Portfolio design and challenges inherent in multiple manager structures

The adage that too many chefs spoil the soup also has its parallel in the fund management industry, as **DAVID GALLAGHER** and **PETER GARDNER** explain.

David R. Gallagher PhD
Associate Professor of Finance, School of Banking and Finance, The University of New South Wales, Sydney, NSW

Peter Gardner
doctoral candidate
School of Banking and Finance, The University of New South Wales, Sydney, NSW

In Australia and throughout the world, implementation of a pension fund's investment strategy typically involves delegating responsibility to external investment managers, who themselves operate independently and competitively. In light of the fact that the portfolio management function is commonly executed by a number of decentralised decision-makers, pension fund trustees should be even more concerned about the need to ensure optimality of the aggregate fund's investment arrangements.

In the context of decentralised portfolio management, Sharpe (1981) provides an important analysis of the problems associated with optimal portfolio management where a single client engages multiple investment managers. Elton and Gruber (2004) also argue that an overall pension fund's investment strategy is unlikely to be executed in an optimum fashion, given that each component of the client's portfolio is managed separately and independently of the other fund managers.

While the purpose of combining different funds into the one portfolio structure is to provide diversification benefits across investment process and style, diBartolomeo (1999) argues that such an arrangement can adversely impact on the opportunity for the overall fund to outperform appropriate benchmarks. In addition, given the decentralisation of the investment arrangements in pension fund management, there is an increasing probability that the alphas for each manager utilised in the multi-manager structure will be correlated, and the outcome of combining active managers will be sub-optimal. In terms of transaction costs ultimately borne by the pension fund, there is the possibility that common managers in the multi-manager structure may be counterparties to the same transactions, which therefore erodes the value in alpha forecasts and leads to economic inefficiencies.

The purpose of this study is to empirically examine the potential problems associated with decentralised portfolio management, where a centralised decision-maker (i.e. pension fund trustees) delegates investment responsibility to a number of independent and competitive equity fund managers. We perform a simulation analysis for a sample of Australian equity managers using monthly portfolio holdings.

DATA AND DESCRIPTIVE STATISTICS

We examine the issue of portfolio blending at the portfolio holdings level for active Australian equity managers who have an exante tracking error exceeding 100 basis points per annum. Our sample comprises the monthly portfolio holdings of 38 institutional equity funds in the period January 1994 to June 2002, sourced from the Portfolio Analytics Database. The funds represent the largest publicly offered institutional products for each of the participating investment management

companies, and the funds are benchmarked to either the S&P/ASX 200 or 300 Accumulation Indices.[1]

Our sample is representative of the Australian investment management industry and includes six of the largest 10 managers, six of the next 10, four from those managers ranked 21–30, and 14 managers from outside the largest 30. We also include funds with various investment styles (i.e. value (12), growth (4), growth-at-a-reasonable-price (11), style neutral (11), etc.), and operated by different types of companies (i.e. bank or life-office affiliated, boutique, large versus small firms).

In addition to the use of portfolio holdings data, we obtained ASX SEATS data from the Securities Industry Research Centre of Asia-Pacific (SIRCA), which includes stock price information for valuation purposes at month-end, S&P/ASX historical index constituents and securities weights, and industry classifications defined by the Global Industry Classification Standard (GICS®) for each stock (which was developed jointly by S&P and MSCI).

Our first objective is to briefly examine Australia's concentrated investment management industry as well as the small number of ASX-listed stocks which dominate the market index. The Australian market is unique relative to many of the larger markets, in particular the largest and most liquid capital market in the world—the United States.

Concentration is important from a portfolio blending perspective, because the narrower the set of choices of stocks which can be held by portfolio managers within any given universe of securities, the greater the probability that fund managers will hold similar portfolios of stocks.

In terms of aggregate manager size at March 2002, the largest five and 10 managers accounted for approximately 45 per cent and 69 per cent, respectively. The largest 20 investment managers in Australian equities control almost 90 per cent of total industry assets. In terms of stock index weights in the ASX All Ordinaries benchmark (the broadest equity market index), the size of companies listed on the exchange is also similarly concentrated. The largest stock in the index accounts for an eight per cent weighting, and the aggregate proportion of stocks ranked as the largest five, 10 and 20 stocks constitute approximately 30, 47 and 62 per cent of the index.

Research by Brands, Brown and Gallagher (2003) using the Australian database shows that on average, active equity managers hold 57 stocks, and a median of 50 securities. The standard deviation of portfolio holdings for active equity managers is approximately 29.

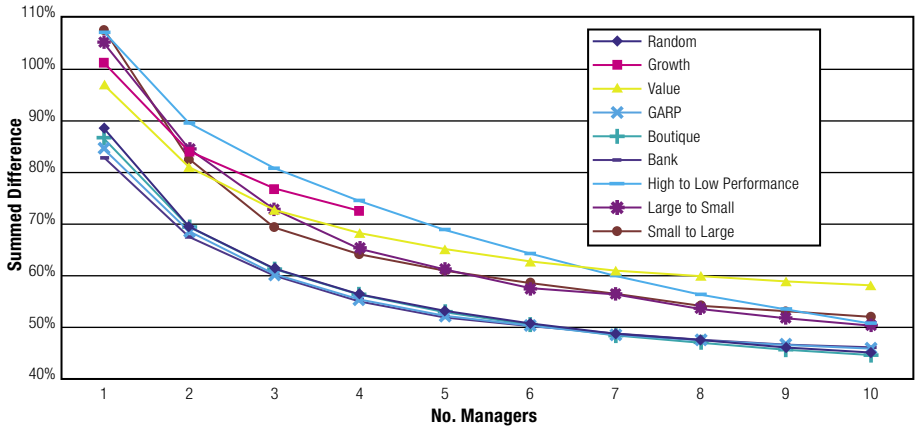
Due to the high stock concentration amongst the largest Australian-listed stocks, active managers tend to hold the majority of the largest stocks in the benchmark. We found that the proportional ownership of stocks by active managers held in their portfolios and ranked in the largest 10, 20, 30 and 40 stocks on ASX, translates into funds

TABLE 1: RELATIVE WEIGHT POSITION WITH INDEX

	Index Weight	All mgrs	Growth	GARP	Value	Style Neutral	Q1 (Small)	Q2	Q3	Q4 (Large)
Top 5	31.4%	-2.6%	-1.0%	-0.4%	-5.2%	-0.1%	-3.9%	-0.2%	-4.5%	-2.5%
5–10	13.6%	0.0%	1.8%	1.0%	-1.4%	0.5%	0.4%	1.8%	-0.8%	-1.1%
11–20	13.2%	-0.4%	3.6%	-1.6%	-2.0%	0.3%	-0.6%	1.2%	-1.0%	-1.2%
21–50	18.8%	-0.5%	-0.9%	-0.7%	0.2%	-1.6%	-0.3%	-1.2%	0.2%	-0.7%
51–100	11.6%	0.6%	-0.6%	-0.4%	1.1%	0.4%	2.6%	-0.6%	0.9%	0.0%
101–200	9.3%	-0.8%	-3.1%	-1.8%	1.4%	-2.3%	-1.1%	-3.2%	0.7%	0.1%
200–All Ords	2.2%	-0.5%	-1.7%	-0.2%	0.1%	-0.7%	-0.7%	-1.3%	-0.1%	0.1%
Outside All Ords	0.0%	4.3%	1.9%	4.1%	5.9%	3.4%	3.5%	3.4%	4.6%	5.4%

For each monthly period in our sample, we sum the All Ordinaries Index weight for stocks within certain bands. Next, after equally weighting managers we sum the difference between the manager weight and index weight in the particular band. We measure this relative weight for just growth, value, GARP, and Style Neutral managers. Lastly, we measure the relative weight for funds divided into quartiles, based upon size.

FIGURE 1: SUMMED DIFFERENCE OF MONTHLY PORTFOLIO HOLDINGS FROM INDEX



For each monthly period we sum the absolute value of the difference between the manager weight and the index weight in stocks in the All Ordinaries Index. Next, we add other managers to our portfolio, equally weighting the pension funds amongst the active managers. We then again sum the difference between the manager weights and the index weights. We simulate this 500 times taking random managers each time to add to the portfolio, without replacement. We average the difference in holdings across periods and across simulations. We also complete this test for just growth, value, GARP, bank and boutique managers. Lastly, we complete the test taking the highest performing managers over the prior three months, as well as the largest to smallest and smallest to largest managers.

holding 78%, 68%, 60% and 52%, respectively, of the largest securities in their funds.

In terms of the proportional positions held overweight according to stocks ranked by size, the evidence indicates a monotonically decreasing function of active bets held overweight, where the largest 10 stocks are held overweight 52 per cent of the time and the largest 40 stocks are held overweight 39 per cent.

We report further descriptive statistics for our sample in Table 1 (see previous page). We find that on average, fund managers underweight the largest five stocks, particularly small and value managers. Fund managers on average hold over four per cent of their portfolio in stocks not listed in the index (genuine small stocks, and also larger stocks which are later included in the index, IPOs). This position is most substantial for large and value managers. Managers also tend to overweight stocks 51–100.

We also examine the trading activity of active managers in our sample, where portfolio turnover is defined as the minimum of buys/sells divided by the average net assets of the fund (per annum). This variable is important in estimating the frequency of trading, and therefore the potential overlap in trading that might arise where the industry is highly concentrated in stocks and across competitors. Using monthly data, we find that the funds' turnover ratio is on average 1.16 times fund assets per year, with a standard deviation of 0.39. This indicates that the managers in our sample are highly active and turn over their securities on average more than once in any 12-month period.

EMPIRICAL RESULTS FROM SIMULATION ANALYSIS

The aim of our first test is to quantify the level of erosion in the active bets of active Australian equity managers using simulation analysis. For each month-end period, we sum the absolute value of the difference between the manager's weight and the index weight of constituent stocks in the S&P/ASX All Ordinaries Index. This measure, expressed in percentage terms, provides an overall analysis of the divergence of the aggregate portfolio's holding from the underlying index.

Using simulation analysis, we select individual managers to participate in the aggregate portfolio by equally weighting all funds within a single portfolio structure to a maximum of 10 managers. The use of a '1/n Rule' in describing investor choice has been highlighted in a number of recent studies.[2] We perform a cut-off at 10 managers for a number of reasons, the two most important being that the likelihood of more than 10 mandates appearing in a single pension fund intra asset class is low, as well as the empirical results showing that the magnitude of active bet size decreases at a decreasing rate. Huberman and Jiang (2004) also confirm that 401k pension plan investors select a relatively small number of funds, typically not exceeding three or four funds, and this number is found to be insensitive relative to the number of choices available in the plan.

We simulate each portfolio combination 500 times, drawing random managers each time as we add to the aggregate portfolio without replacement. We average the difference in holdings both across periods and across simulations. We also undertake this test using constraints on the selection procedure according to a single investment style (namely growth, growth at a reasonable price, and value) and ownership structure (whether bank affiliated or a boutique manager). We also perform a portfolio selection procedure that is conditional on selecting funds from the largest to smallest, smallest to largest, and best to worst performing managers.[3] A portfolio with constituents completely different from the index would receive a value of two using this measure, and a value of one represents a portfolio with half its weight contained within the index (See Figure 1 on previous page).

Consistent with the theory of portfolio selection and diversification, as new managers are progressively added to the single portfolio structure, the difference between the aggregated and equally weighted portfolio relative to the benchmark decreases. This is consistent with the active bets on stocks for each individual manager being eroded by the positions taken in stocks by other managers.[4]

Figure 1 reveals that the rate of decay in a manager's active bets relative to the benchmark is similar for all managers, and managers affiliated with either a bank/life-office firm or boutique managers. However, when we examine managers according to self-reported investment style (particularly growth and value managers), the erosion is lower and indicates that active managers implementing consistent styles tend to take similar bets in stocks with comparable characteristics. The difference in the portfolio from the index is greater for the highest performing managers, which is indicative of the fact that better performing managers tend to have higher differentiation in their portfolio positions compared to the average manager.

We next extend our analysis by directly quantifying the change in unique portfolio holdings and their impact on the multi-fund's tracking error. An investor should expect that at the limit, where successive active funds are added to the overall portfolio, the portfolio's number of unique stock holdings will gradually increase, and the level of tracking error volatility will decline. We should also expect variation across fund selection practices, depending on whether the portfolio is constructed within a single investment style or across investment styles. We construct multi-fund portfolios using simulation analysis which is repeated 500 times (without replacement) each for 1) portfolios selected as random constituents, 2) portfolios selected from within a certain style of fund manager, 3) the largest to smallest and 4) smallest to largest managers.

Figure 2 (see next page) shows that as successive funds are added to the single portfolio, the number of unique stocks added to the portfolio increases at a decreasing rate. An interesting issue is that the average growth manager holds a significantly smaller number of stocks in their portfolio relative to managers implementing other investment styles. This illustrates that growth managers hold more concentrated portfolios. Value managers and boutique managers also tend to hold less unique stocks than the average manager, in contrast to GARP managers and managers affiliated with banks, which tend to exhibit more diverse stock holdings. Unsurprisingly, large managers also tend to hold a higher number of stocks compared to small managers, which is consistent with a large manager attempting to minimise market impact costs from trading large positions.

Figure 3 (see next page) shows the effects on tracking error where funds are added to the single portfolio structure. The evidence shows a significant deterioration in tracking error. By definition, a tracking error of zero is equivalent to the underlying benchmark, and as more funds are added to the portfolio on an equally weighted basis, tracking error magnitude erodes by a factor of at least half of the one fund case where a portfolio comprises 10 funds (except growth funds and high-to-low performing fund categories). The tracking error of boutique managers (which is also highly correlated with manager size) also decreases significantly. The evidence presented shows that active manager blending can have significant implications for the ability of active management to earn superior returns to the benchmark.

Our analysis next provides an examination of the potential for active funds to trade as counterparties to one another within a single portfolio structure. During a certain period, if one manager was to purchase a certain stock, while simultaneously another manager sold the same security, this would result in zero net change to the overall portfolio's exposure of the security.

However, engaging in a transaction where two managers are the buyer and seller incurs two separate brokerage commissions attributable to the same parcel, as well as the crystallisation of capital gains/losses on the sale of stock.

The propensity for cross-trading between commonly held fund managers by the single portfolio structure will be amplified where the securities market is highly concentrated and where the number and size of participants offering investment services is not highly diverse. This situation is of particular concern in Australia, and represents an interesting empirical problem that can be answered using a unique and highly granular dataset of the holdings and trades of active investment managers.

We calculate the level of net trades of managers (where the buys of one manager in a certain stock are negated by the sells of another manager in that same stock) divided by the total trades (buys plus sells) of the managers. We calculate this for a single portfolio manager, and then add managers progressively until 10 managers are included in the overall portfolio structure. We simulate this 500 times, equally weighting across monthly periods for the funds in our sample.

Figure 4 (see page 25) shows the proportion of fund assets where common managers buy and sell the same securities within a one-period window. Our measure of net monthly trading in specific securities is quantified as follows. Using an equally weighted portfolio methodology, we identify all trades in particular stocks executed by individual managers, and then take the difference between buys and sells, and then divide by the total market value of trading (i.e. buys plus sells). For the one manager case, by definition there are no competing or contradictory trades from using other managers.

However, once we progressively configure a multi-fund portfolio of active managers, the evidence suggests that an economically significant proportion of the trades executed by individual managers are fractionally reversed by the trades of other managers in individual stocks. Given that individual managers are themselves competitors, and execute their trade strategies without reference to one another, where these funds are combined into a single portfolio, the aggregate fund incurs unnecessarily high transaction costs.

Figure 4 shows that if 10 managers are included in a single portfolio, then if unnecessary trading was excluded, the multi-fund structure would save approximately 30 per cent of their trading costs for a 10-manager portfolio. The extent of overlap in trading is not as substantial for growth managers, which suggests that growth managers tend to trade more often in the same direction as other growth managers (although we also recognise that our sample of growth managers is very small).

For comparison purposes, we also examine cross-trading between managers across individual industries, and these results are presented in Figure 5 (see page 25). Given this approach relies on aggregating stocks into larger groups, one should expect our measure will increase the probability of the sector bets of active managers being fractionally unwound by other funds in the multi-fund portfolio. We can identify that this is indeed the case, and at the 10-manager portfolio, the erosion is between 35 and 40% (excluding Australian growth funds).

CONCLUSION

We examine the potential impact of manager configuration or portfolio blending strategies that might be adopted by pension fund trustees or multiple manager providers. Using simulation analysis with month-end portfolio holdings for actively managed Australian equity managers, we provide an analysis of the various portfolio blends that might arise when additional

active equity portfolios are added to a single portfolio structure.

We document significant erosion in the active bets of stocks held in blended portfolios, although blending within style-specific categories shows less pronounced deterioration in the net active exposures across stocks for fund-of-fund structures. Overall, active portfolio blending, in terms of portfolio composition and fund performance, potentially represents a potentially significant economic efficiency problem. At the limit, as active managers are blended together in a single portfolio structure, the opportunities to generate positive alpha diminish, and net portfolio returns from this strategy will be inferior to that of a passively managed fund after costs.

In addition, a significant problem for fund-of-fund portfolios utilising the services of active managers is that given the high frequency of trading, there is the chance that single portfolio structures engaging common managers will actively trade with one another. If this arises, the overall fund structure incurs unnecessary trading costs (e.g. brokerage) and the crystallisation of tax liabilities, for little or no net change in beneficial ownership.

In this study, we use simulation analysis to document that up to 30 per cent of trading in any month is performed by two managers who comprise a blended portfolio. Improved efficiencies in active portfolio design are most likely to be achieved where an agent is permitted to construct and maintain a single portfolio structure comprising active managers that does not erode the active investment opportunities offered by these institutions. Future research is currently examining these issues.

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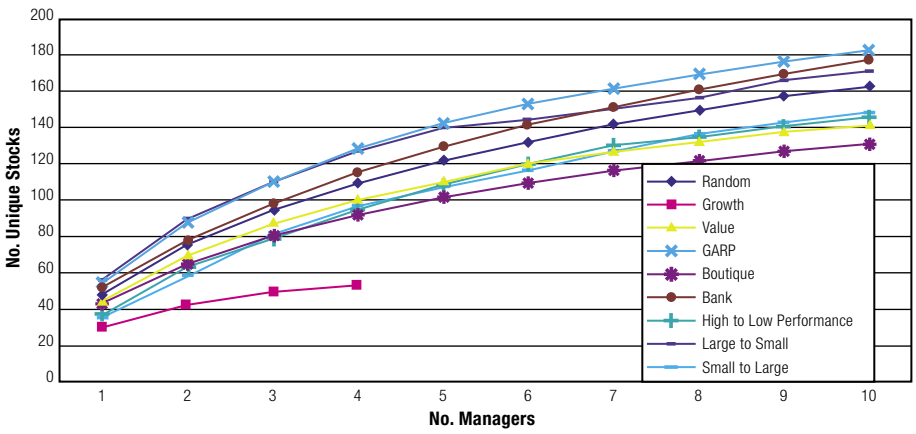
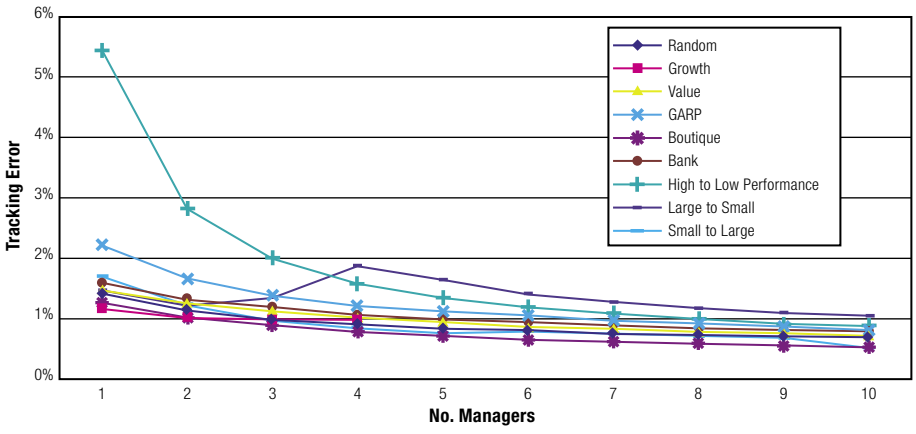
FIGURE 2: NUMBER OF UNIQUE STOCKS IN MONTHLY PORTFOLIO HOLDINGS



We calculate the average number of unique stocks held by the combined portfolio as we add more managers. This average is taken across monthly periods, and completed for 500 simulations. It is calculated for managers of a certain style (Growth, Value, GARP, boutique and for managers affiliated with a bank, as well as for the high-to-low performing managers, the large to small and small to large managers).

FIGURE 3: TRACKING ERROR IN MONTHLY PORTFOLIO HOLDINGS



We calculate the tracking error of the portfolio with respect to the Australian All Ordinaries using monthly returns. As we add more managers (keeping them equally weighted), we average their performances to create the portfolio performance, to determine the tracking error of the portfolio. Once again, we simulated this 500 times for random, growth, value, GARP, bank and boutique managers, as well as for the best-to-worst performers, the largest to smallest and smallest to largest managers.

References

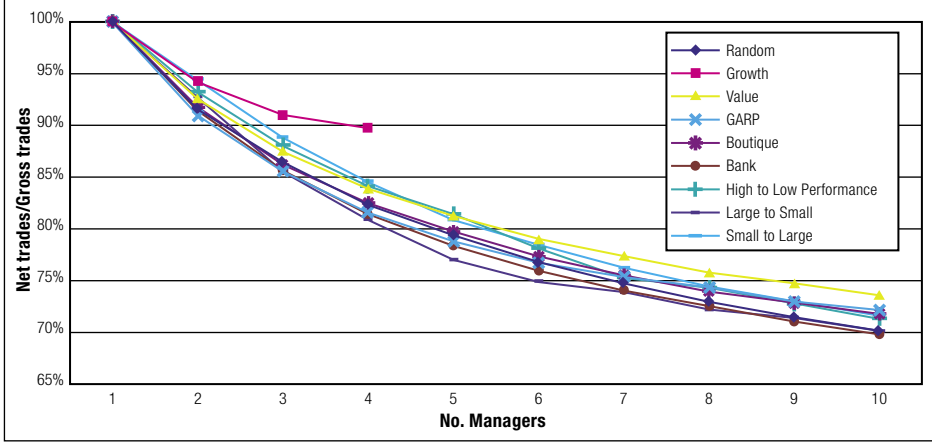
Benartzi, S., Thaler, R. (2001), Naïve Diversification Strategies in Defined Contribution Saving Plans, *American Economic Review*, Vol. 91(1): pp 79–98.

Brands, S., Brown, S., Gallagher, D. (2003), Portfolio Concentration and Investment Manager Performance, Working Paper, School of Banking and Finance, The University of NSW and Stern School of Business, New York University.

diBartolomeo, D. (1999), A Radical Proposal for the Operation of Multi-Manager Investment Funds, Working Paper, Northfield Information Services.

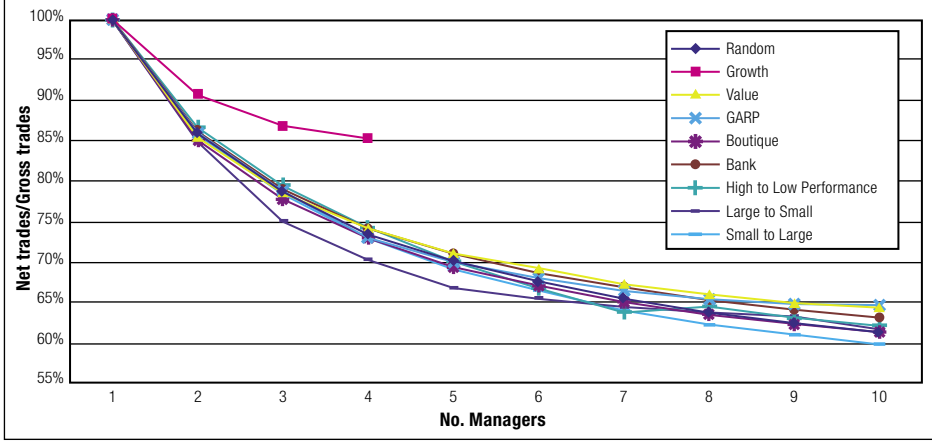
Elton, E., Gruber, M. (2004), Optimum Centralized Portfolio Construction with Decentralized Portfolio Management, *Journal of Financial and Quantitative Analysis*.

FIGURE 4: POTENTIAL REDUCTION IN TRADING BASED ON MONTHLY AUSTRALIAN ACTIVE EQUITY FUND HOLDINGS



We calculate the level of the net monthly trades of managers (where the buys of one manager in a certain stock are negated by the sells of another manager in that same stock) divided by the total monthly trades (buys plus sells) of the managers. Once again, we calculate this for a portfolio of one manager (yielding a value of one, as the net trades must equal the total trades), and then add managers until we have ten managers in the portfolio. We simulate this 500 times, averaging across periods, in order to get a good average measure across various managers.

FIGURE 5: POTENTIAL REDUCTION IN INDUSTRY TRADING BASED ON MONTHLY AUSTRALIAN ACTIVE EQUITY FUND HOLDINGS



We calculate the level of the net monthly trades of managers at an industry level (where the buys of one manager in a certain industry are negated by the sells of another manager in that same industry) divided by the total monthly trades (buys plus sells) of the managers. Once again, we calculate this for a portfolio of one manager (yielding a value of one, as the net trades must equal the total trades), and then add managers until we have 10 managers in the portfolio. We simulate this 500 times, averaging across periods, in order to achieve a good average measure across various fund managers.

Elton, E., Gruber, M., Blake, C. (2004), The Adequacy of Investment Choices Offered by 401K Plans, Working Paper, NYU Stern School of Business.

Ferguson, R., (1978), Do Market Inventory Funds Make Sense?, *Financial Analysts Journal*, May–June, pp38–43.

Huberman, G., Jiang, W. (2004), The 1/n Heuristic in 401(k) Plans, Working Paper, Columbia Business School.

Kacperczyk, M., Sialm C., Zheng, L. (2003), On the Industry Concentration of Actively Managed Equity Mutual Funds, *Journal of Finance*.

Parwada, J., Faff, R. (2004), Pension Plan Investment Management Mandates: An Empirical Analysis of Manager Selection, *Journal of Financial Services Research*.

Rosenberg, B. (1977), Institutional Investment Management with Multiple Portfolio Managers, Working Paper, University of California – Berkley, Institute of Business and Economic Research.

Sharpe W. F. (1981), Decentralized Investment Management, *Journal of Finance*, Vol. 36(2): pp 217–234.

Wagner, W., Ziplin, C. (1978), Can Inventory Index Funds Improve Active Equity Performance?, *Financial Analysts Journal*, May–June, pp 34–36.

Notes

1 The ASX All Ordinaries Accumulation Index is applicable as the appropriate benchmark prior to 3 April 2000. Post the index change to 30 June 2002, the correlation in returns between the new All Ordinaries 200 and 300 benchmarks is extremely high (>0.995), which further highlights the high concentration of stocks in existence on the Australian Stock Exchange.

2 See Benartzi and Thaler (2001) and Elton, Gruber and Blake (2004).

3 We calculate performance over the prior three months.

4 Our analysis also considered the impact of portfolio erosion in simulated fund-of-fund structures by classifying individual stock holdings into industries. The results are similar to our findings based on the stock-level analysis.