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

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Abstract: Prospect theory of Kahneman and Tversky (1979) suggests that traders will typically lock in gains and gamble on losses. In extreme situations such behavior can lead to significant downside risk for fund investors. 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 examine a unique database of daily transactions and holdings of a set of thirty nine successful Australian equity managers. While this pattern of trading does seem to characterize the portfolios of some of the largest funds in Australia, this phenomenon is limited to positions taken in individual securities within large and well diversified funds. For this reason the negative consequences for fund investors appear to be limited.

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Prospect theory of Kahneman and Tversky (1979) suggests that traders typically lock in gains and gamble on losses. In extreme situations such loss averse trading behavior can lead to significant downside risk. We examine a unique database of daily transactions and holdings of a set of thirty nine successful Australian equity managers. While this pattern of trading does seem to characterize the portfolios of some of the largest funds in Australia, this phenomenon is limited to positions taken in individual securities within large and well diversified funds. For this reason the negative consequences for fund investors appear to be limited.

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I. Introduction

A close analysis of recent financial disasters ranging from the Barings fiasco of 1995 to the more recent foreign currency losses of National Australia Bank (NAB) in 2004 reveals a common pattern of traders who overextend themselves and the resources of their employers by gambling on losses and locking in gains, a behavior consistent with the predictions of the prospect theory of Kahneman and Tversky (1979) . Experiments have confirmed that agents prefer to realize gains and gamble on losses. In other words, the agent would sell out on a gain, but increase his or her position on a loss, hoping that the gamble would restore the amount lost. An implication of this preference is that the agent would choose a portfolio exhibiting a payoff that is concave relative to benchmark.

A recurring question is why management would allow traders to engage in concave payoff strategies that may prove dangerous to their financial health[1]. Goetzmann et al. (2002) (GISW) show that such payoff strategies can artificially augment the fund's reported Sharpe (1966) ratio, at the expense of increasing downside risk. They further show that by leveraging this portfolio, the fund can increase the reported Jensen (1968) alpha without limit. Weisman (2002) uses the term "informationless investing" to describe such concave payoff strategies and argues that they

[1]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 well publicized losses on the foreign currency desk of National Australia Bank (NAB) (APRA(2004), PwC(2004)).

can produce the appearance of return enhancement without necessarily providing any value to an investor. Such strategies include but are not limited to the short volatility (short out of money calls and puts in combination with the benchmark) strategies considered by GISW. Another example of informationless investing is loss averse trading where the investor increases his or her position on a loss to be recovered on a gain[2]. Management may be disinclined to discipline traders whose patterns of trading improves measures of risk-adjusted return and consequent flow of money into the fund[3].

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[4]. However, it is not correct to assert that all informationless trading behavior leads to the possibility of ruin. Long-term asset mix guidelines are a highly conservative investment strategy that generates payoffs that are concave relative to benchmark. Such a strategy will also generate

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

[3]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.

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

a Sharpe ratio greater than that of the benchmark[5]. Of course, extensive short volatility positions and a pattern of increasing trading positions on a loss 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 constructed on the basis of security (as opposed to index) options held short may have a limited impact on a well diversified portfolio. Indeed, while 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. On the other hand, 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, or when proprietary trading desks establish large open positions in just one or several related contracts, as was the case at both Barings[6] and the recent scandal at NAB[7].

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[5]While true in general, this proposition can easily be illustrated by means of a simple two period binomial example involving investment in equity and a riskless security. Rebalancing to the initial asset mix in the second period leads to a concave payoff relative to a buy and hold benchmark and an increase in the Sharpe ratio over that benchmark.

[6]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).

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

Evidence of behavioral patterns of trading is generally hard to find. Coval and Shumway (2005), citing Campbell (2000) argue that "testing behavioral models is quite difficult without detailed information on the trading behavior of market participants. Unfortunately, given the issues of confidentiality associated with such data, availability of such information is generally quite low". While there have been reports and case studies that have examined the role of loss aversion trading in specific instances[8] the Coval and Shumway study was the first to document patterns of informationless investing on a reasonably comprehensive basis. They show that the Chicago Board of Trade proprietary traders regularly assume above average afternoon risk to make up for morning losses. It is of some interest to discover whether this behavior is shared by traders working on behalf of funds that have investment horizons that extend beyond the trading day to months or even years. In this context, the data is even more difficult to acquire.

Indeed, it is not possible to find evidence of day to day informationless trading in US public funds because public information about fund holdings and transactions are available only on a quarterly basis. There is even less information available about positions and trading of hedge funds except in the extreme case of a blow out, when all is revealed. But by then it is too late. By contrast, the Australian case is interesting because there exists a unique and otherwise inaccessible data set containing daily data on transactions and holdings for many large public equity funds operating in that country. This evidence shows that some of the largest and most successful funds in Australia engage in loss averse trading consistent with the findings documented by Coval and Shumway (2005). This result follows even after controlling for long-

[8]See, for example Brown and Steenbeek (2001).

term asset mix rebalancing and various measures of informed trading. Fund returns that can be attributed to trading were less satisfactory for these funds than for other funds in our sample. Taken together, these results suggest that behavioral factors contribute significantly to the trading behavior of some of the largest funds in Australia.

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

"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 that yields a Sharpe ratio in excess of the benchmark using only public information. When the benchmark is LogNormal, GISW (2002) show that the nonlinear portfolio strategy that maximizes the Sharpe ratio (and leads to an unbounded Jensen alpha) has payoffs that are concave relative to benchmark[9]. This concave payoff strategy can be considered an overlay

[9]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. When the representative agent has a utility function that displays diminishing absolute risk aversion, a somewhat stronger result follows from this assumption alone. No globally convex informationless portfolio strategy can generate Sharpe ratios in excess of the benchmark. 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

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 loss averse trading.

The fact that an active trader may execute 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 loss averse trading. Since unhedged short volatility and loss averse trading 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.

The examples provided in GISW suggest that simple empirical procedures might be used to uncover evidence consistent with informationless investing. Agarwall and Naik (2004) show that regressing fund returns on benchmark and benchmark option payoffs reveals that many hedge fund strategies use concave payoff strategies. Alternatively the Treynor Mazuy (1966) measure

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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.

that might be used to discover evidence consistent with informationless investing. If a manager has positive market timing ability, we should expect that in the regression

$$R_{it} - r_{ft} = \alpha_i + \beta_i \times (R_{mt} - r_{ft}) + \gamma_i \times (R_{mt} - r_{ft})^2 + \epsilon_{it} \quad (1)$$

where β_i is positive we should expect that γ_i should also be positive. On the other hand, if a manager tries to use concave trading strategies to boost the reported Sharpe ratio, we should expect that that γ_i should be negative.

However, a finding that fund returns are concave relative to benchmark is a very weak test of whether managers allow traders to engage in a pattern of informationless trading. On the one hand, while informationless trading strategies generate concave payoff patterns and positive alphas, we cannot rule out the possibility that informed trading may also yield concave payoff patterns and positive alphas. Long Term Capital Management believed that the short volatility strategy was justified because in their view the options they wrote were overvalued, but difficult to hedge (Lowenstein 2000). On the other hand, if a manager were actually in the business of maximizing alpha through informationless investing, we may not observe sufficient tail region observations to estimate the quadratic term in the Treynor Mazuy regressions with sufficient precision to conclude that the trading strategy was in fact concave. This is a limitation that results from only considering return information. Holdings data is generally available for US mutual funds only on a quarterly basis. While some very interesting work has been completed

using this data[10], fund managers and pension fund trustees typically have more information on holdings and transactions and are not necessarily limited to return data alone. In the present case, we have higher frequency holdings data and daily transactions, as well as options, futures and other exchange traded derivatives that are not 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 on the basis of information. He or she may believe that volatility is about to fall, or may anticipate 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 systematically selling out positions immediately on a gain but holding the position – or even increasing it – on a loss. The idea that one should increase position size on a loss because the

[10]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).

cost basis is lower in that event is the powerful intuition that supports the popular dollar-cost averaging (DCA) investment strategy. While Constantinides (1979) shows that this path-dependent strategy is inefficient, its popularity suggests a strong behavioral foundation, and in fact Statman (1995) shows that it is indeed implied by prospect theory. In this context, the familiar loss aversion trading example[11] is just a more extreme version of DCA. Under DCA a fixed dollar amount is invested every period. Loss averse trading on the other hand increases investment in the risky security on a loss so as to recoup past losses on a favorable market outcome. 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. The evidence suggests that this pattern is descriptive of the behavior of Nicholas Leeson at Barings (Brown and Steenbeek 2001), a behavior that is difficult to reconcile with rational decision making[12].

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[11]See Samuelson (1977) for an enlightening survey of the extensive literature on this subject.

[12]"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. The results of Coval and Shumway (2005) show that the market distinguishes informationless trades from informed trades and for this reason, loss aversion induced trading has little empirical effect on prices of contracts traded on the Chicago Board of Trade.

How might we distinguish loss averse trading from DCA or other such patterns of trading? Consider a simple example. 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[13], 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 loss aversion trader will increase the value of his or her position by an amount equal to

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

[13]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.

where the first term accounts for past losses, and the second term reestablishes the position in the security. In other words, a loss averse trader will increase the value of units purchased on a loss as the value of the position *S* falls and the cost basis *C* and highwater mark *h* rise. DCA traders on the other hand will continue to invest a constant amount $\Delta_t = S_0$ on a loss regardless of the value or cost basis of the position.

One limitation of trading models such as that given in Equation (2) applied to actual data is the implied assumption that the target allocation S_0 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 model this to a first approximation as

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

where the initial allocation S_t depends on a vector of instruments z_{t-1} scaled by V_{t-1}, the value of the position in the security as of the prior month end[14].

In summary, while concave payoff distributions are consistent with informationless investing, such evidence is not dispositive. Informed trading can also generate concave payoff distributions. Net short positions in out of the money calls and puts are equally consistent with informed trading where the underlying contracts are difficult or impossible to hedge. However,

[14]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.

concave payoff strategies when combined with trading patterns consistent with loss averse trading would increase the concern that the trader is in fact engaging in informationless investing. The question is how widespread is this pattern of trading among active traders.

3. Data

This study uses a unique database of daily transactions and periodic holdings of 39 (includes one 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 extracted from the Portfolio Analytics Database. The data, provided under strict conditions of confidentiality, contains the periodic portfolio holdings and daily trade information of 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 are “flagship funds” publicly available to institutional investors as pooled investment products. 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[15].

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.[16] The remaining nine managers not included in the sample are removed because the back-office systems of the managers did not permit a complete extraction of the relevant holdings and transactions data. Our study also relies on stock price information from the Australian Stock Exchange (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 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

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

[16] This data provided by Rainmaker Information.

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, the largest and hence most successful active pooled equity funds within each investment organization were chosen, skewing the sample as a result[17]. 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[18]. 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.

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

[17]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.

[18]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.

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)[19], '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 (12) 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 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

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

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 30. Fund 1 is a very active trader, while fund 30 does very little trading. While the median amount of trading in the Value style is less than that of the Growth

and 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 United States.

Table 2 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[20], and in more than half of the cases these measures are statistically significant[21]. On the other hand almost all of the funds exhibit negative skewness. This is not surprising as the benchmark All Ordinaries index exhibited similar skewness over the same measurement interval.

[20]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.

[21]One caveat to these results is the fact that Australian equity funds did not customarily report daily unit values until relatively recently. 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.

We obtain some interesting results computing the Treynor Mazuy measures for funds in our sample[22]. In Table 2 we report that the largest degree of negative skewness is to be found in the GARP and Value investment styles. It is not surprising that funds corresponding to these investment styles 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 3. 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 return in excess of the short term money rate 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 skewness and extreme left tail outcomes. In each case, the results matched the results obtained from inspection of the Treynor Mazuy coefficient. Ferson and Schadt (1996) conjecture that significantly negative Treynor Mazuy measures are due to failure to account for secular changes

[22]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.

in the information set available to managers. Using the same instruments, constructed using Australian data, made the coefficients reported in Table 3 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, as we noted before, informed trading strategies may also lead to concave payoff strategies. 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

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[23]. 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[24]. In particular almost all of the open option positions maintained by the enhanced index products were in fact concavity increasing. In addition, a majority of the option positions held by growth funds are concavity increasing in character. The fact that so many of the option positions are unhedged short positions suggests that the funds are in fact attempting to improve reported performance numbers by informationless trades. This is particularly the case for the enhanced index products, where the enhancement appears to 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

[23]While only funds 16 and 30 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.

[24] "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.

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 5 presents results based on Equations (2) and (3) presented in Section 2, applied to daily measures of trading in individual stocks[25]. We measure trading as the change in net position valued at the close of day price[26]. The first and most striking fact about these 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 25 out of the 39 funds. In a number of cases this pattern is particularly striking as the funds liquidate almost dollar for dollar with any gain above the high water mark[27].

[25]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.

[26]We also controlled 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. As with all fund flow analysis, the results depend on accurate and timely recording of aggregate net asset values. However, the results were not sensitive to this adjustment and are not reported here.

[27] Cici (2005) documents this effect is indeed a drag on mutual fund performance in the US. Brown et al. (2002) also documents a disposition effect in Australia using ASX CHESS shareholder registry data, but the effect is not as pronounced for institutional investors.

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? A large majority (33 out of 39) of the funds in the sample increase their position on a loss, with the amount of the trade larger as the value of the position falls. In more than 40 percent of the 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, as illustrated in Figure 2 the pattern of trading we observe is significantly correlated with the *ex post* Sharpe ratio measured on the basis of weekly holding period returns[28]. It is not surprising that managers motivated and rewarded on the basis of short term performance measures might be disinclined to discipline managers who resort to this type of behavioral trading.

While increasing equity positions on a loss is consistent with behavioral trading, there are several benign explanations for this empirically observed pattern of trading. Perhaps 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[29]? In the results reported in Table 5 we address this issue

[28]The cross sectional correlation between *ex post* Sharpe ratios given on Table 2 and the significance of this pattern of trading given by the t-value of the value of position on a loss (Table 5) is -0.44746.

[29]This may arise through the use of long term asset mix guidelines or through 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 constraint.

by first 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.

Perhaps the traders sell out on a gain in anticipation that the stock will fall in value, and increase their position on a loss given access to favorable information not generally available to the market at that time? This explanation would suffice to explain the result given in Figure 2 which illustrates the high Sharpe ratios associated with trading on a loss. To examine this hypothesis we calculate returns to a zero net investment trading rule that involves borrowing at the short term money rate to invest in stocks in proportion to the positions taken by the fund, and to sell short positions sold by the fund, investing the proceeds at the short term money rate[30]. All positions are liquidated after one month. Across all trades by all funds we found that this trading rule is profitable, with an aggregate return of 0.72 percent per month (t-value 2.62), consistent with an informed trading hypothesis. However, when we confine attention to the 16 out of 39 funds that show statistically significant (at the five percent level) evidence of increasing their

[30]This procedure is similar to the procedure used by Chen, Jegadeesh and Wermers (2000) to examine the value of trading, except that we have access to daily trades for each of the funds in the study. We also considered the case where the trading rule financed the purchase of stock through short positions in the ASX 200 index, and invested the proceeds of sales in that index. The results were unchanged. Across all funds, the trading return was 0.6 percent per month (t-value 2.40), and across funds that increased their positions on a loss, the trading returns were -0.07 percent per month (t-value -0.32).

position on a loss, the profits to this trading rule disappear. The monthly return is -.02 percent, insignificantly different from zero (t-value -.04). Given this evidence it is difficult to ascribe the pattern of behavioral trading to an information-based explanation.

While the evidence is consistent with a behavioral theory which predicts trading on losses and locking in gains, the results in Table 6 show that this behavior is particularly pronounced in certain styles of management and certain sectors of equity trading. Consistent with the results in Table 2 the behavior tends to correlate with characteristics of fund management. Table 3 shows that returns realized under the GARP style of management are concave relative to benchmark, and we find on Table 6 that the pattern of trading for this style conforms reasonably closely to the behavioral trading 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 and the mining and minerals sectors in which, *a priori*, we would expect the greatest degree of information asymmetry and greatest latitude for behavioral factors in trading. The activity is least pronounced in the financial and consumer services sector, where we would anticipate that information asymmetry would be least pronounced.

Loss averse trading of the type described in Equation (2) seems to be most prominent in large funds with decentralized ownership and control. Examining the trading records of funds operated by the ten largest institutional managers in Australia reveals significant evidence of behavioral

trading as does the evidence for funds affiliated with bank or life insurance companies. Funds where managers are compensated in the form of an annual bonus but do not have an equity stake in the business appear to be the ones where this kind of activity is most pronounced. While this evidence is suggestive of a failure of management controls in decentralized owned and operated funds, it does not explain why domestic owned funds are more prone to this type of behavior than are foreign owned funds which presumably have more indirect management and control mechanisms. A closer analysis of the domestic fund results reveals that the effect is most pronounced both in terms of absolute magnitude and in statistical significance around the turn of the Australian fiscal year at the end of June consistent with an attempt to window dress the portfolio on periodic review dates[31]. We do not see this effect in foreign owned funds whose clientele is both domestic and foreign.

These results are consistent both with the view that behavioral aspects are an important component of trading in equity funds and with the hypothesis that managers in decentralized managed funds may lack the appropriate incentives to keep this behavior in check. Does such behavior represent a clear and present danger to equity fund investors?

[31] "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 loss averse traders, 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).

In the case of derivative security holdings, we see evidence in Table 4 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 informationless trading behavior in Tables 5 and 6 is at the security level, not at the fund level. In results not reported here we observe no evidence of informationless trading at the sector or fund level. In other words there is no evidence that the fund increases the equity allocation as the value of the fund falls below the benchmark (determined by the past maximum equity value) – an anti-momentum strategy. Indeed, such a conjecture is contradicted by evidence of momentum trading others have found using a subset of the active equity funds included in this study[32].

How do we explain the evidence of informationless trading at the individual security level? The larger funds in our sample are managed in a decentralized fashion, where analysts are responsible for a sector and are compensated in the form of an annual bonus based on their contribution to performance. Part of the explanation may lie in this delegation of fund management responsibility[33]. 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

[32]See Gallagher and Looi (2003). Using our dataset, we found that there is little or no evidence of loss averse trading 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.

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

or individually driven obviously depends on unobservable (to us) factors including the head's personality and the firm's internal management processes.

The results are also consistent with a simple behavioral explanation. 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[34]. This might explain the result that traders in some funds tend to trade in a loss averse fashion on individual stocks in an attempt to window dress the portfolio, particularly around the end of the Australian fiscal year. In this context the evidence for loss averse trading in large and decentralized decision-making environments might be consistent with looser management controls in this organizational setting.

5. Conclusion

Prospect theory of Kahneman and Tversky (1979) suggests that individuals tend to lock in gains and gamble on losses. The recent paper by Goetzmann et al. (2002) suggests that fund managers subject to a performance review have an adverse incentive not to limit this behavior on the part of traders reporting to them. Weisman (2002) suggests that these adverse incentives are 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 thirty nine successful Australian equity managers, and find evidence consistent with behavioral trading. High frequency holdings

[34]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.

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.

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. We cannot exclude the possibility that the behavior is a response to a desire on the part of managers to window dress their portfolios particularly 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[35]. It is in this context that informationless investing can be dangerous to your financial health.

[35]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 loss averse trading. This is a very interesting topic for further study.

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Figure 1:Illustration of loss averse trading

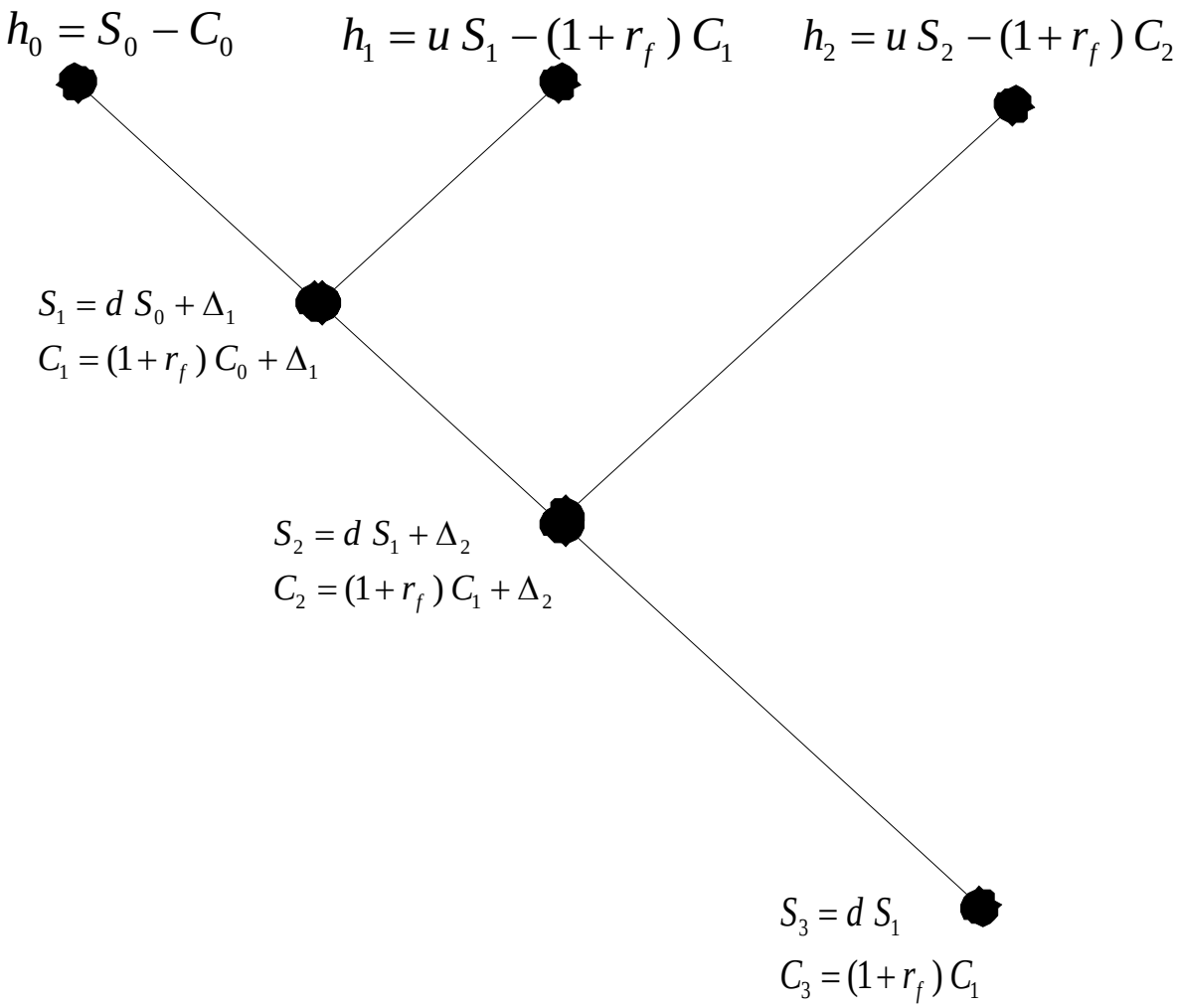
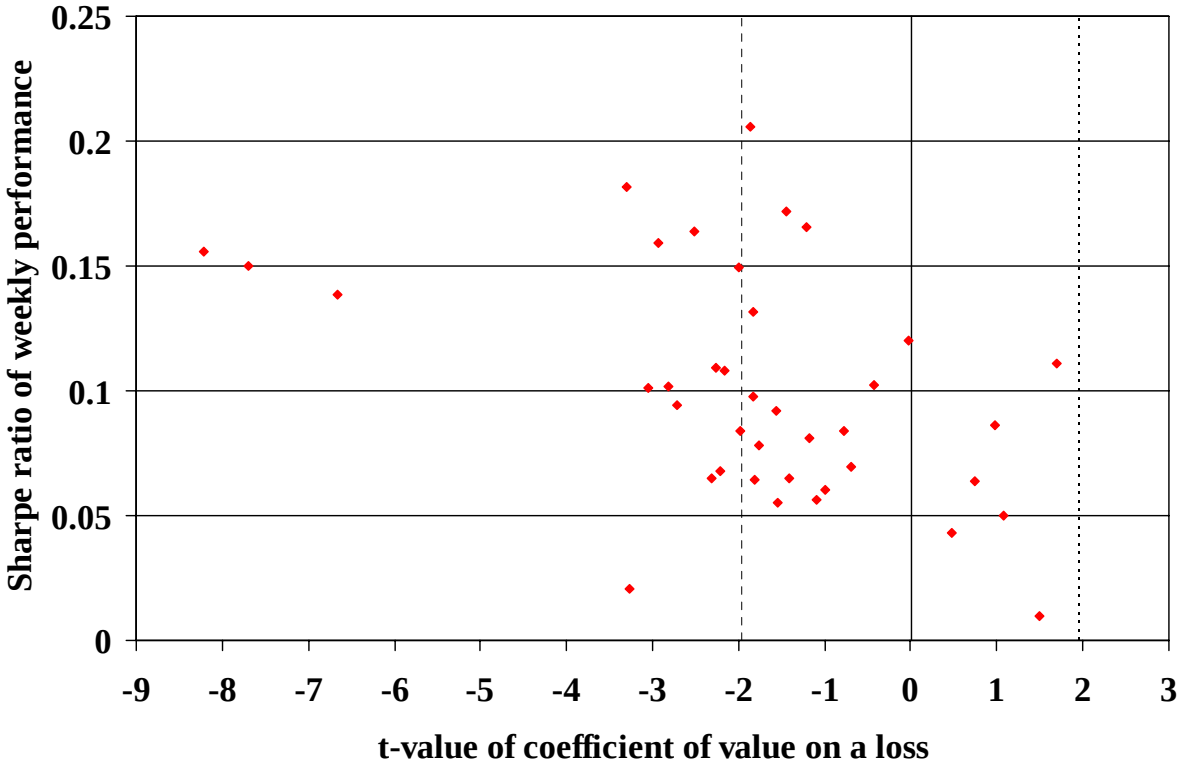


Figure 2: Relationship between propensity to increase position on a loss and resulting Sharpe ratio



This figure shows the relationship between the Sharpe ratio of the thirty nine funds in the sample computed on the basis of weekly holding period returns (Table 2) and the t-value of the coefficient on value of holdings on a loss in the trade analysis regression results presented in Table 5. The correlation coefficient between the Sharpe ratio and this t-value interpreted as a measure of the propensity to trade on a loss is 0.447

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	505	112	117.3	1.44
	11	107	47	67.2	0.86
	12	887	87	82.6	0.16
Growth	13	427	31	90.8	0.35
	14	1954	38	3.9	0.26
	15	1954	35	8.2	0.34
	16	1931	50	41.4	0.85
	17	1339	51	365.7	6.4
Neutral	18	1011	126	287.1	0.64
	19	632	62	97.3	2
	20	1009	45	43.2	6.8
	21	777	31	76.7	0.99
	22	1887	40	22.4	0.51
	23	1092	37	21.6	0.49
Other	24	1506	100	122.2	0.69
	25	797	68	71.1	0.84
	26	837	27	36	1.27
Value	27	2020	87	170.6	0.91
	28	1029	96	76.3	0.5
	29	1836	74	71.6	1.68
	30	528	41	22.4	0.09
	31	365	56	45.8	0.92
	32	884	36	39.3	0.61
	33	1049	72	87.2	0.81
	34	884	32	32	0.59
	35	272	31	26.3	0.62
	36	428	61	296.1	0.02
Passive/ Enhanced	37	778	271	231.3	0.34
	38	1515	308	187	0.33
	39	1897	340	227.6	0.23

Table 2: 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	0.10%	1.77%	0.0551	0.02%	0.02%	0.96	-0.0770	3.6718
					(0.45)	(0.34)			
	11	0.10%	1.73%	0.0564	0.04%	0.18%	0.67	-0.9569	7.5997
					(0.34)	(1.21)			
	12	0.17%	1.80%	0.0922	0.06%	0.07%	0.91	-0.5071	3.6344
					(1.40)	(1.76)			
Growth	13	0.17%	1.92%	0.0862	0.05%	0.05%	1.07	-0.1288	3.3156
					(1.94)	(1.62)			
	14	0.18%	1.86%	0.0944	0.07%	0.08%	1.04	-0.1838	3.8109
					(2.21)	(2.38)			
	15	0.19%	1.77%	0.1079	0.09%	0.09%	0.96	-0.2558	4.1749
					(2.66)	(2.61)			
	16	0.12%	1.75%	0.0676	0.02%	0.03%	1.02	-0.1120	3.2110
					(0.80)	(1.33)			
	17	0.28%	2.00%	0.1383	0.19%	0.20%	1.10	-0.1946	3.1367
					(5.88)	(5.90)			
Neutral	18	0.20%	1.91%	0.1023	0.08%	0.08%	1.03	-0.0627	3.3199
					(3.20)	(3.08)			
	19	0.32%	1.91%	0.1658	0.24%	0.24%	1.01	0.0355	3.1547
					(6.24)	(6.86)			
	20	0.13%	2.00%	0.0643	0.01%	0.01%	1.05	-0.1430	2.7644
					(0.26)	(0.14)			
	21	0.17%	2.04%	0.0837	0.07%	0.07%	1.08	-0.4663	4.2420
					(1.25)	(1.44)			
	22	0.20%	1.70%	0.1203	0.09%	0.10%	0.97	-0.1277	3.4404
					(3.30)	(3.74)			
	23	0.16%	2.02%	0.0812	0.05%	0.06%	1.06	-0.2275	3.5142
					(1.59)	(1.83)			
Other	24	0.17%	1.72%	0.1013	0.06%	0.06%	0.98	-0.1514	3.1595
					(3.32)	(2.91)			
	25	0.02%	1.84%	0.0097	0.04%	0.02%	1.03	-0.0652	3.1059
					(1.43)	(0.64)			
	26	0.19%	1.91%	0.0977	0.12%	0.11%	1.03	-0.2667	3.4316
					(2.42)	(2.25)			
Value	27	0.08%	1.35%	0.0604	0.03%	0.05%	0.67	-0.2704	4.5473
					(0.74)	(1.49)			
	28	0.12%	1.83%	0.0638	0.07%	0.07%	1.00	-0.0052	3.3586
					(3.50)	(3.65)			
	29	0.04%	1.85%	0.0204	-0.05%	-0.05%	0.76	0.0924	4.2838
					(-0.68)	(-0.73)			
	30	0.29%	1.66%	0.1718	0.25%	0.19%	0.87	-0.4338	4.8583
					(3.98)	(2.95)			

Table 2: Characteristics of fund weekly returns (continued)

Fund Investment Style	Fund	Mean	Standard Deviation	Sharpe Ratio	Alpha	FF Alpha	Beta	Skewness	Kurtosis
Value	31	0.30%	1.86%	0.1640	0.29%	0.31%	0.91	-0.4315	3.0761
					(3.48)	(3.32)			
	32	0.19%	1.78%	0.1094	0.11%	0.14%	0.80	-0.2495	3.5236
					(1.48)	(2.07)			
	33	0.15%	1.82%	0.0839	0.13%	0.14%	0.97	-0.0288	3.6216
					(3.60)	(3.68)			
	34	0.41%	1.99%	0.2060	0.35%	0.34%	0.55	-0.2383	3.7300
					(2.72)	(2.72)			
	35	0.34%	1.89%	0.1814	0.29%	0.31%	0.90	-0.6248	5.1278
					(3.02)	(3.06)			
	36	0.09%	1.28%	0.0693	0.03%	0.04%	0.63	-0.4125	4.4588
					(0.81)	(1.30)			
Passive/ Enhanced	37	0.29%	1.91%	0.1495	0.17%	0.18%	1.04	0.0370	4.5980
					(5.39)	(5.06)			
	38	0.28%	1.79%	0.1593	0.17%	0.17%	1.02	0.0540	3.5891
					(8.04)	(8.97)			
	39	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 3: Evidence of concavity in weekly holding period returns

	Category	Beta	Treynor Mazuy measure	Modified Henriksson Merton measure	Number of observations
Style	*GARP*	0.96075	-0.01108	-0.08948	2372
			(-2.25)	(-2.47)	
	Growth	1.03670	-0.00708	-0.03762	1899
			(-1.53)	(-1.15)	
	Neutral	1.02840	-0.00110	-0.02096	1313
			(-0.29)	(-0.72)	
	Other	1.00670	-0.00196	0.00676	640
			(-0.53)	(0.21)	
	Value	0.76897	-0.01258	-0.10823	2250
			(-2.01)	(-2.36)	
	Passive/ Enhanced	1.01460	0.00688	0.04565	859
			(1.50)	(1.46)	
Largest 10 Institutional Manager	*No*	0.96438	-0.00579	-0.04580	6467
			(-2.12)	(-2.25)	
	Yes	0.90590	-0.00999	-0.07793	2866
			(-2.25)	(-2.56)	
Boutique firm	*No*	0.94304	-0.00824	-0.06128	6567
			(-2.78)	(-2.91)	
	Yes	0.95433	-0.00447	-0.04281	2766
			(-1.23)	(-1.53)	
Bank or Life office affiliated	*No*	0.85953	-0.00862	-0.07646	3704
			(-2.06)	(-2.52)	
	Yes	1.00370	-0.00602	-0.04175	5629
			(-2.22)	(-2.12)	
Annual Bonus	*No*	0.98187	0.00013	0.01233	308
			(0.03)	(0.35)	
	Yes	0.94532	-0.00729	-0.05781	9025
			(-3.03)	(-3.31)	
Domestic owned	*No*	0.97431	-0.01009	-0.07408	4261
			(-2.84)	(-2.84)	
	Yes	0.92236	-0.00430	-0.03924	5072
			(-1.41)	(-1.79)	
Equity Ownership by senior staff	*No*	0.94304	-0.00824	-0.06128	6567
			(-2.78)	(-2.91)	
	Yes	0.95433	-0.00447	-0.04281	2766
			(-1.23)	(-1.53)	

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 2

Table 4: Characteristics of options in portfolio:

Fund Investment Style	Fund	Calls		Puts		Month end option positions		
		Number	Strike	Number	Strike	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
	10	0.811	0.002	0.950	0.674	100%	0%	8
	12	0.054	1.076			100%	0%	11
Growth	14	-0.033	1.056			27%	73%	11
	15	-0.039	1.060			0%	100%	8
	16	-0.367	1.067	0.107	0.951	35%	65%	83
	17	-0.059	1.023	0.108	0.913	13%	87%	344
Neutral	20	-0.093	1.038	-0.093	0.947	10%	90%	208
	21	0.567	0.984			100%	0%	10
	23	0.405	0.854			100%	0%	1
Other	24	0.079	1.147	0.147	0.965	94%	6%	35
Value	32	0.050	0.914			57%	43%	23
Passive/	37	-0.013	0.948	-0.017	0.955	9%	91%	340
Enhanced	38	-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 5: Trade analysis regression by Fund

	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	0.0004	-0.0373	0.0563	-63053	-0.0180	0.0668	1951	1.865
		(0.24)	(-2.82)	(3.74)	(-0.39)	(-1.04)			
	2	0.0167	-0.1673	0.0141	-1745815	-0.8812	0.4209	3658	1.926
		(1.56)	(-7.69)	(1.19)	(-6.11)	(-11.55)			
	3	-0.0023	-0.1704	-0.0050	-1994042	-0.9824	0.6422	4684	2.004
		(-0.19)	(-8.22)	(-0.39)	(-8.45)	(-39.16)			
	4	0.0152	-0.0344	0.0040	-257180	-0.0928	0.0420	1507	1.549
		(0.93)	(-1.83)	(0.22)	(-5.75)	(-1.39)			
	5	-0.1273	0.0265	-0.1321	-104653	-1.0148	0.1406	2323	1.894
		(-1.56)	(0.47)	(-2.83)	(-2.49)	(-5.09)			
	6	-0.0991	0.0142	-0.0125	-12599	0.0213	0.2507	1200	1.757
		(-2.99)	(1.69)	(-1.89)	(-0.84)	(0.20)			
	7	0.1075	-0.1932	0.1313	-265401	-0.0049	0.2041	410	1.655
		(0.59)	(-1.41)	(1.06)	(-1.37)	(-0.01)			
	8	-0.1686	0.0368	-0.1188	-122247	-0.4972	0.2163	710	1.894
		(-2.74)	(1.08)	(-4.12)	(-1.72)	(-2.61)			
	9	0.2818	-0.3049	0.2482	-194350	-0.0460	0.1567	452	1.764
		(1.73)	(-2.32)	(2.20)	(-1.57)	(-0.15)			
	10	0.1254	-0.1117	0.0173	-54394	-0.9293	0.2008	533	1.854
		(1.28)	(-1.54)	(0.28)	(-4.27)	(-3.02)			
	11	0.0197	-0.1524	0.0741	-34075	-0.3882	0.1825	364	1.690
		(0.11)	(-1.10)	(0.59)	(-0.90)	(-2.14)			
	12	0.0203	-0.0630	0.0012	-4592	-0.4517	0.3029	1349	1.865
		(0.58)	(-1.56)	(0.03)	(-1.61)	(-3.61)			
Growth	13	-0.0294	0.0066	-0.0201	-332977	-0.3946	0.0734	4844	1.878
		(-2.85)	(0.98)	(-3.69)	(-3.28)	(-3.49)			
	14	-6.4133	-0.7756	-0.0926	-7086204	-3.7316	0.7719	124	2.002
		(-0.77)	(-2.71)	(-0.82)	(-2.31)	(-4.39)			
	15	1.1659	-0.9163	0.0798	-5420311	-0.1697	0.1849	119	1.972
		(1.17)	(-2.16)	(0.57)	(-1.26)	(-0.22)			
	16	-0.0045	-0.1453	-0.0938	-231416	-2.5125	0.2606	2032	2.115
		(-0.10)	(-2.21)	(-1.72)	(-4.36)	(-4.85)			
	17	0.0015	-0.0314	0.0010	-74852	-0.1498	0.0436	6093	1.963
		(0.73)	(-6.66)	(0.59)	(-5.77)	(-3.13)			
Neutral	18	-0.0133	-0.0060	-0.0020	-28656	-0.0777	0.0373	5352	1.692
		(-1.42)	(-0.43)	(-0.16)	(-0.83)	(-0.41)			
	19	0.0460	-0.1077	-0.0029	-438602	-0.6206	0.1418	1013	1.730
		(0.53)	(-1.22)	(-0.04)	(-4.69)	(-3.05)			
	20	-0.0757	-0.0394	-0.1052	-589639	-0.6384	0.2064	1248	1.831
		(-4.43)	(-1.81)	(-5.03)	(-5.87)	(-6.43)			
	21	0.0443	-0.0931	-0.1142	-225744	-1.3620	0.3609	1624	2.465
		(0.52)	(-0.78)	(-0.97)	(-4.04)	(-2.39)			
	22	-0.1455	-0.0014	-0.0381	11469	-0.8745	0.2784	1014	2.206
		(-2.14)	(-0.02)	(-0.51)	(1.43)	(-3.61)			
	23	0.0069	-0.0545	0.0897	-4686	0.1228	0.1560	338	1.873
		(0.12)	(-1.17)	(1.71)	(-0.22)	(0.88)			
Other	24	0.0116	-0.0839	-0.0141	-64869	-0.6434	0.1343	3738	2.084
		(0.66)	(-3.05)	(-0.80)	(-2.61)	(-2.22)			
	25	-0.1041	0.0394	-0.1571	-90992	-0.3583	0.2559	1523	1.813
		(-3.92)	(1.49)	(-6.71)	(-4.63)	(-2.40)			
	26	-0.3633	-0.1626	-0.2532	-183913	-1.1330	0.4480	476	2.074
		(-3.57)	(-1.83)	(-3.79)	(-5.65)	(-2.00)			
Value	27	0.0069	-0.0483	0.0420	-123976	-0.4615	0.0345	4634	1.827
		(0.13)	(-1.00)	(0.92)	(-3.24)	(-2.29)			
	28	-0.0153	0.0203	-0.0759	7538	-0.2269	0.0523	1312	2.141
		(-0.48)	(0.74)	(-2.18)	(0.37)	(-2.25)			
	29	0.0305	-0.1387	-0.0135	-729581	-0.6109	0.1219	2084	1.904
		(1.13)	(-3.27)	(-0.84)	(-4.95)	(-1.71)			
	30	-0.0513	-0.0806	0.0267	-88576	-0.4415	0.3323	287	1.636
		(-0.57)	(-1.44)	(0.51)	(-1.66)	(-2.79)			

Table 5: 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	31	-0.2352	-0.2701	-0.0285	-753580	-0.7186	0.4520	323	1.978
		(-1.00)	(-2.51)	(-0.37)	(-6.22)	(-1.85)			
	32	0.0070	-0.0675	0.0258	-22629	0.0481	0.1094	828	1.806
		(0.10)	(-2.27)	(1.09)	(-1.33)	(0.18)			
	33	0.1426	-0.1538	0.0378	-2815	-1.3593	0.2269	1528	2.064
		(1.82)	(-1.98)	(0.63)	(-0.12)	(-2.62)			
	34	-0.0129	-0.1309	0.0323	-25833	-0.2214	0.1756	553	1.833
		(-0.31)	(-1.87)	(0.83)	(-0.99)	(-2.55)			
	35	-0.0184	-0.1297	-0.0808	-185860	-1.0095	0.4200	258	1.571
		(-0.45)	(-3.30)	(-1.80)	(-4.59)	(-2.48)			
	36	0.0106	-0.0068	-0.0063	-347404	-0.2247	0.0199	6429	1.872
		(1.21)	(-0.70)	(-0.78)	(-4.00)	(-2.75)			
Passive/ Enhanced	37	0.1207	-0.1659	0.0606	-229599	-0.2727	0.2291	4136	2.002
		(1.47)	(-2.00)	(1.11)	(-2.11)	(-1.59)			
	38	0.0899	-0.1322	0.0528	-237799	-0.2102	0.0459	6091	2.043
		(2.71)	(-2.93)	(1.86)	(-2.57)	(-1.01)			
	39	0.0088	-0.0225	-0.0044	-93995	0.3878	0.0969	10552	1.970
		(0.71)	(-1.77)	(-0.50)	(-2.55)	(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 value. 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. t-statistics in parentheses are based on White (1980) heteroskedasticity consistent estimates of the standard error of each coefficient.

Table 6: Trade analysis regression - Trading by sector

			Mining and minerals		Industrial		Financial and consumer services		Health and Biotechnology				
	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	Gain above high water mark	Rsq	N
Style	*GARP*	0.0098	-0.0291	0.0093	-0.0441	0.0031	-0.0213	-0.0037	-0.0637	0.0310	-0.7909	0.3880	19141
		(2.97)	(-2.56)	(1.71)	(-3.62)	(0.55)	(-1.88)	(-0.41)	(-4.50)	(2.22)	(-5.14)		
	Growth	0.0529	0.0102	-0.0911	0.0437	-0.1191	-0.0506	-0.0324	-0.1851	0.1483	-0.6402	0.2730	13212
		(1.00)	(0.67)	(-2.62)	(0.55)	(-1.45)	(-1.50)	(-2.47)	(-2.35)	(2.19)	(-1.46)		
	Neutral	0.0057	0.0041	0.0061	0.0304	-0.0325	0.0057	-0.0041	0.0060	-0.0148	-0.0553	0.0667	10589
		(0.81)	(0.17)	(0.25)	(1.79)	(-1.79)	(0.54)	(-0.43)	(0.07)	(-0.16)	(-0.75)		
	Other	0.0049	0.0126	-0.0047	0.0321	-0.0339	0.0277	-0.0267	0.0425	-0.0203	0.1868	0.0360	5737
		(0.25)	(0.42)	(-0.20)	(0.73)	(-1.16)	(1.04)	(-0.93)	(0.92)	(-0.43)	(1.45)		
	Value	0.0077	-0.0309	0.0248	-0.0247	0.0144	0.0046	-0.0047	-0.0900	0.0892	-0.0300	0.0199	18236
		(0.88)	(-1.73)	(1.45)	(-1.59)	(1.10)	(0.48)	(-0.58)	(-3.29)	(3.03)	(-0.40)		
	Passive/ Enhanced	0.0897	-0.0943	0.0755	-0.1096	0.0771	-0.0612	0.0342	-0.0210	0.0349	0.0197	0.1069	20779
		(1.89)	(-1.59)	(1.52)	(-1.91)	(1.59)	(-1.27)	(1.16)	(-0.49)	(0.95)	(0.13)		
Largest 10 Institutional Manager	*No*	0.0323	-0.0002	-0.0660	0.0508	-0.1154	-0.0423	-0.0284	-0.1508	0.1213	-0.5501	0.2612	48210
		(0.81)	(-0.02)	(-2.75)	(0.67)	(-1.44)	(-1.46)	(-2.54)	(-2.31)	(2.10)	(-1.45)		
	Yes	0.0119	-0.0272	0.0129	-0.0394	0.0063	-0.0151	-0.0036	-0.0649	0.0392	-0.7639	0.2874	39484
		(3.20)	(-3.07)	(2.19)	(-4.48)	(1.14)	(-2.19)	(-0.62)	(-5.66)	(3.37)	(-4.76)		
Boutique firm	*No*	0.0037	-0.0261	0.0030	-0.0116	-0.0314	-0.0090	-0.0194	-0.0587	0.0404	-0.7552	0.2692	72950
		(0.48)	(-2.56)	(0.39)	(-0.47)	(-0.96)	(-1.11)	(-2.44)	(-4.73)	(3.07)	(-4.75)		
	Yes	0.0310	-0.0523	0.0568	-0.0406	0.0356	-0.0075	-0.0033	-0.0813	0.0818	-0.0863	0.0530	14744
		(1.88)	(-0.72)	(0.73)	(-1.66)	(1.55)	(-0.33)	(-0.16)	(-1.50)	(1.54)	(-1.25)		
Bank or Life office affiliated	*No*	0.0082	-0.0264	0.0224	-0.0255	0.0155	0.0042	-0.0047	-0.0903	0.0896	-0.0354	0.0222	26798
		(0.95)	(-1.59)	(1.41)	(-1.69)	(1.22)	(0.44)	(-0.57)	(-3.37)	(3.12)	(-0.51)		
	Yes	0.0024	-0.0390	0.0014	-0.0246	-0.0346	-0.0261	-0.0196	-0.0673	0.0402	-0.7697	0.2968	60896
		(0.27)	(-2.85)	(0.16)	(-0.94)	(-1.00)	(-2.18)	(-2.01)	(-4.31)	(2.74)	(-4.96)		
Annual Bonus	*No*	0.0186	-0.0002	0.0039	0.0361	-0.0339	0.0188	-0.0217	0.0475	-0.0128	0.2645	0.0323	3738
		(0.81)	(0.00)	(0.15)	(0.67)	(-0.97)	(0.63)	(-0.67)	(0.91)	(-0.25)	(1.39)		
	Yes	0.0037	-0.0261	0.0030	-0.0115	-0.0314	-0.0090	-0.0194	-0.0588	0.0406	-0.7541	0.2674	83956
		(0.49)	(-2.57)	(0.39)	(-0.47)	(-0.96)	(-1.11)	(-2.44)	(-4.74)	(3.09)	(-4.73)		
Domestic owned	*No*	0.0056	0.0153	-0.0470	0.0788	-0.1106	-0.0058	-0.0269	-0.1022	0.1000	-0.1200	0.2463	31420
		(0.92)	(1.25)	(-2.62)	(1.10)	(-1.40)	(-0.62)	(-1.50)	(-2.52)	(2.40)	(-1.19)		
	Yes	0.0217	-0.0444	0.0217	-0.0561	0.0162	-0.0270	0.0000	-0.0775	0.0471	-0.8978	0.3394	56274
		(3.18)	(-4.23)	(2.58)	(-5.45)	(2.07)	(-3.18)	(0.00)	(-6.40)	(3.74)	(-11.99)		
Equity Ownership by senior staff	*No*	0.0037	-0.0261	0.0030	-0.0116	-0.0314	-0.0090	-0.0194	-0.0587	0.0404	-0.7552	0.2692	72950
		(0.48)	(-2.56)	(0.39)	(-0.47)	(-0.96)	(-1.11)	(-2.44)	(-4.73)	(3.07)	(-4.75)		
	Yes	0.0310	-0.0523	0.0568	-0.0406	0.0356	-0.0075	-0.0033	-0.0813	0.0818	-0.0863	0.0530	14744
		(1.88)	(-0.72)	(0.73)	(-1.66)	(1.55)	(-0.33)	(-0.16)	(-1.50)	(1.54)	(-1.25)		

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.