An Examination of the Market Impact Costs of Active Australian Equity Managers*

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Executive Summary

This study examines the implicit transaction costs incurred by active Australian equity managers, and specifically quantifies the performance leakage arising from market impact in securities trading. Our research examines a sample of 26 institutions, representative of the Australian market in terms of manager style and size. We report that market impact costs are substantial for active equity managers, and there exists high variation in market impact costs that can be explained by trade size, trade direction (i.e. buys or sells), stock size, investment style, and the type of institution executing the trading package. Overall, we document that active managers incur an impact cost of 0.27% (on a principal-weighted basis) for a round-trip trade package. Although this cost appears small in magnitude, given that the mean abnormal returns gained through a round trip transaction represent 0.92%, it becomes apparent that market impact costs can significantly reduce a manager's performance. Interestingly, we also find that some active managers demonstrate enhanced skills relative to their competitors in minimizing market impact costs. The skill of individual managers to control market impact costs varies widely, where some managers incur costs in excess of 1%, while on the other hand, some managers actually benefit by over 2%. This variation suggests that significant value can be added by clients in the investment manager selection process with respect to an institution's trade execution costs.

I. Introduction and Motivation for Research

This study examines the implicit transaction costs incurred by active Australian equity managers, and specifically quantifies the performance leakage arising from market impact in securities trading. The study represents the first volume of two empirical research papers documenting the magnitude of performance leakage in utilising active management. Performance leakage studies are concerned with measuring the extent to which portfolio returns are reduced from the execution strategies adopted by investment managers, and are decomposed into two trading cost components – *explicit* costs (i.e. brokerage and taxes) and *implicit* costs (i.e. market impact and opportunity costs). While investors, practitioners and academics can easily identify the factors which give rise to leakage in investment performance, there is an absence of empirical evidence which quantifies the magnitude of such costs or the implications arising for investors engaging active managers in Australia.

Our research examines a sample of 26 institutions, representative of the Australian market in terms of manager style and size. We report that market impact costs are substantial for active equity managers, and there exists high variation in market impact costs that can be explained by trade size, trade direction (i.e. buys or sells), stock size, investment style, and the type of institution executing the trade package. Accordingly, our results indicate that consideration of market impact costs is an important component of analysis in the overall manager selection process, as market impact costs represent a sizeable leakage to investment performance.

Market impact quantifies the costs incurred by investment managers given movements in stock price, and is directly related to the size of the trade executed by an institution. It follows that larger trades will account for a higher proportion of total trading volume, and therefore the size of an order can cause an adverse shock in the stock's price, which is ultimately disadvantageous to a trader. It is apparent that larger managers are expected to incur higher market impact costs. Additional implicit costs in trading are opportunity costs, which are costs incurred by patient traders seeking to avoid market impact costs (i.e. the value lost due to information decay). Hence, there exists a trade-off between market impact and opportunity costs. Market impact costs are ultimately dependent on an investment manager's skill in executing strategies to minimize market frictions.

One common strategy to reduce market impact costs requires disaggregating trades into smaller parcels, and trading over several days to more effectively mask (or hide) transactions that comprise a larger total trading strategy. More sophisticated strategies might also involve dividing trades among several brokers, in order to reduce the possibility that information accrues to a single broker. Identifying the types of investment managers who successfully use these strategies should aid the manager selection process, since investment managers that are better equipped to deal with market impact will, all other things being equal, have performance advantages over competitors.

While *explicit* costs are more easily quantified, there is an absence of Australian evidence that provides investors with a true understanding of the total costs associated with the portfolio management process. Investors can indirectly measure the performance impact of explicit trading costs and tax by subtracting the difference between gross and net returns (after accounting for brokerage costs and other management expenses), however they cannot accurately quantify the extent to which market impact costs erode potential returns achievable in the market. The two reasons why this issue arises is due to (a) the debate concerning how market impact should be measured and (b) the absence of any legislative requirements or accounting frameworks enabling these cost elements to be reported to clients.

An empirical examination of market impact costs can also be motivated on the basis of the investment industry exhibiting high concentration, the fact that a relatively small number of large stocks dominate the S&P/ASX Indices, the revenue models which exist in the investment industry, and the style executed by active investment managers. In Australia, more than 60 percent of total assets under management are controlled by the ten largest institutions, which translates into a higher likelihood that there exists high variation in market impact costs between large and small active managers. Size should also become an issue (eventually) for successful and growing active managers, given the high correlation between past performance and fund flows (e.g. Sawicki (2000), Gruber (1996) and Zheng (1999)). Perold and Salomon (1991) and Becker and Vaughan (2001) also highlight the irony that is likely to eventuate for successful active managers. If superior past performance translates into growth in funds under management, given that revenue models in the industry are determined as a percentage of assets invested, active managers are incentivised to maximize their total assets. However where fund

inflows are significant and the manager's total size increases, an increase in the size of funds under management eventually leads to higher trade sizes, higher trading costs, lower flexibility in the management of portfolios and lower portfolio performance. As a consequence, Golec (1996) documents larger managers having a higher propensity to invest in small-cap stocks, which themselves exhibit lower liquidity, higher transaction costs and can adversely impact portfolio performance. In terms of investment style, Keim and Madhavan (1997) find that trading costs indeed vary according to differences in investment manager objectives, given that portfolio managers differ in both their demand for trade immediacy and their order submission strategies. They report value managers experiencing lower trading costs, as the strategy is concerned with long-term fundamental value which can be more easily captured through patient trading.

This study has two objectives. First, we estimate the overall market impact costs of trading incurred by active Australian equity managers. Second, we seek to better understand the factors that are significant determinants of market impact costs for active Australian equity managers. Consistent with theory and previous empirical research, we confirm that transaction costs represent a sizable leakage to investment performance. However, transactions costs across managers are not uniform. Indeed, significant variation exists across our sample, and the evidence suggests that managerial skill is also related to the magnitude of implicit transaction costs incurred.

II. Research Design

A. Preliminary Analysis and Literature Review

The literature identifies a number of sources of price (or market) impact, and these have been articulated as arising due to (1) short-run liquidity costs, (2) imperfect substitution, and (3) information effects. The short-run liquidity cost hypothesis posits that a buyer (seller) of a large number of shares must offer an incentive to the counter party in order to induce a trade. This cost of liquidity, or immediacy, removed after the trade is theorised to cause a quick reversal in price following a large trade as prices return to pre-trade equilibrium. The imperfect substitution hypothesis argues that if there are no close substitutes for a particular stock, then a buyer (seller) facing an inelastic upward (downward) sloping supply (demand) curve must offer a premium (discount) to induce the counter party to sell the extra shares. This creates a permanent shift in the equilibrium price of the stock, and accordingly, the imperfect substitution hypothesis predicts no reversal in security price following large trades. Permanent stock price impact may also arise due to information as a result of trading securities. If the direction and size of a trade reveals private information, then the security price impact is theorised to equal the expected value of the information revealed by the trade. All other things equal, large trades should be indicative of more valuable information, and therefore price impact should be related to trade size.

Early datasets did not contain information regarding the identity of the trading parties, or whether the trade was buyer or seller initiated. As a consequence, block trades (defined by various measures) were used, as well as a tick rule, to classify trades into notional 'buys' and 'sells'. Despite the use of these inferred measures of trading, the early literature overwhelmingly rejected the liquidity hypothesis, finding little evidence of price reversals (for example see Scholes (1972), Holthausen *et al.* (1990), Kraus and Stoll (1972), Ball and Finn (1989), Lakonishok et al. (1992)). Interestingly, Scholes (1972) identifies information as an important determinant of price impact. Scholes (1972) hypothesizes that corporate sellers possess superior information over non-corporate sellers and hence finds the price impact of corporate sales to be higher than that of non-corporate sales.

More recently, Chan and Lakonishok (1993) investigate the price impact of institutional trading in the U.S. given specific knowledge of both the identity of the trader (the investment manager) and the direction of the trade (buy or sell). They find evidence of positive price impact following buy trades, and negative market impact for sells. Chan and Lakonishok (1995) extend and significantly improve their earlier work by aggregating transactions (combining a sequence of individual daily trades) made by the same investment manager (in the same stock) into 'trading packages'. The use of trading packages acknowledges that investment managers exhibit a single trading decision, yet they decide to decompose their aggregate order into smaller trade parcels – with the specific intention of reducing their market impact costs. The authors find that the use of a trading packages methodology gives rise to substantially higher market impact costs incurred by active managers, and in addition, the price impact is non-symmetric given the directional nature of the package – buy packages exhibit higher market impact costs than sell packages.

Further, market impact costs have also been shown to be investment manager specific. Chan and Lakonishok (1995) find that while trade complexity and stock size are important drivers of market impact, the largest component of total market impact is the identity of the investment manager executing the trade packages. This evidence indicates that variation in market impact costs arises according to an institution's identity, and suggests that performance leakage can be mitigated based on the manager's trade execution skill.

B. Trading Packages

Acknowledging that investment managers may break up trades into smaller parcels to reduce market impact, Chan and Lakonishok (1995) aggregate trades into trading packages. Ideally, trading packages should be formed according to the specific intentions of the investment manager; however such data is not available. Accordingly, trades made by the same investment manager, in both the same stock and same direction within 5 trading days of one another, are aggregated into one trading package. Trades in the same trade package are assumed to originate from a single trading decision made at the start of the package and should be acknowledged as a single event rather than a series.[1]

C. Estimating Transaction Costs

The literature presents various measures of market impact costs, however there remains substantial debate concerning which measure most accurately quantifies price impacts from trading. Chan and Lakonishok (1995) employ three measures of market impact cost relative to:

- a volume-weighted average price;
- the opening price at the start of the package; and
- the closing price after the end of the package.

These measures quantify the cost of a manager's executed trade package relative to their respective benchmarks. Chan and Lakonishok (1995) identify that all three methods exhibit problems, particularly where the investment manager has the ability to 'game' the measure. Accordingly, the appropriateness of each measure should be evaluated given its ability to accurately reflect the deterioration in abnormal returns caused by market impact.

If investment managers engaged in an infinitely deep market, then there would be no need to trade over successive days, since an arbitrarily large trade will not adversely impact a security's price level. Therefore, if we assume that investment decisions are made before the start of the

[1] The results are robust even where a dilution adjustment is assumed to be a manager trade within a package

trading day, then the abnormal return from the open of the start of the package to the close at the end of the package represents a theoretical upper limit on the return from a trade based on infinitely deep markets. However, the equity market is not infinitely deep, and the difference between the theoretical upper limit and the abnormal return gained from a manager's implemented strategy represents the cost of trading in a finite market. This is essentially the open-to-trade measure employed in Chan and Lakonishok (1995). While this measure can be 'gamed' by executing trades only if the price falls below the original opening price at the start of the package, analysts should be able to identify such behaviour by examining the abnormal returns during the life of the trade package. More specifically, if investment managers trade a portion of the package early, and then follow this by trading the bulk of their package after a fall in stock price, we should find a negative abnormal return prior to the bulk of the package, and positive abnormal returns thereafter. However, Chan and Lakonishok (1995) find positive abnormal returns relative to both the open and the close of the trading package. We find consistent evidence by examining the mean abnormal return both prior to and after the largest trade in the package. The principal-weighted average abnormal return prior to the largest trade in the package is 0.11% while the abnormal return after is 0.06% (the mean abnormal return on the day of the largest trade is 0.05%). This indicates that managers are not unwilling to purchase the bulk of their package even after a large portion of the abnormal return over the life of the package is lost prior to the largest trade. Therefore, although this study reports market impact measures using the close, the open, and the value-weighted average price (VWAP) as benchmarks, for the purposes of our analysis, the open-to-trade measure is argued to be the most appropriate as this approach more accurately reflects the costs arising from finite markets.

The VWAP measure is not the most appropriate calculation in measuring the deterioration in trading performance, as this approach only accounts for the same day price impact (see Chan and Lakonishok (1995)). For example, an investment manager may be able to obtain the VWAP on days where the investment manager happens to trade, however in the days between trades the market price may move substantially. In order to mitigate this problem, this study includes an additional measure of market impact which assigns an equal proportion of the entire value of the trading package over each trading day of the package. This measure simulates a naïve trader who diversifies the trade package over the life of the package and in so doing does not attempt to reduce market impact in any strategic manner. Skilled investment managers on the other hand would be expected to obtain higher returns from their trading packages compared to a naïve trading strategy.

The trade-to-close measure estimates the abnormal return gained from the trade package measured through to the actual close arising on the day following the last day of the package. This is essentially the realised abnormal return from the package and does not actually capture an opportunity cost, yet it is a useful measure in demonstrating the ability of managers to capture abnormal returns despite market impact costs.

The implemented abnormal return (AR) can be expressed as:

$$AR = \sum_{i=1}^{N} \cdot \frac{qty_i}{Total} \cdot \sum_{t=1}^{Ti} AR(t) \text{ and } AR_t = R_{s,t} - R_{b,t}$$

where there are N trades in the package, and each trade is made T_i days before the close of the day after the last trade in the package. This is simply the sum of the abnormal returns weighted by trade quantity. The abnormal returns are calculated by taking the difference between the return on stock i and the return on stock size (market capitalisation), the ratio of book-to-market

equity, and a momentum-matched portfolio of stocks ($R_{b,t}$). This method was first proposed by Daniel, Grinblatt, Titman and Wermers (1997), and represents a significant improvement over existing studies that only control for size effects. By controlling for book-to-market, size, and momentum, the results presented in this paper account for common risk factors that have been identified in the finance literature as explaining market returns. Performance derived by a manager loading up on common risk factors should not be considered (in performance terms) as value added given a manager's skill.

D. Identifying the Factors that Drive Transaction Costs

The drivers of transaction costs incurred by investment managers are likely to be determined by a number of different factors. Indeed, the literature identifies these factors as important determinants in explaining the magnitude of total transaction costs, and this study is concerned with examining these factors as a means of ascertaining how portfolio managers demonstrate skill in controlling these factor drivers for the benefit of their clients. Accordingly, this study considers the following transaction cost drivers:

- **Trade complexity.** This has been suggested by the literature (Kyle (1985), and Easley and O'Hara (1987)) as an important factor in inflating trading costs. This study follows Chan and Lakonishok (1995) by proxying trade complexity in terms of trade size relative to average daily trading volume (over a 40-day period).
- **Stock size.** Since trading costs increase as liquidity decreases, firm size should exhibit an inverse relationship with market impact costs. Therefore, market impact costs should be significantly higher for active managers engaging in trades involving smaller-cap stocks.
- **Individual Manager Skill.** Chan and Lakonishok (1995) document that an investment manager's identity represents the most important determinant of market impact costs incurred. Indeed, their research identifies substantial dispersion across investment managers, and therefore demonstrates that there is variation in manager skill in terms of market impact cost controls.
- **Investment Manager Style.** Keim and Madhavan (1997, 1998) identify that investment manager style represents an important determinant of market impact costs. They report differences in investment style being associated with differences in a manager's demand for trade immediacy, and therefore the speed at which orders are executed. For example, value managers trade in securities based on a stock's long term fundamental value, and are more likely than growth managers to trade patiently using a combination of market and limit orders.

III. Data

The database was constructed using an 'invitation' approach to the largest Australian equity managers in Australia, measured on the basis of funds under management. In aggregate, 45 individual data requests were sent to investment managers, and 26 fund managers are included in the analysis. In terms of market representation of investment managers contributing data, the sample includes 6 of the top 10 managers, 4 from the next 10, 4 from managers ranked 21-30, and 12 managers outside the top 30 managers. The sample includes 4 boutique firms managing less than $A100 million each.

The investment managers were each requested to provide information for their two largest pooled active Australian equity funds (where appropriate) that were open to institutional investors. The definition of an 'active' fund was defined as funds exhibiting a target tracking error of at least 100 basis points per annum. The term 'largest' was defined as the marked-to-

market valuation of assets under management as at 31 December 2001, and was used as an indicative means of identifying portfolios that were representative of the manager. The study uses data on the largest fund provided by the managers participating in the study, while the data on the second largest fund is used for cross checking purposes. Participating investment managers provided daily trading data for key fields that included the date, ASX stock code, quantity, price of the trade, as well as the broker and transaction costs associated with each trade. This information permits all trades to be cross-checked against the ASX Stock Exchange Automated Trading System (SEATS) for consistency. The SEATS data includes all trade information for stocks listed on the ASX and was provided by SIRCA. Accounting information on the book-to-market ratio was obtained from the ASPECT database. The period examined in this paper is 4 January 1994 to 31 December 2001.

The funds accounted for assets in excess of $A18.2 billion in funds under management at 31 December 2001. The data sample contains some managers providing as much as 8 years of data, while some provided only one year of data. The mean number of ASX-listed stocks traded in the universe is 168. For the period 2 January 2001 to 31 December 2001, where all managers have corresponding data for the entire year, the median proportion of aggregate trading activity (both buy and sells) of managers was 1.2 times fund assets and ranged between 0.22 and 5.2 times. The number of buy trades exceeded the number of sell transactions, both in aggregate and for the majority of managers. Buy transactions were of a larger magnitude (in dollar terms), with the average manager exhibiting a median buy (sell) trade of $A660,360 ($A484,670).

IV. Results

The empirical results are presented as follows. The first two sections (A and B) outline the effect of trade characteristics (i.e. trade size and stock size) on the market impact costs incurred by active equity managers in Australia. Our study finds large trades incur higher market impact costs than smaller trades. Therefore larger managers, who are expected to trade larger parcels, are more adversely affected by market impact costs than smaller managers.

The remaining sections examine market impact costs related to investment manager characteristics (i.e. investment manager skill, investment style, and fund flows). These factors directly influence the ability of managers to reduce their market impact costs. One important result is that those managers experiencing significant fund outflows exhibit a higher need for trade immediacy, which in turn leads to higher market impact costs. While manager characteristics explain some of the variation in the ability of active managers to reduce market impact costs, a large proportion of variation remains idiosyncratic to specific managers. This indicates that reducing market impact costs is an important skill that can have significant performance effects (both positive and negative). For example, the most capable managers in reducing their market impact costs (per trade package) are found to actually benefit in performance terms by over 2%, while the worst managers incur costs of over 1%.

A. General Results

If we accept the notion that market impact may occur during the life of a trading package, even on days where a manager has not actually traded, but has traded recently, then it is useful to divide market impact into inter-day and intra-day costs. Essentially, by acknowledging the possibility of inter-day market impact costs, we account for the possibility that the market may take several days to incorporate information regarding manager trading behaviour.

The inter-day measures are calculated by taking the weighted sum of the abnormal returns during the life of the package. The weights are the proportion of the package invested on the day. The

intra-day measures disregard movements on days where the manager has not traded. In terms of the presentation of results in Table 1 and 2 for market impact costs (both the inter-day and intra-day approaches), positive numbers denote a cost to equity managers, whereas negative numbers indicate that investment managers have received a benefit. In terms of cumulative abnormal returns (CARs) reported in Tables 1 and 2, these are not costs incurred by a manager. We would expect that after the start of a buy package, CARs should be positive, while in the case of sales, the reverse is true.

Inter-day Measures

On a principal-weighted basis (weighting each package by its dollar value), the theoretical upper limit (i.e. performance achievable by active managers) is based on cumulative abnormal returns (CARs). Over the life of the package, CARS are 0.22% for buys and -0.15% for sells (see Table 1). Of this, active Australian equity managers are able to capture 0.12% for buys and -0.10% and sells (denoted as a benefit of 0.12% and 0.1% for buys and sells respectively, using the trade-to-close cost measure in Table 1). In other words, in terms of buy packages, active managers operating in an infinitely deep market have the ability to achieve a CAR of 0.22%, however they incur costs of 0.10% (open-to-trade cost), resulting in an abnormal return achieved of 0.12%.[2]

In order to gain insight into whether active investment managers are timing their trades within the duration of the package to maximize their trade performance, we can compare their implemented abnormal returns with a naïve strategy that relies on trading an equal portion of the package on each day of the overall package. The naïve strategy essentially allocates the value of the package equally over each day of trading without any consideration of skill. For example, if a $1 million package is made by a manager in two equal lots and five days apart (in an attempt to reduce market impact costs), then this execution strategy has been deemed by the manager as a means of reducing market impact. Such a scenario is therefore considered by the manager to be more optimal, rather than trading all $1 million at the beginning, or $200,000 over all five days in the package. Using the $1 million trade at the beginning as the benchmark is equivalent to using an open-to-trade cost measure for market impact, while benchmarking against the $200,000 per day method is equivalent to comparing market impact against a naïve strategy. A comparison against the opening price identifies the cost, compared to the same manager trade that is made in an infinitely deep market, and is therefore a measure of market impact. Comparing against the naïve measure provides an indication as to whether the manager can trade in a finite market (a finite market is one where managers will have to take into account market impact since liquidity is not infinite) more efficiently than a fixed simple rule (i.e. naive strategy).

This naïve strategy earns 0.09% for buys and -0.06% for sells, which is less than what managers achieved (0.12% for buys and -0.10% for sells). This indicates that although a substantial portion of the abnormal returns over the life of a trading package are not realized, active managers are indeed timing their trades to extract more benefit from their package over and above a naïve strategy.

The inter-day market impact costs calculated using the open-to-trade approach is 0.10% for buys and 0.05% (open-to-trade) for sells, which appears to be small in magnitude; however these represent a substantial proportion of the cumulative abnormal returns earned over the life of the package. In Table 1, we identify that the market impact cost of 0.10% is approximately one-half

[2] The CAR over the life of the package is equal to the CAR from the open to the close of the package. This is equal to the addition of the open-to-trade cost and the negative of the trade-to-close cost.

of the CAR of 0.22% over the life of a buy package, while for sells, market impact costs account for approximately one-third of the -0.15% CAR over the life of the package. The asymmetry between the market impact costs may reflect the higher probability of liquidity trading when selling rather than purchasing securities.

Intra-day Measures

An additional cost incurred by managers is lost performance after the market opens through to just immediately prior to a trade being executed. For example, if a trade is made mid-way through the trading day, then any movements in price prior to the trade will not accrue to the investment manager. This cost is measured by the single day cost measures documented in Table 1. The principal-weighted average difference between the open and the trade is -0.13% for buys indicating a net benefit given that buys are transacted at slightly lower prices than the opening price. However, for sales, the difference is 0.25% indicating a net cost – i.e. the sale arises at a price lower than the opening price. These lost opportunities of not trading at the open represent a round-trip cost of 0.12% (i.e. 0.25%-0.13%).

Total Market Impact Costs

The total market impact costs for a round trip transaction is the sum of inter and intra-day costs for both buys and sells. The inter-day costs (open-to-trade measure) are 0.10% and 0.05% for buys and sells respectively. The intra-day costs (open-to-trade) are -0.13% (a net benefit) and 0.25%. The sum total of the market impact costs for a round trip package is therefore 0.10% + 0.05% + -0.13% + 0.25% = 0.27%. While the 0.27% cost may seem small, when compared to the mean cumulative abnormal return achieved by managers of 0.39% and -0.53% (0.92% round trip abnormal return) in the 60 trading days after the start of a buy and sell package respectively, it becomes apparent that market impact costs can have a significant effect on performance.

Both the abnormal returns measured over the life of the package and the measured market impact is consistent with U.S. studies. However, Chan and Lakonishok (1995) report larger abnormal returns and market impact costs. The difference may be attributable to the difference in methodology. Alternatively, Chan and Lakonishok (1995) employ benchmark returns that only account for stock size, while this study utilizes additional risk proxies controlling for size, book-to-market and momentum.

B. Trade Complexity and Stock Size

Inter-day Measures

Characteristics of the trading package, including trade complexity and stock size, influence market impact costs through a variety of mechanisms. With larger and more complex trades, the total volume of the trade represents a larger proportion of daily trading volume, and therefore the package becomes more difficult to mask. All other things being equal, larger trades are more indicative of information content and therefore heavier volume traded in a certain direction is likely to move prices in the same direction as the trade. Additionally, since the ability to transact is affected by the availability of counterparties, liquidity will be a key factor in determining market impact costs incurred by active managers. As such, given that small stocks exhibit lower liquidity, stock size is hypothesized to be an important factor in market impact. Table 2 indeed documents that large trade packages (see Panel B) incur the highest market impact costs, increasing from almost zero percent for all smallest quintile trades to 0.30% for the largest trades (open-to-trade measure). This result is also supported by the trade-to-close measure. Furthermore, we find the dispersion of inter-day market impact costs increases with trade size. The standard deviation of open-to-trade costs increases from 1.2 for the smallest quintile of trades to 2.81 for the largest quintile (see Table 2, Panel B). The high dispersion of market

impact costs for large trades may occur for a few reasons; firstly, larger trades are indicative of information, and to the extent that information is noisy, we would expect higher variability in impact costs for large trades. Furthermore, for every buyer there is a seller, so while one manager may be transacting given private information (and incurring market impact costs), another trader (perhaps another manager) will be offering liquidity at a premium. Therefore, some managers are likely to incur higher costs for large trade packages, while others may actually benefit when offering liquidity. These results are also supported by the trade-to-close measures.

The relationship between market impact and trade size has important implications for the investment management industry as it reveals that larger funds trading larger packages will on average incur higher market impact costs. If these higher market impact costs are not compensated in part by an active manager's access to valuable information, then larger investment vehicles will experience significantly higher performance leakage.

The results in Table 2 also reveal that stock size is indeed an important determinant of market impact costs. Trades in the bottom two quintiles by stock size (Panel A) incur inter-day costs of 0.25% and 0.45%, while trades in the top two quintiles incur inter-day costs of 0.13% and 0.14%. These results are also supported by the trade-to-close measure. However, these higher inter-day market impact costs arise from trades in small stocks are mitigated by increased informational value exploited by active managers, where the executed abnormal return from trading in small stocks remains very high (i.e. see the CAR measures). This indicates that while active investment managers face higher inter-day market impact costs from trades in small stocks, they choose to do so only when their private information translates into commensurately higher returns. As with trade size, the dispersion of inter-day market impact costs is related to stock size. For smaller stocks, the standard deviation of open-to-trade cost is 2.42 while that of the largest quintile of stocks is 0.94. Again, this may reflect the need for some managers to incur market impact costs, while others offer liquidity at a premium. This mechanism is likely to be more pronounced for small stocks since there are less liquidity traders in the market to offer liquidity inexpensively.

Intra-day Measures

Confirming the inter-day results, in Table 2 we document a positive relationship between trade size and intra-day market impact costs. The intra-day open cost for the largest quintile by trade size is 0.24% (Panel B, open-to-trade measure) while trades in the smallest quintile actually receive a net benefit of 0.04%. The implication of this result is that larger trades incur higher costs, both on an inter-day and intra-day measurement approach. Therefore large managers, who may be expected to execute larger trading packages, will be likely to incur substantially higher total market impact costs. The intra-day measures according to stock size do not reveal any meaningful relationships.

Manager Size

Larger managers are expected to execute larger trade parcels, and therefore, other things being equal, we would hypothesise larger managers to incur higher market impact costs. Our sample collected the largest institutional funds available to investors, and accordingly, the analysis relies on these funds as an accurate proxy of relative manager size. Indeed, our analysis confirms that fund size is an accurate proxy for the aggregate institutional manager's size, in terms of funds under management. Figure 1 shows the average total market impact cost by manager size quartiles, where manager size is defined by the dollar value of the fund (at 31 December 2001). Figure 1 also plots the percentage of dollar value trading in the top quartile of trades (by relative trading volume). The graph shows that the largest managers (i.e. top quartile) incurred significant market impact costs, at least partly due to the fact that on average, over 70% of their

trade packages are accounted for in the top quartile of trade package size. Interestingly, the smallest quartile of managers (i.e. bottom quartile) also incurred high market impact costs. It is possible that small managers tend to trade in small stocks more frequently than larger managers, thereby incurring high market impact costs. Indeed, our analysis finds that the bottom quartile of managers traded 18.18% of their trades by dollar value (on average) in the bottom 85% of stocks (by market capitalisation). In contrast, the top quartile of managers traded only 7.56% in the bottom 85% of stocks.

C. Investment Manager Skill and Investment Style

The extent to which market impact costs vary across institution, either on the basis of trade execution skill or investment style adopted remains an empirical issue for active managers in Australia. A closer examination of market impact costs partitioned on individual managers indicates substantial variation in costs. While the median market impact cost for active equity managers is 0.44%, the distribution depicted in Figure 1 documents that almost two-thirds of active managers incur market impact costs detracting from investment performance. The minimum market impact cost for the best performing institution was -2.39% (where a negative number denotes a benefit), indicating the investment manager benefited from price movements over the course of their trading packages, while the maximum market impact was 1.68% (positive number denotes a cost), equivalent to a performance differential between the top ranked and bottom ranked institutions of 4.07%.[3]

The wide range in mean market impact costs across individual managers is indicative of the varying characteristics and skills by institutions in reducing their market impact costs. While some managers incur high costs, others actually benefit. The implication here is that selecting active equity managers only on the basis of stock picking ability ignores another important component of the overall selection decision. Market impact costs are also critical, as these can significantly erode a proportion of any abnormal returns gained through trading (especially those market impact costs incurred by the least performing managers).

Partitioning by trading performance, Figure 3 shows the mean market impact across quartiles of managers ranked by mean trading performance. The figure reveals that investment managers in the top quartile in terms of abnormal return 65 days after the start of a trading package exhibit significantly lower mean market impact than is the case for active managers with less successful trade execution.4 Figure 3 also shows the mean performance of the managers ranked by trading performance. Managers with successful trading performance (above median) not only earn higher abnormal returns, but are also more capable in reducing market impact costs. An important implication of this finding is that analysts should not neglect market impact costs, as this performance variable represents an important component of overall investment manager skill.

An active manager's investment style has also been shown to have an important impact on an investment manager's trading behaviour. Keim and Madhavan (1997) identify that trade immediacy and execution strategy will vary according to the investment objective implemented by investment managers. Value managers generally adopt more patient execution strategies, given that a value manager's investment process relies on long-term fundamental value which can be captured using patient working (limit) orders. Figure 4 supports the U.S. evidence that value managers are indeed more patient, and as a result incur substantially lower market impact

[3] Three investment managers were excluded as these institutions provided data of less than 100 trades.
[4] Performance is evaluated over the quarter (65 trading days) since managers are themselves often monitored on a quarterly basis.

costs. These results however, are not controlled for manager size, and therefore multivariate results are presented in following sections.

D. Fund Flows

Managers that experience significant inflows or outflows will be required to trade large parcels of shares within a short period of time. As a result, such managers are likely to incur higher market impact costs due to the requirement for immediacy in trade execution. Figure 5 shows the mean total market impact costs for a round trip transaction partitioned by fund flow. For each trade package in the sample, a quartile ranking based on fund flow is calculated over the previous 12 months by a comparison against the inflow (or outflow) experienced by the rest of the managers in the sample. The graph shows that on average, packages transacted by managers experiencing significant outflows or inflows over the previous 12 months incurred high market impact costs. Since managers have contractual obligations to fulfil redemptions within certain time periods, the need for immediacy is greater for large outflows than for inflows. Therefore, it is expected that significant outflows will cause higher market impact costs than significant inflows. Indeed, Figure 5 shows that packages by firms experiencing significant outflows incurred the highest market impact costs (0.62%).

E. Multivariate Results

In order to isolate the effects of each factor in determining impact costs for each investment manager, a multivariate regression is run where the mean total market impact costs for each manager are regressed against style, fund size, manager skill and trade composition. Manager style is self proclaimed and represented by a series of dummy variables taking style neutral as the benchmark. Fund size is partitioned into quartiles; taking the smallest fund quartile as the benchmark (therefore the intercept represents style neutral small funds). The proxy for manager skill is the mean abnormal return over the 65 days following each trading package by the manager. Trade composition is the percentage of trading activity (by dollar value) in stocks ranked in the bottom 85% by market capitalisation. This measure is designed to capture the tendency of some managers to trade in small stocks relative to large stocks.

The positive coefficients on all three size quartile dummy variables indicate that relative to the smallest managers, large managers incur higher market impact costs. However the effect is weak for the largest managers. Interestingly, manager trading skill is negatively related to market impact costs. This confirms the univariate results and implies that managers possessing skill in selecting stocks also exhibit skill in timing their trading packages in reducing market impact. Therefore, manager skill aids performance in two ways, through abnormal returns (i.e. CARs) obtained through superior information, and their ability to reduce the performance leakage associated with market impact costs. The amount of trading in small stocks is positively related to market impact, although the result is not statistically significant. Although relative to style neutral managers, we conclude that while growth, value and GARP managers incurred higher market impact costs, these results do not lead to the finding that they are statistically significant.

The adjusted R-Squared of 35.6% indicates that manager characteristics do not explain all of the variation in mean market impact costs. As expected, market impact costs are also determined based on idiosyncratic factors of the individual managers. Given the wide range in mean market impact costs across managers, it becomes important to analyse market impact costs on a manager-by-manager basis. While different managers will exhibit varying degrees of stock selection ability, the wide range in market impact costs will also have important performance implications – in that while highly skilful stock pickers earn higher returns, the same manager may lose either a small or large portion of their performance given their success at controlling for market impact costs.

V. Conclusions

This study examines the market impact costs arising from the daily trading activities of active Australian equity managers, as well as quantifying the extent of leakage in investment performance attributable to implicit trading costs. The literature finds that transaction costs in trading are economically significant, and accordingly can have substantial consequences for investors who engage active managers ignoring the importance of transaction cost controls. This research documents that market impact costs are indeed substantial for active Australian equity investors, and that variation in market impact costs arises on the basis of trade complexity, stock size, the type of institution executing trades, and the investment style adopted by active managers. The most significant findings reported in this study are as follows:

- The overall principal-weighted (or dollar weighted) mean market impact cost for a round-trip trade package for the 26 managers in the sample was 0.27%.
- Larger trade packages incur higher market impact costs than smaller trade packages.
- Trades in smaller stocks incur higher market impact costs than trades in larger stocks.
- Individual managers exhibit a high degree of variation in terms of their market impact costs. Furthermore, market impact costs are related to an individual investment manager's skill.

The main implication of this study is while market impact costs are to a certain extent controllable, a number of active investment managers are shown to be more adept in mitigating market impact costs than some of their competitors. The managers exhibiting the best abilities in minimising the performance leakage arising from market impact are generally the same managers exhibiting the best skills in identifying value-adding trading opportunities.

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Table 1: Abnormal Returns Over the Life of a Trading Package, Principal-Weighted Average Trading Package and Single Day Market Impact Costs (in Percentage Terms %) (For Inter and Intra-day costs, a Positive Number Denotes a Cost; a Negative Number Denotes a Benefit)

This table reports the average market impact costs weighted by package dollar value. The cumulative abnormal return (CAR) is the sum of the abnormal returns over the life of the package available to active managers. Abnormal returns are calculated as the difference between the return on stock *i* and a size, book-to-market, and momentum matched portfolio. The open cost is measured by calculating the weighted average cumulative abnormal return from the open of the start of the package to each trade in the package. The close cost is calculated by cumulating the abnormal returns from each trade within the package to the close of the day following the final trade in the package. The naïve strategy is the abnormal return obtained by equally proportioning the value of the package over the life of the package. The volume-weighted average price (VWAP) measure is the difference between the volume-weighted average price and the trade price, averaged over each day in the package where the investment manager has traded. In order to isolate inter-day costs, we assume trades are made at the opening price for the purposes of calculating inter-day costs. Intra-day costs are calculated using same-day benchmarks.

Panel A - Purchases

	Returns		Inter-day Costs		Intra-day Costs		
	CAR	Naïve	Open	Close	Open	Close	VWAP
P. Mean	0.22	0.09	0.10	-0.12	-0.13	-0.19	0.06
Stdev	2.74	2.14	1.45	2.77	2.06	1.75	1.60
Smallest	-1.40	-1.15	0.53	1.55	-0.85	-0.75	-0.36
40th Percentile	-0.32	-0.21	0.01	0.34	-0.17	-0.21	-0.05
60th Percentile	0.34	0.24	0.00	-0.38	0.23	0.11	0.09
80th Percentile	1.44	1.17	-0.45	-1.56	1.05	0.56	0.41
Largest	42.91	28.37	-13.62	-32.16	15.83	14.21	10.00

Panel B - Sales

	Returns		Inter-day Costs		Intra-day Costs		
	CAR	Naïve	Open	Close	Open	Close	VWAP
P. Mean	-0.15	-0.06	0.05	-0.10	0.25	0.25	0.25
Stdev	2.86	2.27	1.44	2.77	1.78	1.45	1.34
Smallest	-1.51	-1.27	0.48	-1.66	0.88	0.64	0.45
40th Percentile	-0.35	-0.26	0.00	-0.43	0.16	0.18	0.11
60th Percentile	0.32	0.23	0.00	0.30	-0.25	-0.13	-0.03
80th Percentile	1.50	1.25	-0.49	1.53	-0.97	-0.58	-0.28
Largest	36.21	36.21	-15.72	30.85	-20.00	-9.60	-10.00

Table 2: Round-Trip Principal-Weighted Average Trading Package and Single Day Market Impact Costs (in Percent %) by Relative Trade Size and Stock Size (For Inter and Intra-day costs, a Positive Number Denotes a Cost; a Negative Number Denotes a Benefit)

This table reports the average market impact costs by relative trade size and stock size weighted by package dollar value. The cumulative abnormal return (CAR) is the sum of the abnormal returns over the life of the package available to active managers. Abnormal returns are calculated as the difference between the return on stock *i* and a size, book-to-market, and momentum matched portfolio. The open cost is measured by calculating the weighted average cumulative abnormal return from the open of the start of the package to each trade in the package. The close cost is calculated by cumulating the abnormal returns from each trade within the package to the close of the day following the final trade in the package. The naïve strategy is the abnormal return obtained by equally proportioning the value of the package over the life of the package. The volume-weighted average price (VWAP) measure is the difference between the volume-weighted average price and the trade price, averaged over each day in the package where the manager has traded. In order to isolate inter-day costs, we assume trades are made at the opening price for the purposes of calculating inter-day costs. Intra-day costs are calculated using same-day benchmarks.

Panel A - Market Impact Costs by Stock Size

Measure	Smallest Firms	2	3	4	Largest Firms	All Firms
CAR over package	0.53	1.37	-0.79	-0.51	0.34	0.37
Naïve	0.16	0.74	-0.38	-0.47	0.15	0.15
Inter-day Measures						
Trade-to-Close	0.28	0.93	-0.37	-0.64	0.20	0.22
Stdev(Trade-to-Close)	4.76	4.84	3.56	3.60	1.98	3.89
Open-to-Trade	0.25	0.45	-0.42	0.13	0.14	0.15
Stdev(Open-to-Trade)	2.42	2.72	1.90	1.82	0.94	2.05
Intra-day Measures						
VWAP	0.41	0.35	0.21	0.32	0.48	0.35
Stdev(VWAP)	1.60	1.25	1.40	1.57	1.90	1.56
Trade-to-Close	-0.32	0.23	-0.12	0.02	0.42	0.06
Stdev(Trade-to-Close)	2.22	1.66	1.48	1.72	1.88	1.81
Open-to-Trade	-0.40	0.40	-0.16	0.29	0.48	0.12
Stdev(Open-to-Trade)	2.35	2.10	2.02	2.14	2.02	2.13

Panel B - Market Impact Costs by Trade Size

Measure	Smallest Trades	2	3	4	Largest Trades	All Trades
CAR over package	-0.05	-0.23	-0.02	-0.34	0.68	0.37
Naïve	-0.02	-0.17	0.00	-0.09	0.26	0.15
Inter-day Measures						
Trade-to-Close	-0.04	-0.20	0.04	-0.14	0.39	0.22
Stdev(Trade-to-Close)	2.78	3.81	3.89	4.11	4.50	3.89
Open-to-Trade	0.00	-0.03	-0.06	-0.20	0.30	0.15
Stdev(Open-to-Trade)	1.20	1.66	2.04	2.19	2.81	2.05
Intra-day Measures						
VWAP	0.15	0.04	-0.03	0.09	0.50	0.35
Stdev(VWAP)	2.00	1.46	1.56	1.48	1.11	1.56
Trade-to-Close	-0.02	-0.06	-0.13	-0.09	0.12	0.06
Stdev(Trade-to-Close)	1.97	1.59	1.74	1.88	1.78	1.81
Open-to-Trade	-0.04	-0.04	-0.16	-0.07	0.24	0.12
Stdev(Open-to-Trade)	2.19	2.04	2.23	2.17	1.95	2.13

Figure 1: Market Impact by Investment Manager Size (A Positive Number Denotes a Cost; a Negative Number Denotes a Benefit)

The total market impact cost is measured using the open-to-trade approach (measured in percent). The open cost is measured by calculating the weighted average cumulative abnormal return from the open at the start of the package to each trade in the package. Manager size is defined as total dollar value of the fund as at 31 December 2001. Trade size is defined as the difference between the dollar value of the trade package and the mean daily trading volume calculated over the preceding 40 days.

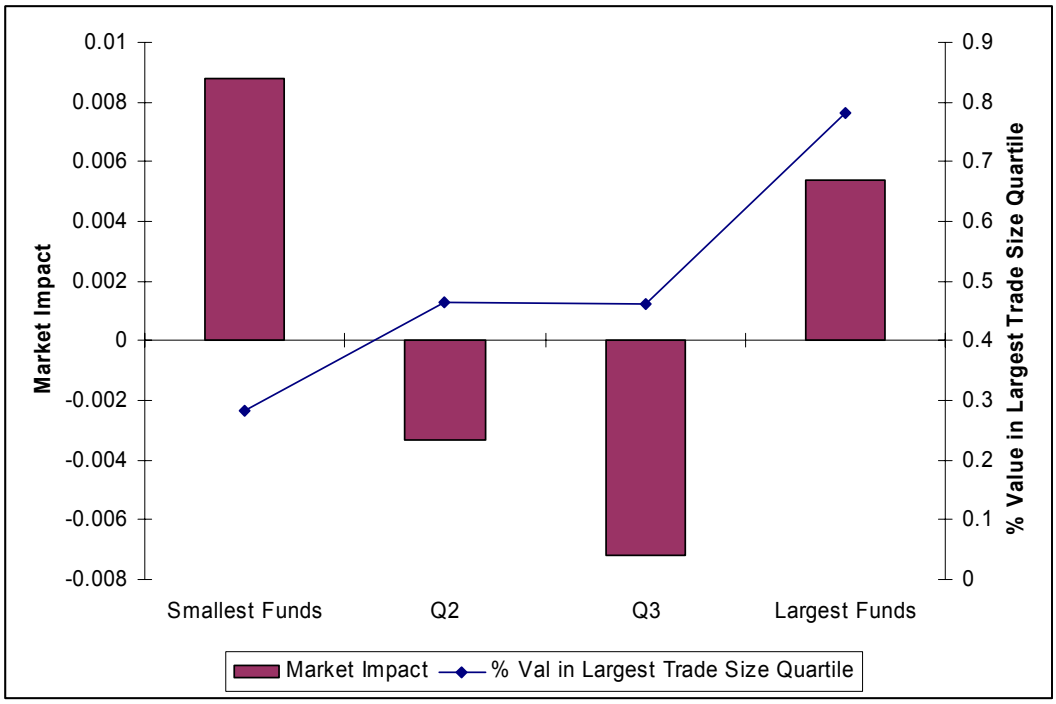

Figure 2: Market Impact by Investment Manager (A Positive Number Denotes a Cost; a Negative Number Denotes a Benefit)

The total market impact cost is measured by the open-to-trade measure. The open cost is measured by calculating the weighted average cumulative abnormal return from the open at the start of the package to each trade in the package. The frequency distribution includes managers in the histogram for each respective total market impact cost that is bounded between both market impact cost intervals.

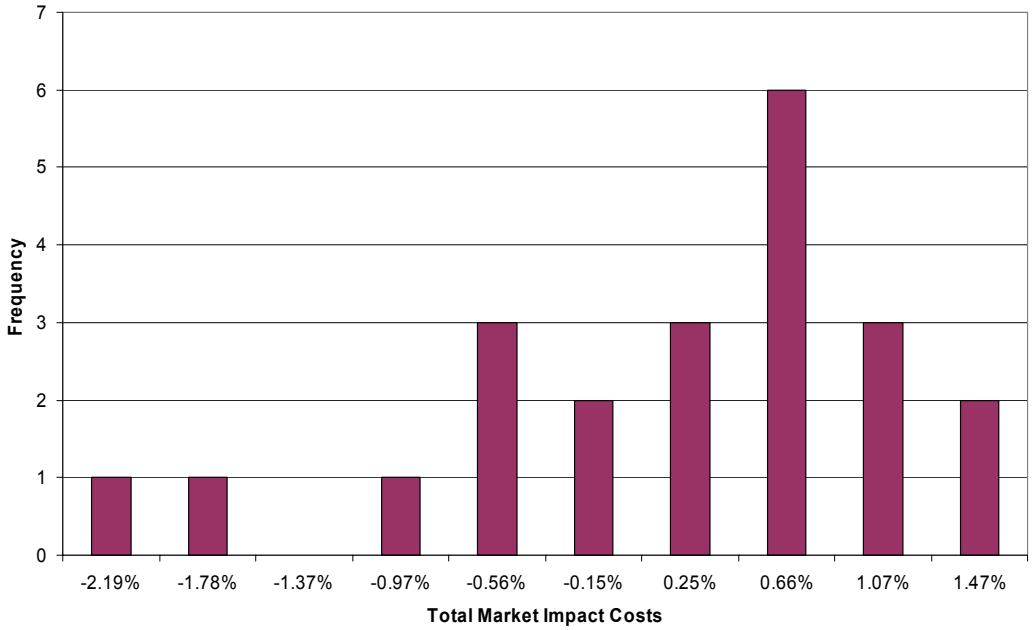

Figure 3: Market Impact by Manager Trading Performance (For Market Impact, a Positive Number Denotes a Cost; a Negative Number Denotes a Benefit)

This figure shows the mean total market impact cost by quartile of manager trading performance. The total market impact cost is measured using the open-to-trade measure. The open cost is measured by calculating the weighted average cumulative abnormal return from the open of the start of the package to each trade in the package. Trading performance is measured by the mean cumulative abnormal return (CAR) obtained 65 trading days after the start of the package.

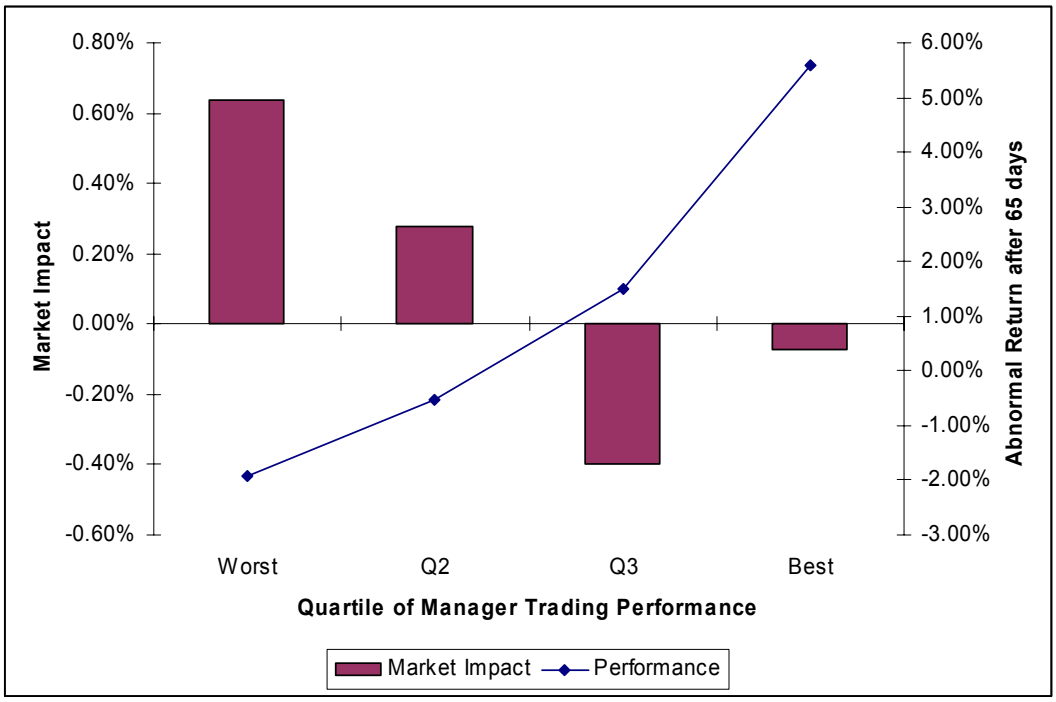

Figure 4: Market Impact by Investment Manager Style (A Positive Number Denotes a Cost; a Negative Number Denotes a Benefit)

This figure gives the mean total market impact by investment manager style. The total market impact cost is measured using the open-to-trade measure. The open cost is measured by calculating the weighted average cumulative abnormal return from the open of the start of the package to each trade in the package. Investment style is determined based on the equity manager's self declared style. Fund size is dollar value of fund as at 31st December 2001.

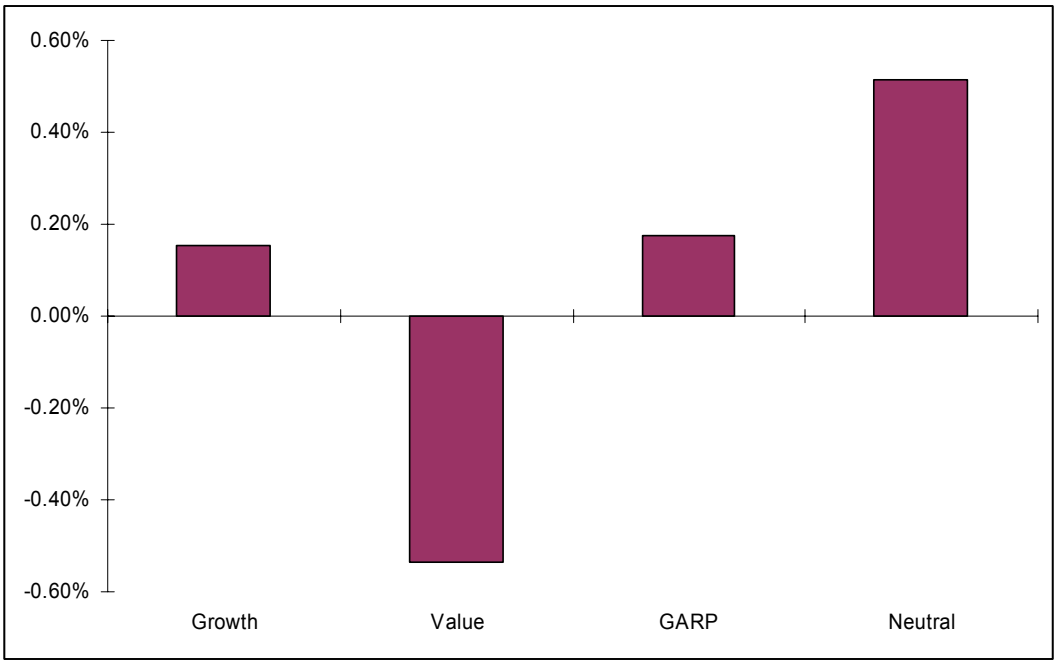

Figure 5: Market Impact by Investment Manager Fund Flow (A Positive Number Denotes a Cost; a Negative Number Denotes a Benefit)

This figure gives the mean total market impact by investment manager fund flow. The total market impact cost is measured using the open-to-trade measure. The open cost is measured by calculating the weighted average cumulative abnormal return from the open of the start of the package to each trade in the package. Fund flow is calculated over the 12 months prior to each trade. The fund flow prior to each package is compared to that of the other managers in the group to form quartile partitions.

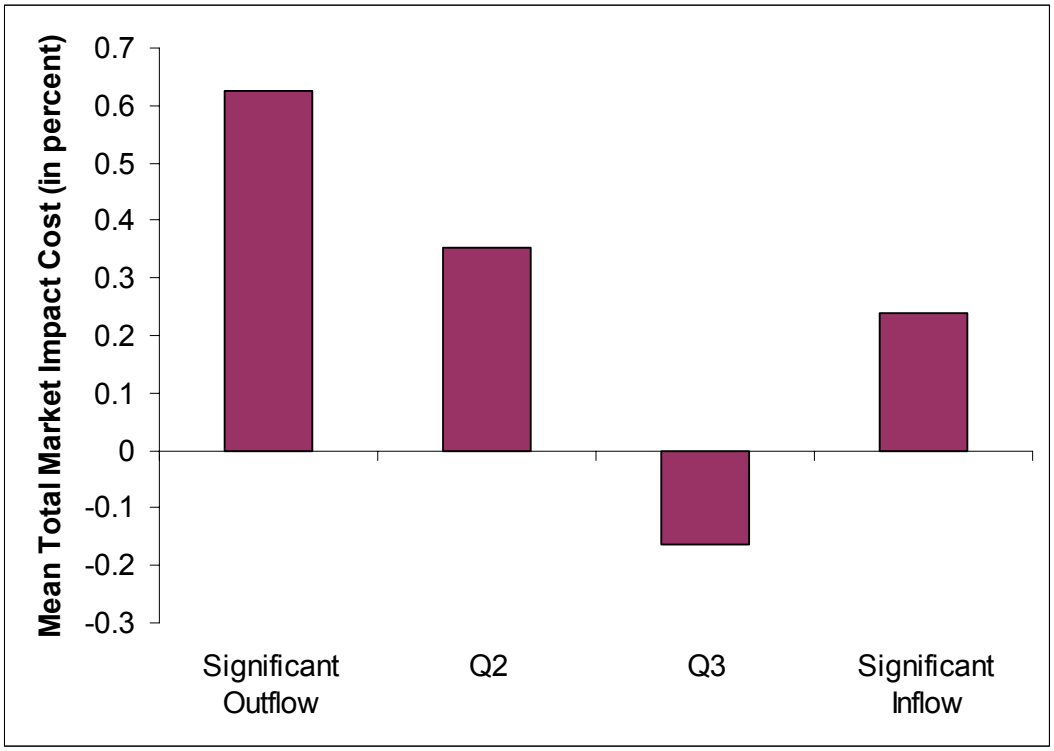

Table 3: Total Market Impact Costs and Trade Size, Stock Size, and Manager Style

This table reports regression results for the following regression equation:

$$Cost_{mgr} = \alpha_0 + \sum_{s=1}^{s=3} \beta_s Style + \sum_{q=1}^{q=3} \delta_q MgrSize + \phi Skill + \varphi SmallStocks + \varepsilon_{mgr}$$

The market impact costs are calculated by summing the open-to-trade inter and intra-day market impact costs. The intra-day open-to-trade costs are calculated by taking the difference between the opening price and the trade price, and then weighting by the dollar value of the trade. The inter-day open-to-trade costs are calculated by taking the difference between the opening price at the start of the package and the trade weighted average price of the package. This difference is adjusted relative to a size, book-to-market and momentum controlled portfolio. The investment style classifications are self proclaimed by the investment managers.

R Square	60.11%
Adjusted R Square	35.56%

	Coefficients	*t*-Stat	
Intercept of Regression			
Style Neutral, Smallest Managers	-0.0071	-3.66	***
Investment Style			
Growth	0.0020	0.49	
Value	0.0026	1.08	
GARP	0.0027	0.79	
Manager Size			
26th - 50th Percentile Managers by Size	0.0056	2.26	***
51st - 75th Percentile Managers by Size	0.0055	1.94	**
Largest Managers	0.0034	0.84	
Skill			
Manager Trading Skill	-0.0809	-1.90	**
Trade Composition			
Small Stock Trades	0.0071	1.05	