.1831	452	1.783
		(1.57)	(-2.16)	(2.04)	(-1.53)	(-0.16)			
	10	0.0499	0.1413	-0.2274	-299112	0.0283	0.6137	40	1.928
		(0.14)	(1.01)	(-1.75)	(-1.53)	(0.08)			
	11	0.1237	-0.1055	0.0145	-48747	-1.0412	0.2176	533	1.834
		(1.53)	(-1.53)	(0.25)	(-3.95)	(-3.80)			
	12	-0.0069	-0.1245	0.0625	-21405	-0.3680	0.1373	364	1.701
		(-0.04)	(-0.90)	(0.50)	(-0.59)	(-2.19)			
	13	-0.0077	-0.0283	0.0114	761	-0.2224	0.1116	1349	1.699
		(-0.32)	(-0.98)	(0.52)	(0.37)	(-4.27)			
Growth	14	-0.0238	0.0204	-0.0123	-34181	-0.1023	0.0238	4844	1.823
		(-2.53)	(3.79)	(-2.83)	(-0.46)	(-1.33)			
	15	-18.6703	-0.6180	0.0275	-6040323	-1.6055	0.4401	124	2.053
		(-1.63)	(-2.39)	(0.27)	(-1.75)	(-1.51)			
	16	1.2284	-0.9120	0.1097	-5064018	-0.2312	0.1809	119	1.985
		(1.26)	(-2.19)	(0.82)	(-1.19)	(-0.32)			
	17	-0.0127	0.0700	-0.0796	18894	-0.9911	0.0555	2032	2.194
		(-0.28)	(1.17)	(-1.42)	(0.43)	(-2.35)			
	18	0.0097	-0.0372	0.0095	-66323	-0.1465	0.0056	6093	1.878
		(1.41)	(-1.91)	(1.59)	(-1.09)	(-1.19)			
Neutral	19	-0.0086	-0.0073	0.0026	-5693	-0.0908	0.0140	5352	1.599
		(-0.89)	(-0.52)	(0.22)	(-0.18)	(-0.47)			
	20	0.0593	-0.1146	0.0059	-436689	-0.5747	0.1342	1013	1.718
		(0.68)	(-1.30)	(0.08)	(-4.63)	(-2.96)			
	21	-0.0983	0.0089	-0.0979	-374054	-0.3488	0.1417	1248	1.690
		(-6.07)	(0.53)	(-5.58)	(-4.37)	(-5.24)			
	22	0.0564	-0.0655	0.0844	21124	-0.0883	0.0302	1624	2.474
		(0.53)	(-0.46)	(0.62)	(0.76)	(-0.75)			
	23	-0.0038	-0.0794	0.0435	17221	-0.6794	0.1683	1014	2.035
		(-0.07)	(-1.20)	(0.69)	(2.69)	(-3.86)			
	24	0.0255	-0.0683	0.0687	-4696	-0.0251	0.1019	338	1.829
		(0.57)	(-1.83)	(1.60)	(-0.26)	(-0.27)			
Other	25	0.0219	-0.0167	-0.0092	-23762	0.1129	0.0536	3738	1.912
		(1.34)	(-1.10)	(-0.62)	(-1.71)	(0.76)			
	26	-0.0885	0.0268	-0.1493	-86874	-0.3994	0.2564	1523	1.798
		(-3.43)	(1.01)	(-6.42)	(-4.51)	(-2.78)			
	27	-0.2093	-0.1899	-0.2148	-162378	-1.1825	0.4175	476	2.057
		(-2.02)	(-2.07)	(-3.25)	(-4.92)	(-2.07)			
Value	28	0.0085	-0.0400	0.0538	-59357	-0.2607	0.0238	4634	1.858
		(0.17)	(-0.83)	(1.20)	(-1.66)	(-2.17)			
	29	0.0048	-0.0023	-0.0561	2956	-0.2698	0.0468	1312	2.122
		(0.17)	(-0.09)	(-1.84)	(0.15)	(-2.39)			
	30	0.0090	-0.0574	0.0048	-374754	-0.4267	0.0794	2084	1.863
		(0.44)	(-2.14)	(0.33)	(-4.42)	(-1.74)			
	31	-0.0626	-0.0741	0.0612	-46806	-0.2407	0.2473	287	1.667
		(-0.66)	(-1.26)	(1.19)	(-0.87)	(-1.45)			

Table 6: Trade analysis regression (continued)

Fund Investment Style	Fund	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	-0.2129	-0.2612	-0.0335	-749047	-0.7118	0.4477	323	1.973
		(-0.90)	(-2.44)	(-0.44)	(-6.25)	(-1.87)			
	33	0.0032	-0.0503	0.0296	-18166	0.1879	0.1105	828	1.817
		(0.05)	(-1.75)	(1.36)	(-1.10)	(0.81)			
	34	0.0389	-0.0502	0.0363	24179	-0.8368	0.0253	1528	1.951
		(0.75)	(-0.93)	(0.75)	(1.65)	(-3.14)			
	35	0.0316	-0.1105	0.0854	10103	-0.0914	0.1232	553	1.750
		(0.80)	(-1.66)	(2.15)	(0.46)	(-1.60)			
	36	-0.0187	-0.0997	-0.0921	-164887	-0.9929	0.3969	258	1.537
		(-0.44)	(-2.46)	(-1.99)	(-4.11)	(-2.41)			
	37	-0.0016	0.0093	-0.0116	-233976	-0.1019	0.0094	6429	1.878
		(-0.18)	(0.95)	(-1.37)	(-2.70)	(-1.50)			
Passive/ Enhanced	38	0.1036	-0.1201	0.0682	-65356	-0.0666	0.0880	4136	1.941
		(1.35)	(-1.68)	(1.44)	(-1.26)	(-0.60)			
	39	0.0207	-0.0369	0.0071	-119027	-0.1016	0.0205	6091	2.001
		(0.80)	(-1.02)	(0.28)	(-1.66)	(-0.53)			
	40	0.0382	0.0456	-0.0013	469294	-3.0821	0.0179	10552	2.077
		(0.53)	(0.51)	(-0.02)	(1.37)	(-0.98)			

This table gives results regressing the value of security 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 security 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 δi 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 position exceeds the current highwatermark.

We also include in the regression (not displayed) macro instruments designed to capture informed trading: prior month annual short term money rate, yield spread credit spread and dividend yield all scaled by the prior month security portfolio weight. In addition, to capture portfolio rebalancing effects, we include the extent to which the security portfolio weight at the last recorded holding date deviated from a prior two year moving average either in a positive or negative direction.

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 (1980) heteroskedasticity consistent estimates of the standard error of each coefficient.

Table 7: Trade analysis regression - Trading by sector

	Category	High water mark on a loss	Mining and minerals: Value of Holdings on Loss	Mining and minerals: Cost Basis on Loss	Industrial: Value of Holdings on Loss	Industrial: Cost Basis on Loss	Financial and consumer services: Value of Holdings on Loss	Financial and consumer services: Cost Basis on Loss	Health and Biotechnology: Value of Holdings on Loss	Health and Biotechnology: Cost Basis on Loss	Gain above high water mark
Style	*GARP*	0.0084	-0.0210	0.0078	-0.0357	0.0027	-0.0155	-0.0054	-0.0578	0.0316	-0.7866
		(2.65)	(-2.51)	(1.48)	(-3.85)	(0.52)	(-1.93)	(-0.60)	(-4.87)	(2.30)	(-5.10)
	Growth	0.0447	0.0363	-0.0513	0.0544	-0.0671	-0.0045	-0.0123	-0.1203	0.1410	-0.1074
		(1.16)	(3.23)	(-2.77)	(0.95)	(-1.16)	(-0.26)	(-1.48)	(-2.26)	(2.44)	(-0.30)
	Neutral	0.0033	0.0033	0.0114	0.0292	-0.0243	0.0128	-0.0059	-0.0097	0.0088	0.0067
		(0.52)	(0.14)	(0.47)	(1.82)	(-1.39)	(1.30)	(-0.67)	(-0.12)	(0.10)	(0.12)
	Other	0.0031	0.0245	-0.0178	0.0261	-0.0336	0.0262	-0.0311	0.0166	0.0052	0.1713
		(0.19)	(0.96)	(-0.85)	(0.63)	(-1.17)	(1.37)	(-1.29)	(0.40)	(0.12)	(1.53)
	Value	-0.0025	-0.0162	0.0038	-0.0148	0.0052	0.0130	-0.0124	-0.0847	0.0874	-0.0681
		(-0.29)	(-1.03)	(0.26)	(-0.99)	(0.42)	(1.33)	(-1.42)	(-3.10)	(2.98)	(-1.08)
	Passive/ Enhance	0.0689	-0.0703	0.0782	-0.0376	0.0427	-0.0129	0.0087	-0.0456	0.0790	-0.0803
		(1.49)	(-1.27)	(1.54)	(-0.62)	(0.76)	(-0.25)	(0.25)	(-0.82)	(1.24)	(-0.43)
Largest 10 Institutional Manager	*No*	0.0411	0.0250	-0.0347	0.0555	-0.0662	0.0008	-0.0142	-0.1068	0.1278	-0.1794
		(1.35)	(2.14)	(-2.13)	(1.00)	(-1.18)	(0.05)	(-1.62)	(-2.40)	(2.57)	(-0.54)
	Yes	0.0080	-0.0127	0.0091	-0.0223	0.0038	-0.0034	-0.0043	-0.0541	0.0370	-0.7542
		(2.24)	(-1.82)	(1.60)	(-3.13)	(0.75)	(-0.62)	(-0.77)	(-5.22)	(3.26)	(-4.65)
Boutique firm	*No*	0.0040	-0.0044	0.0032	0.0019	-0.0188	0.0033	-0.0097	-0.0412	0.0425	-0.7288
		(0.73)	(-0.62)	(0.51)	(0.11)	(-0.84)	(0.55)	(-1.70)	(-4.15)	(3.59)	(-4.36)
	Yes	0.0056	-0.0499	0.0531	-0.0332	0.0288	0.0052	-0.0165	-0.0744	0.0745	-0.1141
		(0.37)	(-0.68)	(0.68)	(-1.39)	(1.29)	(0.24)	(-0.86)	(-1.51)	(1.57)	(-1.72)
Annual Bonus	*No*	0.0175	0.0124	-0.0105	0.0265	-0.0314	0.0165	-0.0268	0.0155	0.0158	0.2569
		(0.95)	(0.43)	(-0.45)	(0.52)	(-0.91)	(0.77)	(-0.98)	(0.34)	(0.34)	(1.73)
	Yes	0.0040	-0.0045	0.0033	0.0019	-0.0187	0.0033	-0.0098	-0.0412	0.0428	-0.7276
		(0.74)	(-0.64)	(0.52)	(0.11)	(-0.84)	(0.55)	(-1.71)	(-4.16)	(3.62)	(-4.35)
Domestic owned	*No*	0.0038	0.0300	-0.0335	0.0641	-0.0684	0.0032	-0.0080	-0.0742	0.0961	-0.0294
		(0.84)	(3.03)	(-3.23)	(1.24)	(-1.26)	(0.50)	(-0.87)	(-2.56)	(2.55)	(-0.40)
	Yes	0.0163	-0.0226	0.0168	-0.0325	0.0116	-0.0102	0.0007	-0.0605	0.0438	-0.8915
		(2.44)	(-2.35)	(2.05)	(-3.44)	(1.53)	(-1.30)	(0.10)	(-5.25)	(3.55)	(-11.42)
Equity Ownership by senior staff	*No*	0.0040	-0.0044	0.0032	0.0019	-0.0188	0.0033	-0.0097	-0.0412	0.0425	-0.7288
		(0.73)	(-0.62)	(0.51)	(0.11)	(-0.84)	(0.55)	(-1.70)	(-4.15)	(3.59)	(-4.36)
	Yes	0.0056	-0.0499	0.0531	-0.0332	0.0288	0.0052	-0.0165	-0.0744	0.0745	-0.1141
		(0.37)	(-0.68)	(0.68)	(-1.39)	(1.29)	(0.24)	(-0.86)	(-1.51)	(1.57)	(-1.72)

In this Table we report results for the trade regression reported in Table 6 broken down by style of management and sector of trade. Value of position and cost basis on a loss were defined separately for four sectors. "Mining and Minerals" comprises ASX classifications Diversified Resources, Energy, Gold, and Other Metals, "Industrial" comprises ASX classifications Building Materials, Chemicals, Developers & Contractors, Diversified Industrials, Engineering, Infrastructure & Utilities, Miscellaneous Industries, Paper & Packaging, and Transport, "Finance and services" comprises ASX classifications Alcohol & Tobacco, Banks & Finance, Food & Household, Insurance, Investment and Financial Services, Media, Property, Retail, Telecommunications, and Tourism & Leisure, and "Health and Biotechnology" is the ASX classification Healthcare & Biotechnology.

Table 8: Trade analysis regression - Trading by time of year

			February-April		May-July		August-October		November-January		Gain above high water mark
	Category	High water mark on a loss	Value of Holdings on Loss	Cost Basis on Loss	Value of Holdings on Loss	Cost Basis on Loss	Value of Holdings on Loss	Cost Basis on Loss	Value of Holdings on Loss	Cost Basis on Loss	
Style	*GARP*	0.0087	-0.0220	0.0079	-0.0267	0.0104	-0.0137	-0.0034	-0.0230	0.0061	-0.7865
		(2.63)	(-1.57)	(0.60)	(-3.32)	(1.21)	(-1.80)	(-0.66)	(-3.20)	(1.29)	(-5.10)
	Growth	0.0310	-0.0003	-0.0080	-0.0011	-0.0084	0.0025	-0.0138	0.0780	-0.1043	-0.1209
		(1.04)	(-0.01)	(-0.57)	(-0.07)	(-0.82)	(0.19)	(-1.70)	(1.27)	(-1.59)	(-0.34)
	Neutral	0.0061	-0.0020	0.0075	-0.0118	0.0222	0.0313	-0.0283	-0.0180	0.0306	0.0024
		(0.83)	(-0.17)	(0.64)	(-0.81)	(1.44)	(2.04)	(-1.83)	(-1.41)	(2.38)	(0.04)
	Other	0.0047	0.0249	-0.0220	-0.0015	0.0007	0.0288	-0.0375	-0.0021	0.0019	0.1651
		(0.28)	(1.10)	(-1.07)	(-0.08)	(0.05)	(1.37)	(-1.47)	(-0.10)	(0.11)	(1.47)
	Value	0.0008	0.0098	-0.0139	0.0017	0.0029	-0.0013	0.0048	0.0332	-0.0374	-0.0636
		(0.10)	(0.86)	(-1.09)	(0.16)	(0.26)	(-0.13)	(0.45)	(2.02)	(-2.27)	(-1.01)
	Passive/ Enhance	0.0707	-0.0328	-0.0009	-0.0504	0.0789	-0.0417	0.0310	-0.0242	0.0328	-0.0885
		(1.63)	(-0.37)	(-0.01)	(-0.71)	(1.16)	(-1.09)	(1.13)	(-0.54)	(0.84)	(-0.48)
Largest 10 Institutional Manager	*No*	0.0327	0.0048	-0.0124	0.0043	-0.0108	0.0028	-0.0119	0.0684	-0.0920	-0.1899
		(1.32)	(0.20)	(-0.64)	(0.29)	(-1.02)	(0.22)	(-1.48)	(1.16)	(-1.46)	(-0.57)
	Yes	0.0083	-0.0103	0.0004	-0.0159	0.0152	-0.0065	-0.0016	-0.0027	-0.0002	-0.7539
		(2.23)	(-1.20)	(0.04)	(-2.25)	(1.75)	(-1.22)	(-0.33)	(-0.34)	(-0.04)	(-4.65)
Boutique firm	*No*	0.0044	-0.0040	-0.0027	-0.0089	0.0090	-0.0006	-0.0050	0.0147	-0.0242	-0.7291
		(0.78)	(-0.44)	(-0.29)	(-1.17)	(1.12)	(-0.10)	(-0.94)	(0.94)	(-1.29)	(-4.36)
	Yes	0.0179	-0.0059	0.0026	-0.0490	0.0515	0.0322	-0.0524	-0.0742	0.0564	-0.1053
		(1.10)	(-0.21)	(0.10)	(-1.14)	(1.19)	(1.35)	(-2.23)	(-2.21)	(1.84)	(-1.59)
Annual Bonus	*No*	0.0228	0.0034	-0.0045	-0.0273	0.0229	0.0213	-0.0370	-0.0141	0.0060	0.2435
		(1.23)	(0.13)	(-0.18)	(-1.31)	(1.31)	(0.95)	(-1.36)	(-0.62)	(0.33)	(1.63)
	Yes	0.0044	-0.0041	-0.0027	-0.0090	0.0092	-0.0007	-0.0051	0.0146	-0.0241	-0.7280
		(0.79)	(-0.45)	(-0.29)	(-1.19)	(1.14)	(-0.10)	(-0.95)	(0.93)	(-1.29)	(-4.35)
Domestic owned	*No*	0.0021	0.0180	-0.0174	0.0024	-0.0049	0.0064	-0.0100	0.0656	-0.0845	-0.0313
		(0.49)	(1.84)	(-1.94)	(0.29)	(-0.55)	(0.82)	(-1.43)	(1.33)	(-1.48)	(-0.42)
	Yes	0.0174	-0.0184	0.0049	-0.0244	0.0236	-0.0152	0.0057	-0.0111	0.0073	-0.8912
		(2.51)	(-1.76)	(0.45)	(-2.45)	(2.13)	(-1.87)	(0.83)	(-1.08)	(0.86)	(-11.39)
Equity Ownership by senior staff	*No*	0.0044	-0.0040	-0.0027	-0.0089	0.0090	-0.0006	-0.0050	0.0147	-0.0242	-0.7291
		(0.78)	(-0.44)	(-0.29)	(-1.17)	(1.12)	(-0.10)	(-0.94)	(0.94)	(-1.29)	(-4.36)
	Yes	0.0179	-0.0059	0.0026	-0.0490	0.0515	0.0322	-0.0524	-0.0742	0.0564	-0.1053
		(1.10)	(-0.21)	(0.10)	(-1.14)	(1.19)	(1.35)	(-2.23)	(-2.21)	(1.84)	(-1.59)

In this Table we report results for the trade regression reported in Table 6 broken down by style of management and time of year of the trade. Value of position and cost basis on a loss were defined separately for four periods of the year, February through April, May through July, August through October and November through the following January.