How has the relevance of institutional brokerage changed?

Kingsley Y. L. Fong[a],
F. Douglas Foster[b],
David R. Gallagher[a,c,d,e],
Adrian D. Lee[b,*]

a UNSW Business School, UNSW Australia, Sydney NSW 2052 AUSTRALIA

b Finance Discipline Group, University of Technology, Sydney, Broadway NSW 2007 AUSTRALIA

c Macquarie Graduate School of Management, Sydney NSW 2109, AUSTRALIA

d Capital Markets CRC Limited, Sydney NSW 2001, AUSTRALIA

e Centre for International Finance and Regulation, Sydney NSW 2000, AUSTRALIA

Current Draft: August 05, 2014

This research was funded through an ARC Linkage Grant (LP0561160) with Vanguard Investments Australia and the Securities Industry Research Centre of Asia-Pacific (SIRCA). Earlier versions of this paper benefited from helpful comments by Geoff Warren, Terry Walter and seminar participants at the Royal Melbourne Institute of Technology, the 2007 Australasian Finance and Banking Conference, 2008 Accounting and Finance Association of Australia and New Zealand Conference (AFAANZ), and the 2008 Financial Management Association Annual Meeting.

[*] Corresponding author: E-mail address: adrian.lee@uts.edu.au (A.D. Lee) Telephone: (+61 2) 9514 7765

How has the relevance of institutional brokerage changed?

Abstract

Institutional brokerage rates have been in decline. We investigate whether this reduction has coincided with a fall in benefits provided by brokers to institutional asset managers. We use trade packages from both active and passive equity funds from 1995 to 2001, and active equity funds from 2002 to 2010. We find that later period active funds recoup a combined 1.75 basis point benefit (from price impact cost recovery and short-term alpha) per basis point of brokerage cost. Later period active investors saw improved trade price impact and shorter-term alpha net benefits, relative to earlier period active investors. These results are robust after controlling for trade characteristics and cross-sectional variation over time. Our findings suggest brokers innovate to provide valuable services in the subsequent, lower brokerage environment.

JEL Classification: G14, G23

Keywords**: Transaction costs, price impact, brokers**

1. Introduction

We find that brokers enable active equity managers to trade at favorable prices. We measure this advantage in two ways. First, higher brokerage payments are associated with lower price impact from trading. Second, higher brokerage is associated with better post-trade market-adjusted returns. Our evidence suggests that brokers create value both through improving trade execution, as well as through a range of services that enhance investment choice. This effect has become more pronounced recently, as brokerage rates (as a percent of trade value) have fallen.

The assessment of brokerage costs and benefits is challenging. Payments to brokers are relatively clear; they are explicit and made when trades occur. However, benefits received from brokers are varied, difficult to quantify, and dispersed through time (e.g. transaction services, access to research reports, access to analysts, security allocations in primary market transactions, etc.). Past research comparing brokerage benefits to costs has typically focused on comparing brokerage payments to trade price impact. These studies suggest that brokerage costs exceed trade price impact benefits. Hence these authors conclude that there may be other benefits provided by brokers, but do not attempt to catalog or measure these contributions.[1]

We investigate the relation between brokerage costs, implicit trading costs and market-adjusted returns (alpha) using two sample periods of fund manager trades: active and passive fund trades from 1995 to 2001 (period 1 or 'P1'); and active fund trades from 2002 to 2010 (period 2 or 'P2') on the Australian Securities Exchange (ASX). These two samples cover a period of time that saw significant technological change in the trading environment, as well as marked reductions in percentage brokerage costs.

We have detailed information for brokerage costs. Calculating benefits from employing brokers is more complex. One key possible benefit to fund managers from brokers would be

[1] E.g. Berkowitz, Logue and Noser (1988), Chan and Lakonishok (1995) and Comerton-Forde *et al.* (2005).

lower price impact of trades. Hence we use price impact measures to assess non-brokerage (implicit) trading costs incurred by our sample funds. Of course, brokers provide their clients services other than transaction assistance. Rather than attempt to list other possible broker services, and measure their associated benefits, we focus on the post-trade investment performance of each trade package and investigate its relation to the brokerage that was paid. Specifically, we compute 20-day (short-run) and 20-day to 1-year (long-run) market-adjusted returns subsequent to each trade package and estimate the relation between brokerage costs and post-trade alphas. Associating broker benefits with particular trades is difficult – the broker who processes the trade may not have provided the relevant non-trade services supporting this transaction. Hence, we assume that higher brokerage payments are associated with transactions that generate higher alpha.

Consistent with other studies, we find that estimated price impact improvement cannot, by itself, justify paying higher brokerage rates. However, when we include estimated post-trade investment performance, then higher brokerage payments appear to provide benefits that exceed brokerage costs. The net gain to brokerage has become more apparent recently, as brokerage costs (relative to trade value) have fallen.

We find that brokerage costs have halved and turnover increased tenfold during our entire sample period (including both P1 and P2). Over this time there has been little change in the market shares of brokers – consistent with these changes to costs and turnover being technologically driven, rather than a consequence of a major change in the competitive environment of the brokerage industry.

Our regression analysis shows that passive (defined to be index and enhanced index funds) funds experience lower implicit (non-brokerage) transaction costs when greater percentage brokerage is paid during P1. Active funds earn higher long-term alpha, but have statistically insignificant differences in implicit transaction costs when higher brokerage is paid during P1. With falling brokerage rates in the second (P2) sample, we find that active funds have reduced implicit transaction costs and increased short-term alpha for higher brokerage paid. These results are robust using Fama-MacBeth cross-sectional analysis and an analysis of the residuals from the baseline regression. During the recent decline in brokerage rates benefits from brokerage services are more than commensurate with brokerage paid.

The study is structured as follows: Section 2 provides background and hypotheses development. Section 3 describes the data used and develops our empirical method. Section 4 reports our results and Section 5 concludes.

2. Background and Hypotheses Development

Several papers demonstrate that paying higher brokerage costs does not necessarily result in commensurately lower implicit transaction costs. For example, Berkowitz, Logue and Noser (1988) find a one basis point increase in brokerage paid is associated with only a 0.23 basis point decrease in price impact (measured as the difference in the traded price relative to Volume Weighted Average Price (VWAP) that day). This suggests an uneconomic net incremental benefit to paying higher brokerage. Chan and Lakonishok (1995) and Comerton-Forde *et al.* (2005) find little association between trade price impact and brokerage paid.

A possible explanation for these results is that brokers provide benefits other than execution services. That is, an incomplete account of benefits provided by brokers may obscure the relation between brokerage paid and benefits received. Examples of additional benefits include analytic services, broker research, IPO allocations (e.g. Nimalendran, Ritter and Zhang (2007); Goldstein, Irvine and Puckett (2011)) and soft dollar benefits (e.g. Blume (1993) and Conrad, Johnson and Wahal (2001)).

Rather than listing and valuing possible ancillary benefits, we focus on the consequences of employing additional services. That is, if these bundled brokerage services are associated with improved stock selection or portfolio construction (e.g. Womack (1996), Barber *et al.* (2001), Aitken, Muthuswamy and Wong (2001) and Kadan *et al.* (2009)), we expect a positive relation between brokerage paid and abnormal returns for each transaction for active funds. Further, we expect different types of funds to have varying need for ancillary services. For example, we expect no relation between brokerage paid per trade and the market-adjusted excess returns for index funds and a weaker (relative to active funds) relation between trade brokerage and alpha for enhanced index funds. In addition, passive (i.e. index and enhanced index) funds may face lower adverse selection costs, thereby resulting in simpler trade construction with lower price impact. This leads to our first two hypotheses:

H1: Brokerage costs are positively related to transaction market-adjusted excess returns and negatively related to implicit transaction costs, controlling for trade characteristics and fund characteristics.

H2: The estimated relation between brokerage costs and implicit transaction costs is more negative for passive funds than for active funds. Also, for passive (index and enhanced index) funds there is a weaker relation between transaction brokerage costs and market-adjusted excess returns.

In assessing the value brokers create for active investors we need to recognize that our sample periods contain events related to the 2003 Global Settlement.[2] Broker firm actions noted in the Global Settlement may not have been consistent with providing long-term benefits to investors from some bundled services (e.g. stock research). Almost all penalized firms are major brokers in Australia (see Jackson (2005)) and have changed their practices since the Global Settlement. Hence, in the period subsequent to the announcement of the Global Settlement there may have been a shift from bundling to pure execution services for active funds. This could be due a reduction in the demand or supply of broker research (partly as a result of Global Settlement (e.g. Kelly and Ljungqvist (2007)) and/or improved trading technologies, which

[2] On 28 April 2003 a legally enforceable agreement was reached by the SEC, NYSE, NASDAQ and the largest 10 investment banking firms to address conflict of interest issues arising from the activities of investment banks in providing diverse securities market services to clients.

bring a focus to transactions services. Whether a lower brokerage environment results in a stronger relation between brokerage and implicit transaction costs is unclear. Even with lower overall brokerage rates, there may be a stronger link between these payments and the quality of transaction services. This motivates our final hypothesis:

H3: The brokerage and implicit transaction cost relation for active funds is stronger in P2 than in P1.

3. Data and Approach

3.1. Data

Our two samples use daily institutional trades recorded in the Portfolio Analytics Database (PAD). PAD is a privately constructed database for academic research that was compiled using an 'invitation' approach to the largest Australian equity managers in Australia, based on their funds under management (FUM). The data were collected with the support of investment consulting firms who have close connections to these fund management firms. Two data requests were made to each fund manager. The first request was for data from the period January 1995 to December 2001; 18 active and 8 passive equity funds (3 index and 5 enhanced index) provided both monthly holdings data as well as daily trades. The second request provided similar data for the period January 2002 through December 2010, with 33 active funds participating. The two samples do not necessarily share common funds and so cannot be linked explicitly. Both datasets contain the date (without timestamp), ticker, quantity traded, value-weighted average price traded, brokerage costs, and broker identity for every trade for each fund. Month-end portfolio holdings (ticker and number of shares held) of each fund were also provided by each fund.

Market capitalization, capitalization adjustment and dividend information for the stocks in every portfolio are taken from the Securities Industry Research Centre of Asia-Pacific (SIRCA) Share Price and Price Relative Database (SPPR). Daily opening, high, low, closing prices, VWAP, and trading volume for stocks listed on the Australian Securities Exchange (ASX) are also provided by SIRCA.

3.2. Trade Packages and Broker Trade Packages

Institutions may spread their transactions (from a single trade decision) across time to reduce price impact; i.e. they may package a trade decision into a series of transactions. Hence, we follow the approach of Chan and Lakonishok (1995) to identify and consolidate these trade packages. A buy (sell) transaction is considered part of a trade package if there is less than a five-day gap from the previous purchase (sale) of the stock. Further, each trade package is decomposed into trade packages handled by a specific broker to form broker trade packages. Hence, a broker trade package consolidates purchases (sales) by the same broker occurring within five days.

3.3. Implicit Transaction Costs and Alpha

We use two measures of implicit transaction costs: Price Impact and Trade to VWAP. We follow Chan and Lakonishok (1995) and calculate Price Impact as the traded price relative to the opening price on the first day of a trade package. Price Impact measures upward price pressure for buy trades (or downward pressure for sells) relative to the price just prior to the transaction. Trade to VWAP measures the traded price on a day relative to the value-weighted average traded price that day (the VWAP price). By buying below or selling above the VWAP price the fund manager acquires or disposes of stock on better terms than the average investor that day. Trade to VWAP is used in Berkowitz, Logue and Noser (1988) and is a commonly used benchmark for assessing execution costs.[3] These measures are given by:

$$PriceImpact = (Price_t/OpeningPrice_t - 1) * Buy \tag{1}$$

[3] For example, it is used in the Institutional Investor's Annual Transaction Cost Analysis Survey to rank fund managers based on their trading costs (see Sweeney (2012)).

$$TradetoVWAP = (Price_t/VWAP_t - 1) * Buy \qquad (2)$$

Buy takes the value of 1 if the trade is a buy and -1 if the trade is a sell. Thus, positive values for these measures represent a cost to the fund; negative measures represent cost recovery. $Price_t$ is the value-weighted average trade price of all trades executed in a package. $OpeningPrice_t$ is the first traded price of the stock on the day the first trade in the package was executed. $VWAP_t$ is the volume-weighted average price of all trades on a given day. This means that a trade on a given day in a package is benchmarked against the same day's VWAP, and then a value-weighted *TradetoVWAP* measure is calculated for trade packages over multiple days. Hence *TradetoVWAP* may be seen as to measure transaction cost performance at the intraday level while *PriceImpact* is at the interday level. The two measures therefore measure different aspects of transaction costs.

We also use two measures of alpha: excess returns for 20 trading days (roughly a month) subsequent to trade, and excess returns for the period from 20 trading days after the transaction to 254 trading days after the transaction (roughly an 11 month return computed from one month after the trade). This gives measures of the more immediate benefit of a trade, as well as a longer-term performance measure. Specifically we use:

$$ExcessReturns_{t+20} = (ClosingPrice_{t+20}/ClosingPrice_t - Market_{t+20}/Market_t)*Buy \qquad (3)$$

$$ExcessReturns_{t+254} = (ClosingPrice_{t+254}/ClosingPrice_{t+20} - Market_{t+254}/Market_{t+20})*Buy \qquad (4)$$

$ClosingPrice_t$ is the last trade price on the day the final trade in a package is executed. $ClosingPrice_{t+20}$ and $ClosingPrice_{t+254}$ are dividend and split adjusted stock closing prices 20 and 254 days after the end of the trade package. $Market_t$, $Market_{t+20}$ and $Market_{t+254}$ are the value of the All Ordinaries Accumulation Index at the end of, 20 days after the end of, and 254 days after the end of a trade package, respectively.

Note that *PriceImpact* (*TradetoVWAP*), $ExcessReturns_{t+20}$, and $ExcessReturns_{t+254}$ measures are intentionally structured so that the time periods for each do not overlap. Hence, we are able to track benefits to brokerage paid from the start of the trade package to one year after the end of the package.[4]

3.4. The Model

Our focus is on differences in performance (alpha and implicit transaction costs of trades) between active and passive funds, and between P1 active and P2 active funds. We want to see whether active managers use brokerage services differently than passive managers, and whether these differences allow active managers to mitigate adverse price impacts from their potentially informed trades.

We begin by relating implicit transaction costs (defined either as Price Impact or Trade to VWAP) and alphas of a trade package at the fund/broker level to basic characteristics of the order, prevailing market conditions and the style of the fund manager. Hence we specify the following regression model for transactions by fund *f* in stock *i*, using broker *b*, where each broker / trade package constitutes an observation:

$$Performance = \gamma_f + \alpha_i + \beta_1{*}Market{*}Buy + \beta_2{*}Cap + \beta_3{*}Brokerage + \beta_4{*}Complex + \beta_5{*}Volatility + \beta_6{*}Days + \beta_7{*}Informed + \beta_8\,Lagflow{*}Buy + \beta_8{*}Dayid + \varepsilon \quad (5)$$

Where *Performance* is each of the alpha or transaction cost measures given in equations 1 through 4. γ_f and α_i denote fund and stock style fixed effects, respectively. These and other explanatory variables are defined in the Appendix.

The basic model outlined in equation (5) is constructed relying on explanatory variables from the literature. For example, Chiyachantana *et al*. (2004) use *Cap*, *Complex*, *Days*, *Market*

[4] We also use log versions of our measures and find that it did not affect the implications of our results.

and *Volatility*. *Brokerage*, our variable of interest, is used by Chan and Lakonishok (1995) in their price impact regressions. *Lagflow* is taken from papers examining fund flows and mutual fund performance (e.g. Alexander, Cici and Gibson (2007)). Relying on these studies, we expect *Lagflow*Buy* to be positive and statistically significant if lagged fund flow is associated with greater trading immediacy (and therefore higher transaction costs) by funds. We follow Chiyachantana and Jain (2009) and use the ex post measure, *Informed*, to denote trades that may contain more information, thereby generating greater price impact and excess return.[5]

Our model also includes a time trend, fund ability, and stock style differences in transactions (and alpha). *Dayid* is a trend variable to control for falling brokerage and implicit transaction costs.[6] The use of fund fixed effects is motivated by Chan and Lakonishok (1995) who use univariate analysis to demonstrate price impact differences between growth and value funds. In addition, Keim and Madhavan (1997) note that institutions with similar investment styles may have different approaches in filling orders and consequently face different implicit transactions costs. Motivated by Anand *et al*. (2012), we control for the systematic difference in the type of stocks that institutions trade by using fixed effects based on the style bins used in the characteristic-based benchmark method of Pinnuck (2003) (this consists of 60 bins (five size, four book-to-market, and three momentum bins)).

4. Results

Our analysis of broker trade packages proceeds as follows. In section 4.1 we report descriptive statistics and provide an overview of the funds and their broker package trades. We then examine changes to the brokerage industry during our sample period. In section 4.2 we give

---

[5] Note that for the $ExcessReturns_{t+254}$ regressions we do not include the *Informed* variable as it is essentially a dummy variable version of $ExcessReturns_{t+254}$.

[6] As an alternative to linear time trend, we use a proxy for algorithmic trading as developed by Hendershott, Jones and Menkveld (2011). That is, we compute the lagged monthly average daily negative value of dollar turnover (in hundreds of dollars) divided by the number of order messages (amend, entry and cancellations) of all top 200 stocks by market capitalization on the ASX. We find similar results and for conciseness only report using linear time trend.

yearly summaries of brokerage rates, broker revenue, and broker competition. In section 4.3 we use estimate based on expression (5) to test *H1*. This allows us to explore the link between brokerage rates and our performance measures (implicit transaction costs and alpha) across our funds (active or passive) and sample periods (P1 and P2). In section 4.4 we test *H2* and *H3* by considering differences in *Brokerage* coefficient estimates. We link these differences to package characteristics based on fund type (P1 active relative to P1 passive funds) and period (P1 active relative to P2 active funds). We test the robustness of our results by considering whether brokerage relations outlined in sections 4.3 and 4.4 hold cross-sectionally with Fama-MacBeth regression analysis (in section 4.5). Finally, we test whether the residuals of our baseline regression have any subsequent explanatory power (section 4.6). This gives us information on the extent to which the model of equation (5) accounts account for sources of variation in our performance measures.

4.1. Descriptive Statistics

Table 1 reports descriptive statistics for our sample of funds. Our transaction data consists of 26 funds (18 active and 8 passive) from our first (P1) sample and 33 active funds from our second (P2) sample with a total of 118,776 broker trade packages covering $A102.86 billion dollars of trades.[7]

[INSERT TABLE 1 HERE]

There are notable differences between the P1 active and P1 passive samples. Active funds trade on average larger trade packages (AUD537,640 for P1 active versus AUD192,370 for P1 passive funds), are smaller (mean monthly fund size of AUD184.86 million versus AUD477.39 million), pay higher brokerage (mean value weighted brokerage of 0.275 percent versus 0.235 percent), use more brokers (mean monthly brokers per fund of 9.14 versus 7.00)

[7] Trades with no broker ID or that were outside of the reported daily low and high prices were removed. These deletions represent AUD5.2 billion in trades, or about 4.8% of total trade value.

and trade much more (mean annual turnover ratio of 64.68 percent versus 8.88 percent). P1 active funds also have higher trade value weighted transaction costs in terms of *PriceImpact* (0.442 percent versus -0.104 percent) and *TradetoVWAP* (0.154 percent versus 0.053 percent); similar short-term alpha ($ExcessReturns_{t+20}$ of -0.025 percent versus -0.002 percent) and higher long-term alpha ($ExcessReturns_{t+254}$ of 2.093 percent versus 0.950 percent).

We compare funds between the two periods in terms of size, trading costs, and performance. P2 active funds are larger than the P1 active funds; roughly four times as big and execute trade packages of over twice the value. P2 active funds incur lower brokerage and implicit transaction costs relative to both P1 active and passive funds. In particular, P2 active funds earn negative *TradetoVWAP* costs whereas P1 active and passive funds have positive *TradetoVWAP* costs. Lower P2 transaction costs may be due to less aggressive trading, an increase in liquidity, or broker effectiveness. P2 active funds have higher value-weighted $ExcessReturns_{t+20}$ than active and passive P1 funds. However equal weighted $ExcessReturns_{t+20}$ and $ExcessReturns_{t+254}$ values are lower for P2 active funds than P1 active funds. Our regression analysis investigates in more detail the relation between brokerage paid and both alpha and implicit transaction costs. Finally, the standard deviation of *Brokerage* (equally weighted) is roughly half of average *Brokerage*; this suggests that there is significant scope for *Brokerage* to explain our *Performance* variables.

4.2. Broker Revenue and Competition

In this section we investigate whether brokers had declining revenue with lower institutional brokerage rates. We are also interested in whether there are any changes to the broker concentration, i.e. whether changing broker revenue appears to be linked to a changing competitive environment.

For each year we calculate the value-weighted brokerage rate of active funds and the total ASX on-market turnover. From these values we compute geometric (log) growth rates of year-on-year brokerage rates, turnover, and implied broker revenue.[8] In addition, we calculate two industry concentration measures to proxy for broker competitiveness. The first concentration measure uses ASX dollar value of trades by broker to calculate a broker Herfindahl–Hirschman Index (HHI).[9] Our second competitiveness measure uses PAD active fund trades to compute a broker HHI value.

[INSERT TABLE 2 HERE]

Over our sample period active fund brokerage rates (as a percent of trade value) has roughly halved from 32.7 basis points in 1995 to 15.5 basis points in 2010. On-market turnover has increased dramatically from AUD67.01 billion to AUD981.85 billion (although it peaked during 2007 (AUD1,370.20 billion) and 2008 (AUD1,212.17 billion)). Cumulative broker revenue log growth (i.e. brokerage log growth plus turnover log growth) over the period is 193.96 percent.

Despite this dramatic increase in revenue we find that the HHI of ASX broker trades is only slightly higher during our P1 sample. That is, from 1995 to 2001 the yearly average HHI is 4.83 while in the P2 period it is 5.27. The higher HHI indicates an increase in concentration of trading volume via certain brokers. For the HHI of PAD trades we find a similar increase in concentration between the P1 and P2 sample periods. Our results suggest that the Australian brokerage industry has flourished despite falling brokerage rates, and without an increase in industry concentration.

4.3. Regression Results

In this section we examine whether brokerage paid (as a percent of trade value) is related to either post trade alpha or implicit transaction costs. We find evidence consistent with *H1* for

---

[8] We define revenue log growth as the log change in brokerage plus the log growth in turnover. Using the median brokerage rate of broker trade packages does not change the implication of our results.

[9] The HHI is defined as the sum of the market shares of each broker's ASX turnover squared, multiplied by 100. An industry with only one firm would have an HHI value of 100. An industry with many small firms would have an HHI value close to zero.

index funds and P2 active funds; brokerage is negatively related to implicit transaction costs. Also consistent with *H1*, P1 and P2 active fund brokerage is positively related to alpha (albeit short-term alpha benefits to P2 active funds and long-term alpha benefits to P1 active funds).

Table 3 reports coefficient estimates for regressions with the four possible dependent variable specifications: *PriceImpact* (Panel A); *TradetoVWAP* (Panel B); *Excess Returns* $_{t+20}$ (Panel C); and *ExcessReturns* $_{t+254}$ (Panel D). Values are given for each sample (P1 passive funds, P1 active funds, and P2 active funds). Performance measures are measured as percentages; positive coefficients denote increases in alpha or trading costs, whereas negative coefficients represent alpha losses or transaction cost recovery.

[INSERT TABLE 3 HERE]

The control variables across all funds are mostly of the expected sign and are statistically significant across the four panels. For example for *PriceImpact* in Table 3 Panel A, broker trade packages are positively related to the market return (*Market*Buy*) indicating that buy (sell) trade packages in a bull (bear) market have higher price impact. Also trades in low liquidity stocks (*Complex*) and by flow pressured funds (*Lagflow*Buy*) are associated with higher *PriceImpact* and Trade to VWAP. Volatility is negative and significantly related to VWAP across fund samples, which suggests that funds are able to improve upon daily VWAP when stocks are more volatile.

We also find that the longer a fund takes to complete a trade package the greater is *PriceImpact* but the lower is *TradetoVWAP*. Package duration (*Days*) is positive and statistically significant across fund samples for *PriceImpact*. This findings is similar to Chiyachantana *et al.* (2004) who suggest longer duration trades tend to be worked orders that are more difficult to trade. For *TradetoVWAP*, longer package duration is associated with statistically significant lower costs for P1 and P2 active funds, consistent with trading patience. The discrepancy between these two measures may be because *PriceImpact* is measured over several days for a trade package (and so allows for the price to drift from day to day), while *TradetoVWAP* uses the daily VWAP as the benchmark for each day traded in a broker trade package. As such it appears that P1 and P2 active funds beat daily VWAP more easily with trade packages of longer duration, however at the cost of higher *PriceImpact* when benchmarked by the opening price at the start of the trade package.

We find evidence that transaction costs are sensitive to brokerage, which is consistent with *H1* that brokerage is an important factor in assessing implicit transaction costs.[10] For *PriceImpact*, the coefficient of *Brokerage* is negative and statistically significant for our P1 passive and P2 active funds. For *TradetoVWAP* it is negative and statistically significant for P1 passive and P2 active funds, although positive and statistically significant for P1 active funds. For example, for P2 active funds, the coefficients for *Brokerage* across transaction cost measures suggests that a basis point increase in brokerage results in a 0.545 basis points fall in *PriceImpact*, 0.444 basis point fall in *TradetoVWAP*. Our findings therefore provide support for *H1* that brokers create value by reducing trading costs.

Our analysis of short-term alpha (*ExcessReturns* $_{t+20}$) shows P2 active funds have a positive and statistically significant *Brokerage* coefficient of 1.207, suggesting short-term alpha is improved for these funds when paying higher brokerage. For our long-term alpha measure, *Excess Returns*$_{t+254}$, we find that Brokerage is statistically significant only for P1 active funds with a large and statistically significant coefficient of 4.793. This may partly explain why P1 active funds exhibit a positive and statistically significant *TradetoVWAP Brokerage* coefficient of 0.173 and a statistically insignificant coefficient for *PriceImpact*. That is, P1 active funds may be gaining value from brokerage services through alpha at the expense of execution quality. Meanwhile, it appears that P1 passive and P2 active funds derive most benefit from brokerage through transaction cost recovery. For P2 active funds, the significant *PriceImpact* and short-term alpha *Brokerage* coefficients suggest a combined benefit through alpha and implicit

[10] Removing trade packages with brokerage rates of one basis point or less did not quantitatively change our results.

transaction cost recovery of 1.752 basis points per basis point of brokerage spent. For P1 passive funds the significant *PriceImpact* coefficient of 0.567 suggests slightly more than half of brokerage is recovered from implicit transaction costs, while the alpha *Brokerage* coefficients are statistically insignificant.

Our finding that active funds benefit from long-term alpha (i.e. P1 active funds for *Excess* $Returns_{t+254}$) or transaction cost recovery (i.e. P2 active for *PriceImpact* and *Excess* $Returns_{t+20}$ combined) exceed the amount of brokerage paid is of particular note. It may appear that paying higher brokerage provides better alpha and/or transaction cost outcomes. However, brokerage is only one observable cost component of funds management and as such brokerage recovery may be subsidizing other unobservable fund costs, such as fund manager remuneration. In addition, the ability of institutional investors to extract value from brokerage is not new. For example, Goldstein, Irvine and Puckett (2011) find that for every $1 excess commission that institutional investors pay to lead underwriters results in $2.21 in profits from allocated initial public offerings (IPOs). Our results are consistent with active fund managers being able to extract different sources of value from brokerage.

4.4. Brokerage Effects across Samples

To test *H2* and *H3* we consider whether the relation between brokerage and the performance measures (alpha or implicit transaction costs) differs between P1 active funds, P1 passive funds, and P2 active funds. We find evidence consistent with *H2* that index funds benefit more from brokerage with lower implicit transaction costs than active funds. Also consistent with *H3*, P2 active funds benefit more from brokerage than P1 active funds with lower implicit transaction costs.

To assess the statistical significance of the differences noted above we re-compute the regression in equation (5) pooling P1 active and P1 passive fund broker packages while adding a P1 fund interaction variable with *Brokerage*. The interacted *Brokerage* coefficient is a measure of differences in the sensitivity of brokerage between P1 active and P1 passive funds. We also pool P1 active and P2 active fund trade packages and use a P2 fund interaction variable with *Brokerage* to compare brokerage sensitivity between P1 active and P2 active funds. We also include similar interactions with the explanatory variables *Complex*, *Volatility* and *Days* to test whether these fund groups have different abilities in managing implicit transaction costs or alpha generation for various package characteristics (e.g. does *Volatility* affect *TradetoVWAP* differently for P1 active and P1 passive funds).

We report the significance of these interacted explanatory variables in Table 3 (we do not report updated parameter estimates). We denote statistical significance of the interacted coefficients by adding *a*, *b*, or *c* to the reported P1 passive or P2 active regression specifications. These denote statistically significant differences from the P1 active coefficients at the one, five and ten percent levels, respectively.

Between P1 passive and P1 active funds, we find there is a statistically significant interacted *Brokerage* coefficient at the ten percent level for both *PriceImpact* (Table 3 Panel A) and *TradetoVWAP* (Table 3 Panel B). These results provide weak evidence for *H2* that passive funds are better able to influence implicit transaction costs through brokerage than are active funds. Between P1 active and P2 active funds, the interacted *Brokerage* coefficients for both *PriceImpact* (Table 3 Panel A) and *TradetoVWAP* (Table 3 Panel B) is statistically significant at the one percent level.

We find no statistically significant interacted *Brokerage* coefficients for either of the excess return performance measures. For trade characteristics, we find that P1 active funds trade more complex packages at lower transaction costs and achieve higher long-term alpha than P1 passive funds and P2 active funds. This is evident by the significantly different interacted *Complex* coefficients for P1 active relative to P1 passive funds. That is, coefficients are significantly smaller for implicit transaction cost regressions and larger for $ExcessReturns_{t+254}$ regressions. Our findings are consistent with *H3*, where we expected lower brokerage rates in the P2 sample to improve the relation between *Brokerage* and our implicit transaction cost measures. Combined with the individual regression results, it appears that P2 active funds receive relatively better transaction cost services for brokerage spent than P1 active funds.

4.5. Quarterly Fama-MacBeth Analysis

Our base results show that the P1 passive funds and P2 active funds value broker transaction services differently and that there is some evidence P1 active funds value broker advisory services, as measured by trade package alpha. However this may be a statistical artifact of our time period rather than a cross-sectional relation. For example, P1 funds may be paying higher brokerage for more effective 'high touch' transaction services. In P2 brokerage rates are lower and there may be an erosion of brokerage transaction services, which may have poorer implicit transaction cost outcomes. While the effect of falling brokerage and transaction costs is somewhat captured through the use of the linear time trend variable *Dayid*, we employ Fama-MacBeth quarterly cross-sectional regressions (i.e. based on the approach in Fama and MacBeth (1973)) to test whether the *Brokerage* coefficient is stable over time. This serves as a robustness check to our basic regression results. A stable *Brokerage* coefficient that is negative for transaction costs specifications and positive for alpha specifications would provide stronger evidence that high values for *Brokerage* is not a simple consequence of falling brokerage rates.

Every quarter, we estimate our transaction cost models for the P1 and P2 active fund samples to obtain quarterly estimates of the *Brokerage* coefficient.[11] We then calculate the average quarterly time series *Brokerage* coefficient. Newey-West standard errors with three lags are used to estimate *t*-statistics corrected for autocorrelation. To calculate coefficient differences between the P1 and P2 active fund sample, we regress all quarterly *Brokerage* coefficients on a P1 active fund dummy variable and report its coefficient and *t*-statistic.

[11] There is not enough quarterly variation in brokerage data to provide reliable *Brokerage* coefficient estimates for passive funds.

Fama-MacBeth regression results are reported in Table 4. These are consistent with our main results that P1 active funds benefit from long-term alpha for brokerage paid, while P2 active funds benefit from short-term alpha and lower implicit transaction costs. P2 active funds benefit more from lower implicit transaction costs for brokerage paid than P1 active funds.

Table 4 lists average quarterly *Brokerage* coefficients. Panel A reports average *Brokerage* effects for our two implicit transaction costs measures. Panel B lists average *Brokerage* effects for our two alpha specifications. These results are generally consistent with the pooled regression significance results from Table 3.

For *PriceImpact* specifications we find P1 active funds have an average *Brokerage* coefficient of -0.005, which is statistically insignificant. This suggests that no *PriceImpact* benefit is derived from brokerage paid in the P1 sample. P2 active funds have an average *Brokerage* coefficient of -0.421 for the *PriceImpact* measure, which is statistically significant at the five percent level.[12] However we do not find a statistically significant difference between the P1 and P2 active fund coefficients for the *PriceImpact* measure.

For our alternative transaction cost measure, *TradetoVWAP* the coefficient estimates are similar to the results reported in Table 3. The difference in coefficients for P1 and P2 active funds is statistically significant at the one percent level.

[INSERT TABLE 4 HERE]

Results using the $ExcessReturns_{t+20}$ performance measure are reported in Table 4 Panel B. We find P2 active funds have a positive and weakly statistically significant average *Brokerage* coefficient of 1.063 which is similar in magnitude, although lacking in statistical significance, to the value of 1.207 reported in Table 3 Panel B.

Finally for $ExcessReturns_{t+254}$ we find P1 active funds have an average *Brokerage* coefficient of 6.460 which is statistically significant at the ten percent level. Also, the difference

[12] This estimate is slightly lower than the -0.545 reported for the pooled regression in Table 3 Panel A.

between the coefficients of P1 and P2 active funds ('P1 Active - P2 Active') is statistically significant at the five percent level.

The Fama-MacBeth excess return results provide further evidence that P1 active funds are valuing brokerage through long-term alpha rather than through transaction cost recovery. P2 active funds obtain value from transaction cost recovery and short-term alpha.

Overall the Fama-MacBeth results reinforce our pooled regression estimate of statistical significance while confirming that estimates reported in Table 3 do not appear to be a consequence of inter-temporal variation in brokerage costs.

4.6. Quarterly Fund and Broker Transaction Cost Contributions

The findings from our regression and Fama-MacBeth tests show that price impact and alpha are related to brokerage. However we do not directly test whether individual broker ability may be responsible for improving price impact or trade alpha. If individual brokers or fund managers are able to have lower price impact or improve the alpha of trades (controlling for trade characteristics) then simply paying higher brokerage may not be a valuable way of improving price impact or alpha. That is, the variation in outcome might be broker or fund specific. In this section we investigate how brokers and fund managers contribute to transaction costs beyond what is captured through the *Brokerage* regression variable, as well as through our control variables. This also serves as a diagnostic to our basic regression – do our regression residuals suggest additional, relevant broker or fund related features associated with our performance measures.

We calculate transaction cost contributions of both brokers and active fund trades across the two sample periods using a method similar to Anand *et al.* (2012).[13] We calculate the

---

[13] While our method is similar we lack the cross-sectional breadth of fund and broker pairs required to employ Anand *et al.* (2012)'s exact method. As in our Fama-MacBeth results, we do not analyse P1 Passive funds due to a the limited number of quarters for which we have passive fund data.

residual performance measure for each trade package (price impact or alpha) after controlling for trade characteristics. The residual price impact reflects the broker or fund manager's ability to lower (or increase) price impact beyond what is expected by the characteristics of the trade. For example, if the average residual price impact across trades by a broker is negative then the broker has shown ability to lower price impact. Broker transaction cost contributions are calculated using a two-step procedure. First, we compute residuals from the regression of a broker package's *PriceImpact* or *TradetoVWAP* cost against our explanatory variables and fund fixed effects for every quarter. In the second step, we regress these residuals on broker fixed effects and take the estimated coefficients for each broker as their transaction cost contribution for each of the trade packages that they execute. The broker transaction cost contribution for a given quarter is the broker's trade package value weighted average transaction cost contribution. For fund transaction cost contributions, we first use broker (instead of fund) fixed effects followed by regressing the residuals on fund fixed effects in the second step.

Table 5 reports the average quarterly broker and fund transaction cost contributions. We find that brokers do not generate economically or statistically significant differences in implicit transaction costs, beyond those based on our control variables. P2 active broker contribution for *TradetoVWAP* is statistically significant at the five percent level. However, it is an economically insignificant -0.3 basis points per quarter.

[INSERT TABLE 5 HERE]

In contrast, fund transaction cost contributions are mostly statistically significant at the one percent level for both P1 and P2 active funds. For Price Impact, P2 funds have less than half the price impact of P1 active funds (0.109 versus 0.252), with the difference being statistically significant at the five percent level. For Trade to VWAP, P1 active funds contribute 9.8 basis points per quarter while P2 active funds save 4.1 basis points per quarter, with the difference between the samples being statistically significant at the one percent level.

For the alpha results in Table 5 Panel B, we find P1 and P2 active fund contributions for Excess $Returns_{t+20}$ being statistically significant at the ten and five percent level, respectively. However the P1 Active - P2 Active difference is not statistically significant.

Overall, the main contributor to variation in incremental transaction costs is the funds themselves with the P2 sample experiencing lower transaction costs. Specific brokers do not provide additional contributions to alpha and implicit transaction costs. This suggests that the brokerage coefficient in our transaction cost and alpha regressions captures the value of brokerage. It also suggests that, while brokers appear to provide valuable transaction and investment services, there is no strong evidence of broker-specific differences in this value.

5. Conclusion

We examine whether brokers provide valuable transaction services that are both scrutinized and valued by their clients. Using the trades of active and passive fund managers we do not find that active investors in our early sample period (1995-2001) value the implicit transaction services of brokers. Across two implicit transaction cost measures we find either no statistically significant relation to brokerage costs, and or significantly higher implicit transactions costs with higher brokerage rates. We find weak evidence that active fund brokerage is positively related to abnormal returns over a one year period, suggesting that higher brokerage fees may be related to valuable ancillary brokerage services. Passive funds in the same period have weakly significant, negative relation between brokerage rates and implicit transaction costs, consistent with better trade execution with higher brokerage.

In the lower brokerage rate environment from 2002 to 2010, the implicit transaction cost measures for our sample of active funds exhibit a highly statistically significant and negative relation to brokerage. The estimated coefficients indicate that at 54.5 percent of brokerage payments are recouped through lower implicit transaction costs. In addition, short-term alpha improvements are estimated to be 120.7 percent of brokerage paid. The finding is robust to a quarterly Fama-MacBeth regression framework, which accounts for differences in trading ability over time. In summary, we find that brokers have become even more relevant in providing transaction services in the recent low brokerage environment.

References

Aitken, M. J., J. Muthuswamy, and K. L. Wong, 2001, The impact of brokers' recommendations: Australian evidence, Working paper, SIRCA.

Alexander, G. J., G. Cici, and S. Gibson, 2007, Does motivation matter when assessing trade performance? An analysis of mutual funds, *Review of Financial Studies* 20, 125-150.

Anand, A., P. J. Irvine, A. Puckett, and K. Venkataraman, 2012, Performance of institutional trading desks: An analysis of persistence in trading costs, *Review of Financial Studies* 25, 557-598.

Barber, B., R. Lehavy, M. McNichols, and B. Trueman, 2001, Can investors profit from the prophets? Security analyst recommendations and stock returns, *Journal of Finance* 56, 531-563.

Berkowitz, S. A., D. E. Logue, and J. E. A. Noser, 1988, The total cost of transactions on the NYSE, *Journal of Finance* 43, 97-112.

Blume, M. E., 1993, Soft dollars and the brokerage industry, *Financial Analysts Journal* 49, 36-44.

Chan, L. K. C., and J. Lakonishok, 1995, The behavior of stock prices around institutional trades, *Journal of Finance* 50, 1147-1174.

Chiyachantana, C., and P. Jain, 2009, Institutional trading frictions, Working paper, Singapore Management University.

Chiyachantana, C. N., P. K. Jain, C. Jiang, and R. A. Wood, 2004, International evidence on institutional trading behavior and price impact, *Journal of Finance* 59, 869-898.

Comerton-Forde, C., C. Fernandez, A. Frino, and T. Oetomo, 2005, How broker ability affects institutional trading costs, *Accounting and Finance* 45, 351-374.

Conrad, J. S., K. M. Johnson, and S. Wahal, 2001, Institutional trading and soft dollars, *Journal of Finance* 56, 397-416.

Fama, E. F., and J. D. MacBeth, 1973, Risk, return, and equilibrium: Empirical tests, *Journal of Political Economy* 81, 607-636.

Goldstein, M. A., P. Irvine, and A. Puckett, 2011, Purchasing ipos with commissions, *Journal of Financial and Quantitative Analysis* 46, 1193-1225.

Hendershott, T., C. M. Jones, and A. J. Menkveld, 2011, Does algorithmic trading improve liquidity?, *Journal of Finance* 66, 1-33.

Jackson, A. R., 2005, Trade generation, reputation, and sell-side analysts, *Journal of Finance* 60, 673-717.

Kadan, O., L. Madureira, R. Wang, and T. Zach, 2009, Conflicts of interest and stock recommendations: The effects of the global settlement and related regulations, *Review of Financial Studies* 22, 4189.

Keim, D. B., and A. Madhavan, 1997, Transactions costs and investment style: An inter-exchange analysis of institutional equity trades, *Journal of Financial Economics* 46, 265-292.

Kelly, B. T., and A. Ljungqvist, 2007, The value of research, Working paper, New York University.

Nimalendran, M., J. Ritter, and D. Zhang, 2007, Do today's trades affect tomorrow's ipo allocations?, *Journal of Financial Economics* 84, 87-109.

Pinnuck, M., 2003, An examination of the performance of the trades and stock holdings of fund managers: Further evidence, *Journal of Financial and Quantitative Analysis* 38, 811-828.

Sweeney, P., 2012, Where should thrifty traders go for lowest transaction costs?, *Institutional Investor*, accessed 4th March 2013.

Womack, K. L., 1996, Do brokerage analysts' recommendations have investment value?, *Journal of Finance* 51, 137-167.

Appendix

Explanatory Variables

Name	***Definition***
Buy	Dummy variable of 1 for a buy broker package and 0 for a sell.
Brokerage	Total dollar brokerage cost divided by the dollar trade value of a broker package times 100.
Cap	Natural logarithm of the stock's market capitalization.
Complex	Natural logarithm of the volume of a broker package divided by the average daily trading volume over the prior five days.
Dayid	Count of the number of trading days after the start of the sample period.
Days	Number of days between the first and last trade in a broker package.
Fund Fixed Effects	Dummy variables for each fund.
Informed	Dummy with a value of 1 if the t+21 to t+254 excess market return after the last day of the broker package is positive for buys or negative for sells. 0 otherwise.
Lagflow*Buy	Prior month's percentage fund flow. Reversed for sells.
Market*Buy	Return from the opening level on the first day of the broker package to the closing level on the last day of the broker package of the All Ordinaries index. Reversed for sells.
Stock Style Fixed Effects	Dummy variable for the size, book-to-market and momentum portfolio bin that a stock belongs in following Pinnuck (2003).
Volatility	Standard deviation of a stock's daily stock returns in the prior 180 days in percentage.

Table 1
Descriptive Statistics

The table reports various descriptive statistics of fund trade packages from the Portfolio Analytics Database. 'P1 Passive' and 'P1 Active' refer to funds obtained from the first survey request from January 1995 to December 2001 while 'P2 Active' funds are from the second survey request from January 2002 to December 2010. Passive funds comprise index and enhanced index funds while active funds are those that select stocks. A broker trade package is defined by consecutive trades in the same direction for a stock with trades being less than a five-day gap apart by the same broker for a given fund. Mean monthly fund size is the time series average mean month-end fund size. Mean monthly turnover ratio is the time series average monthly turnover ratio. The annual turnover ratio is the sum of buy and sell trade values divided by two in a month as a percentage of the total month-end fund size multiplied by twelve. Mean monthly brokers per fund is the time series average monthly mean number of brokers used per month per fund. 'Equal Weight' denotes equally weighted broker trade package statistics. 'Value Weight' denotes trade value weighted broker trade package statistics.

Fund Statistics	*P1 Passive*		*P1 Active*		*P2 Active*	
Number of Funds	8		18		33	
Number of Brokers Used	47		82		83	
Number of Broker Packages	16,109		38,339		64,348	
Total Packages Value ($bill)	3.10		20.61		79.16	
Mean Monthly Fund Size ($mill)	477.39		184.86		769.85	
Mean Annual Turnover Ratio (%)	8.88		64.68		40.80	
Mean Monthly Brokers per Fund	7.00		9.14		8.80	
Mean Package Value ($'000)	192.37		537.64		1230.17	
% Buy Packages by Count	57.58		53.03		49.61	
% Buy Package by Value	54.51		51.22		48.47	
Broker Package Statistics	*Equal Weight*	*Value Weight*	*Equal Weight*	*Value Weight*	*Equal Weight*	*Value Weight*
Mean Brokerage (%)	0.205	0.235	0.287	0.275	0.171	0.185
Standard Deviation Brokerage (%)	0.105	-	0.137	-	0.084	-
Mean Package Duration (Days)	1.357	1.616	1.676	2.806	1.998	3.046
Mean Price Impact (%)	0.088	-0.104	0.231	0.442	0.082	0.141
Mean Trade to VWAP (%)	0.135	0.053	0.068	0.154	-0.050	-0.015
Mean Excess Returns$_{t+20}$ (%)	-0.253	-0.002	0.250	-0.025	0.130	0.105
Mean Excess Returns$_{t+254}$ (%)	0.974	0.950	2.143	2.093	-0.501	-0.316

Table 2
Brokerage Rates and Revenue

This table reports yearly brokerage and trade statistics of active funds in the Portfolio Analytics Database (PAD) and aggregate on-market trade statistics on the Australian Securities Exchange (ASX) from 1995 to 2010. 'Value Weighted Mean Brokerage' is the trade value weighted brokerage of PAD trades. Brokerage is calculated as the dollar commission divided by the trade value times 100. 'ASX Turnover' is the dollar value of on-market buy and sell trades divided by two. 'Brokerage Log Growth' is the natural log of the current year's brokerage over the prior year's brokerage. 'Turnover Log Growth' is the natural log of the current year's market turnover over the prior year's market turnover. 'Revenue Log Growth' is Brokerage Log Growth plus Turnover Log Growth. Broker HHI ASX Trades is the Herfindahl–Hirschman Index (HHI) of broker trades on the ASX. Broker HHI PAD Trades is the HHI of PAD trade based on the executing brokers.

Year	*Value Weighted Mean Brokerage (%)*	*ASX Turnover ($bill)*	*Brokerage Log Growth (%)*	*Turnover Log Growth (%)*	*Revenue Log Growth (%)*	*Cumulative Revenue Log Growth (%)*	*Broker HHI ASX Trades*	*Broker HHI PAD Trades*
1995	0.327	67.01					5.27	10.35
1996	0.373	91.08	13.07	30.70	43.77	43.77	4.66	5.91
1997	0.283	114.20	-27.51	22.62	-4.89	38.88	4.78	6.64
1998	0.275	129.30	-2.88	12.42	9.54	48.42	4.81	7.27
1999	0.277	170.33	0.58	27.56	28.14	76.56	4.74	7.89
2000	0.280	218.21	1.17	24.77	25.94	102.50	4.63	7.95
2001	0.241	269.73	-14.97	21.20	6.23	108.72	4.91	8.19
2002	0.192	311.03	-22.81	14.24	-8.56	100.16	4.83	9.50
2003	0.255	334.70	28.39	7.34	35.72	135.89	4.99	6.66
2004	0.236	429.08	-7.46	24.84	17.38	153.26	4.86	8.74
2005	0.207	572.75	-13.44	28.88	15.44	168.71	5.10	8.09
2006	0.190	822.34	-8.42	36.17	27.75	196.45	5.38	8.46
2007	0.176	1,370.20	-7.51	51.06	43.55	240.01	5.52	7.69
2008	0.162	1,212.17	-8.36	-12.25	-20.62	219.39	5.79	7.99
2009	0.164	860.84	1.20	-34.23	-33.03	186.36	5.33	8.30
2010	0.155	981.85	-5.55	13.15	7.60	193.96	5.66	8.58

Table 3
Transaction Costs - Base Model

The table reports the regression coefficient estimates of broker trade package transaction costs from fund manager trades in the Portfolio Analytics Database as the dependent variable against explanatory variables. A broker trade package is defined by consecutive trades in the same direction for a stock with trades being less than a five-day gap apart by the same broker for a given fund. 'P1 Passive' and 'P1 Active' refer to funds obtained from the first survey request from January 1995 to December 2001 while 'P2 Active' funds are from the second survey request from January 2002 to December 2010. Passive funds consist of index and enhanced index funds while active funds are those that select stocks. Clustered standard errors by the start date of a trade package are used. Descriptions of explanatory variables are in the Appendix. ***, **, * denotes statistical significance at the 1, 5 and 10 percent level, respectively. a, b, c denote that *brokerage*, *complex*, *volatility* or *days* coefficients are statistically different to the P1 Active coefficient at the 1, 5 and 10 percent level, respectively.

Panel A. ***PriceImpact***

	P1 Passive		*P1 Active*		*P2 Active*	
Intercept	1.708	***	0.902	***	0.879	***
Market*Buy	0.225	***	0.236	***	0.247	***
Cap	-0.075	***	-0.011		0.013	*
Brokerage	-0.567	*b	0.046		-0.545	***a
Complex	0.081	***a	0.043	***	0.043	***
Volatility	-0.026		0.023		0.018	*
Days*100	7.462	***	3.509	***	1.906	***c
Informed	-0.038		0.018		0.006	
Lagflow*Buy*100	11.770		3.335	***	0.033	
Dayid*1000	0.207	*	-0.019		-0.068	***
Fund Fixed Effects	*Yes*		*Yes*		*Yes*	
Stock Style Fixed Effects	*Yes*		*Yes*		*Yes*	
Adjusted R-square	*0.066*		*0.053*		*0.070*	
Number of Broker Packages	16,109		38,339		*64,348*	

Panel B. ***TradetoVWAP***

	P1 Passive		*P1 Active*		*P2 Active*	
Intercept	1.494	***	-0.005		-0.395	***
Market*Buy	0.005		0.002		0.006	***
Cap	-0.019	**	0.010	***	0.042	***
Brokerage	-0.315	*b	0.174	***	-0.444	***a
Complex	0.022	**b	0.012	***	0.047	***a
Volatility	-0.043	***	-0.026	***	-0.005	
Days*100	-1.610		-0.870	***	-1.020	***
Informed	-0.024		0.005		0.020	***
Lagflow*Buy*100	27.630	***	3.092	***	0.021	***
Dayid*1000	-0.154	**	-0.017		-0.038	***
Fund Fixed Effects	*Yes*		*Yes*		*Yes*	
Stock Style Fixed Effects	*Yes*		*Yes*		*Yes*	
Adjusted R-square	0.069		0.056		0.036	
Number of Broker Packages	16,109		38,339		*64,348*	

Panel C. ***ExcessReturns*** $_{t+20}$

	P1 Passive		*P1 Active*		*P2 Active*	
Intercept	-2.170		-2.730	**	1.572	*
Market* Buy	0.137		0.149	***	0.108	***
Cap	0.008		0.056		-0.076	**
Brokerage	0.079		0.292		1.207	**
Complex	-0.148	***c***	-0.036		-0.079	***
Volatility	-0.260	***a***	0.233	***	-0.051	***a***
Days*100	-3.610		-1.480		-1.200	
Informed	-0.069		0.189	**	-0.110	
Lagflow*Buy*100	-17.90		3.645		-0.203	*
Dayid*1000	0.443		0.14		0.013	
Fund Fixed Effects	*Yes*		*Yes*		*Yes*	
Stock Style Fixed Effects	*Yes*		*Yes*		*Yes*	
Adjusted R-square	0.008		0.004		0.003	
Number of Broker Packages	16,109		38,339		*64,348*	

Panel D. ***ExcessReturns*** $_{t+254}$

	P1 Passive		*P1 Active*		*P2 Active*	
Intercept	-14.100		-5.000		12.510	***
Market* Buy	0.676		0.309	*	-0.038	
Cap	-0.293		-0.513	***	0.125	
Brokerage	7.134		4.793	***	-2.980	***c***
Complex	0.108	***a***	0.475	***	-0.034	***a***
Volatility	-6.310	****c***	-9.930	***	3.337	****a***
Days*100	31.140		-17.90	*	-16.200	**
Lagflow*Buy*100	-23.700		3.968		1.657	***
Dayid*1000	11.620	***	8.914	***	-3.130	***
Fund Fixed Effects	*Yes*		*Yes*		*Yes*	
Stock Style Fixed Effects	*Yes*		*Yes*		*Yes*	
Adjusted R-square	0.085		0.141		0.034	
Number of Broker Packages	16,109		38,339		*64,348*	

Table 4
Fama-MacBeth Cross-Sectional Brokerage Coefficients

The table reports average quarterly Fama-MacBeth coefficients of *Brokerage* from regressing transaction cost variables on explanatory variables. The sample contains active funds from the first survey request from January 1995 to December 2001 ('P1 Active') and active funds from the second survey request from January 2002 to December 2010 ('P2 Active') from the Portfolio Analytics Database. A broker trade package is defined by consecutive trades in the same direction for a stock with trades being less than a five-day gap apart by the same broker for a given fund. Transaction cost measures are described in section 3.3 and are in percentages. Explanatory variables are described in the Appendix. Newey-West standard errors with three lags are used to adjust the *t*-statistics. *t*-statistics are in parenthesis. ***, **, * denotes statistical significance at the 1, 5 and 10 percent level, respectively.

Panel A. Transaction Cost Measures

	PriceImpact		*TradetoVWAP*	
P1 Active	-0.005		0.270	***
	(-0.02)		(3.98)	
P2 Active	-0.421	**	-0.455	***
	(-2.24)		(-5.54)	
P1 Active – P2 Active	0.417		0.725	***
	(1.26)		(6.81)	

Panel B. Excess Returns Measures

	$ExcessReturns_{t+20}$		$ExcessReturns_{t+254}$	
P1 Active	-0.032		6.460	*
	(-0.05)		(2.05)	
P2 Active	1.063	*	-1.929	
	(1.74)		(-0.96)	
P1 Active – P2 Active	-1.095		8.389	**
	(-1.24)		(2.23)	

Table 5
Average Quarterly Transaction Cost Contributions by Active Funds and Brokers

Broker transaction cost contributions are calculated using a two-step procedure. Firstly every quarter, we obtain the residuals from the regression of a broker package's *Price Impact* or *Trade to VWAP* cost against our explanatory variables and fund fixed effects. In the second step we regress these residuals on broker fixed effects and take the estimated coefficients for each broker as their transaction cost contribution for each of the trade packages that they execute. The broker transaction cost contribution in a given quarter is the broker trade package value weighted average broker transaction cost contribution. For fund transaction cost contributions, we first use broker (instead of fund) fixed effects followed by regressing the residuals on fund fixed effects in the second step. The sample contains active funds from the first survey request from January 1995 to December 2001 ('P1 active') and active funds from the second survey request from January 2002 to December 2010 ('P2 active') from the Portfolio Analytics Database. A broker trade package is defined by consecutive trades in the same direction for a stock with trades being less than a five-day gap apart by the same broker for a given fund. Transaction cost measures are described in section 3.3 and are in percentages. The table reports average quarterly active fund and broker transaction cost contributions for P1 active, P2 active and their differences. Explanatory variables are described in the Appendix. Newey-West standard errors with three lags are used to adjust the *t*-statistics. *t*-statistics are in parenthesis. ***, **, * denotes statistical significance at the 1, 5 and 10 percent level, respectively.

Panel A. Transaction Cost Measures

	PriceImpact		*TradetoVWAP*	
	Broker	*Fund*	*Broker*	*Fund*
P1 Active	0.001	0.252 ***	-0.004	0.098 ***
	(0.13)	(3.96)	(-1.05)	(3.10)
P2 Active	0.003	0.109 ***	-0.003 ***	-0.041 ***
	(0.36)	(6.15)	(-3.14)	(-6.94)
P1 Active – P2 Active	-0.002	0.143 **	0.000	0.139 ***
	(-0.14)	(2.16)	(-0.045)	(4.32)

Panel B. Excess Returns Measures

	ExcessReturns$_{t+20}$		*ExcessReturns* $_{t+254}$	
	Broker	*Fund*	*Broker*	*Fund*
P1 Active	0.026	0.170 *	0.119	0.024
	(1.31)	(1.76)	(0.63)	(0.01)
P2 Active	0.004	0.334 ***	-0.015	-0.663
	(0.30)	(2.93)	(-0.38)	(-0.75)
P1 Active – P2 Active	0.022	-0.163	0.134	0.687
	(0.88)	(-1.09)	(0.69)	(0.33)