Trading by Crossing

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Abstract

We study actual trading transactions that are darker than all "dark pools," as they are truly invisible to the marketplace both pre- and post-trade. Using a proprietary dataset of institutional trades, we analyze internal crosses – transactions which allow institutions to match purchases and sales without exposing them to an external marketplace. Unlike dark pool trades, internal crosses are not publicly reported to the consolidated tape post-trade, but represent a meaningful proportion of reported volume. Over a 12-year sample period, we estimate total trading cost savings from internal crosses to be $1.9 billion for sample institutions. We also identify potential crosses as market trades that could have been crossed internally absent regulatory or other restrictions. We estimate cost savings from potential crosses to be about $2.4 billion. We provide the first evidence on significant cost savings of internal crosses, thus offer justifications for the Securities and Exchange Commission to continue to allow such invisible trading for mutual funds, and add support to the debate at the Department of Labor on whether to loosen the prohibition of cross trading for plan sponsors. We show that fund families with more assets under management and higher trading intensity are more likely to trade by crossing internally. Overall, our study provides concrete evidence for a new source of economies of scale in asset management via this unusual channel.

Keywords: Institutional Trading, Cross Trading, Inter-Fund Trade, Asset Management, Economies of Scale, Trading Cost, Best Execution

JEL Classification: G10; G23

1. Introduction

Execution costs are an important component of realized returns for investment managers, a fact emphasized by Perold (1988) in the construction of his now widely used method for measuring price impact. By extension, execution costs are important for clients of investment managers whether they are plan sponsors (for institutional investment managers) or individual investors (for retail mutual funds). Considerable attention has been devoted to the minimization of execution costs (seeking "best execution"), both in a normative and positive sense.[1] In this paper, we examine the use of a trading mechanism that is widespread but hitherto understudied: internal crosses.

An internal cross, as its name suggests, is a trade where both counterparties are internal to an investment manager.[2] It is a way for institutional investors to execute some naturally-occurring opposite side transactions without exposing them to the external marketplace. Consider, for example, a large mutual fund family that manages a small-cap fund and a mid-cap fund. As a security moves between small- and mid-cap boundaries, one fund might be a natural buyer while another is a natural seller. Rather than exposing both transactions to the external marketplace, the fund family may cross these trades internally provided certain regulatory restrictions are satisfied. If the trades originate from retail mutual fund accounts or institutional accounts that are not subject to the Employment Retirement Income Security Act (ERISA), then such crosses can be executed without the involvement of a broker and are referred to as direct crosses. If one of the accounts fall under the jurisdiction of ERISA, then the investment manager can conduct a brokered cross in which the manager places simultaneous buy and sell orders for the same security with a broker with the understanding that commissions are reduced because the transaction has natural counterparty liquidity. In addition, the Department of Labor sometimes grants individual exemptions so that even accounts subject to ERISA can participate in direct crosses. We elaborate on the details of this process in Section 2 below.

[1] Models such as Bertsimas and Lo (1998), Almgren and Chriss (2001), and others seek to identify parameters and techniques that minimize the impact of large institutional trades. There is also an extensive empirical literature that documents the determinants of institutional trading costs.

[2] This is not to be confused with internalization in which a broker-dealer crosses order flows from different buy-side investment managers.

Internal crosses have several interesting features. First, the use of internal crossing represents a strategic choice by an investment manager and can affect execution costs as the trades have no price impact and either reduced (for brokered crosses) or zero (for direct crosses) commissions. For the investment manager, they bring obvious benefits with no readily apparent incremental costs. Second, for the client, there are potential benefits and costs: such trades can be used to favor one counterparty over the other. Therefore, both the Securities and Exchange Commission (SEC) and Department of Labor (DOL) regulate such transactions in an effort to ensure that cost-shifting does not take place. Third, from a microstructure perspective, an internal cross represents a unique and interesting trading mechanism. Consider a continuum of order types with varying degrees of exposure to aggregate market order flow. Internal crosses fall in the extreme left tail of such a distribution of external market exposure (or lack thereof), followed by dark pools and external crossing systems, electronic communication networks (ECNs) with limit order books, and finally traditional exchanges.[3] As markets become fragmented across an array of execution platforms and venues, this fragmentation may enhance an *individual* trader's ability to improve execution costs. However, an excessive number of execution systems that provide no price discovery (effectively, all crossing systems), may result in a reduction in the informativeness of market prices due to negative liquidity externalities.

There is relatively little direct empirical evidence on the extent, determinants, and effect of internal crosses. Gaspar, Massa, and Matos (2006) provide evidences on strategic cross-fund subsidization within mutual fund families, based on observed fund returns, allocations of underpriced initial public offerings, and finally opposite trades across member funds inferred from quarterly changes in holdings reported by mutual funds. Using both claims data in class action securities cases and a subset of Abel Noser data, Feinstein, Hu, Marcus, and Ali (2013) find that aggregate damages in class action securities cases estimated using public volume data may be understated due to the frequent occurrence of inter-fund trades (or internal crosses). Eisele, Nefedova, Parise, and Peijnenburg (2017) use a random sample of one million or 1% of Abel Noser equity

[3] Crosses in dark pools involve considerable execution risk since orders may or may not be executed. Dark pool orders also involve price risk because of timing differences between order submission and execution. In contrast, in internal crosses, both risks are removed.

transactions to explore the incentives for mutual funds to trade with sibling funds. They find that cross-trades are used either to opportunistically reallocate performance among trading funds or to reduce trading costs for both counterparties.

The reason for the relatively scant empirical evidence is not surprising – direct crosses are not reported to the Consolidated Transaction System and hence are not included in reported market volume. Unlike dark pool trades which do not generate public pre-trade quotations but publicly report post-trade, internal crosses are not publicly reported at any time. In other words, dark pools are dark pre-trade but "lit" post-trade, whereas internal crosses are dark both pre- and post-trade. Therefore, internal crosses are, in a sense, darker than all dark pools.[4] We extract internal crosses from a proprietary database of institutional trades provided by Abel Noser Solutions, a leading execution quality measurement service provider for institutional investors. The algorithm that we use is simple – it requires that an investment manager have two or more trades on opposite sides of the market (i.e. a buy and a sell) in the same security day, at the same price but from different accounts and zero commissions. This identification allows us to study a unique trading mechanism that is truly invisible to the market.

The database consists of trades executed by 388 investment managers (mutual fund families) over a 12-year sample period between 1999 and 2010. It contains over 31 million daily trade orders that represent over $33 trillion in trade value. Of these, there are nearly half a million internal crosses with a total of over $1 trillion in trade value. Across all years, internal crosses represent 1.6% of the total number of orders executed and 3.1% of total trade value.

We estimate the savings incurred by internal crosses by comparing them to benchmark trades. By definition, an internal cross is both a buy and a sell. Therefore, to estimate potential savings from internal crosses, we must compare them to equivalent market trades. Given the well-known asymmetry in trading costs between buys and sells, we conduct separate benchmark analyses. That is, we compare internal crosses to buy orders and sell orders separately, while controlling for a host of order-, security-, and institution-specific effects. Differences in total costs estimates from such regressions

[4] For information and analysis on dark pool, see, e.g., Zhu (2014), Comerton-Forde and Putniņš (2015), Foley and Putniņš (2016), and Shorter and Miller (2014).

range from 8 to 14 basis points, depending on the benchmark and specification. In dollar terms, a rough estimate of the implied cost saving is about $1.9 billion over the sample period.

We also investigate factors that determine the use of internal crosses. Two economic primitives (that we can measure) appear to drive the usage of internal crosses: the size of the institution measured by the value of assets under management, and the trading intensity measured by dollar trading volume, number of trading orders, and churn rate (Gaspar, Massa, and Matos (2005) and Yan (2008)). Both have straightforward economic interpretations. All else equal, a larger investment manager with more assets under management is more likely to have funds that seek to take opposite positions in a security across their respective portfolios, generating more opportunities to cross trades internally. Similarly, an investment manager that trades more (either because of flow volatility or portfolio turnover), is likely to have more opportunities to cross trades internally. Both factors suggest a channel that generates at least some economies of scale in investment management, in contrast to the typical diseconomies of scale studied in the mutual fund literature (e.g., Berk and Green (2004), Chen, Hong, Huang, and Kubik (2004), and Yan (2008)).

We then turn to examine potential crosses – transactions that investment managers conduct in public markets, which barring regulatory hurdles (and perhaps timing issues) could have been conducted via an internal cross. We detect over four million cases in which an investment manager bought and sold the same security on the same day but for different accounts. There are at least three reasons why these trades may not have been crossed internally. First, it may be that regulatory constraints require that these trades be conducted in a public marketplace. Second, it is possible that a timing mismatch eliminated the possibility of an internal cross. For example, if a buy market order came to the trading desk in the morning and the sell order was not generated until the afternoon, the trade could not been done via an internal cross.[5] Third, it is possible that the trading and compliance infrastructure is simply not in place to conduct the internal cross. We calculate *realizable* crosses as the portion of these paired

[5] For instance, the buys and sells may be motivated by private information which expires or dissipates during a short interval of time, creating urgency to the execution. To the extent that this is the case, the cost savings generated by internal crosses is likely to be upward biased.

transactions with size equal to the minimum of the number of shares in the buy and sell legs. Of the roughly $5 trillion in potentially crossable trades, about $1.1 trillion are realizable. We then impute the cost savings that could have been achieved if investment managers were to fill these trades internally. These savings amount to $2.4 billion; this figure likely represents an upper bound of potential benefits, since it does not include a consideration of costs which may have precluded the internal cross.

Finally, we analyze the effects of internal crosses on external market liquidity. Internally crossed trades are not exposed to the public market. However, if mutual fund families submit these orders to the public market, the market trading volume will increase and there will be temporary price impacts when the buy and sell orders are executed in different time periods of the trading day. To the extent that trading by internal crossing reduces publicly reported trading volume, internal crosses will increase the observed Amihud (2002) illiquidity measure based on publicly reported trading volume, which reflects the price impact of public market order flow. We find that internal crosses exert a meaningful impact on the external market by increasing the observed Amihud illiquidity measure. Since it is well documented that expected stock returns are positively related with stock illiquidity especially for small stocks, our findings suggest that internal crossing trades create a negative externality in external public stock market liquidity.

In terms of contribution, first, internal crosses are not publicly reported anywhere, and represent one of the "unobserved actions of mutual funds" analyzed in Kacperczyk, Sialm, and Zheng (2008). Using actual institutional trades and internal crosses, we provide direct evidences on the extent, cost savings, determinants, and effects of internal crosses. Second, our findings highlight an unusual channel of economies of scale in investment management, in contrast to the typical diseconomies of scale studied in the mutual fund literature, theoretically by Berk and Green (2004), and empirically by Chen, Hong, Huang, and Kubik (2004) and Yan (2008). Thus, our findings complement prior findings of diseconomies of scale in investment management, which mainly focus on fund size, whereas our findings are based on fund family size. In a recent paper, Jiang, Zaynutdinova, and Yao (2018) find economies of scale in asset management based on fund family size. Our paper provides concrete evidence for a new source of economies of scale in asset management at fund family level. Third, our results also complement the findings in Gaspar, Massa, and Matos (2006), who study indirectly inferred opposite trades based on quarterly fund holding changes and focus on the "dark side" of using internal crosses for strategic cross-fund subsidization. On the other hand, our findings provide sound positive economic reasons for why fund families conduct internal crosses, thus justify their existence.

Our paper has important policy and regulatory implications. First, since prior literature only focuses on the potential dark side of internal crosses, one might wonder why regulators, the SEC and the DOL, do not forbid cross trading altogether. In fact, there are regulatory inconsistencies between the SEC, which allows internal crosses within mutual fund families, and the DOL, which forbids such trading for plan sponsors but grants individual exemptions on a case-by-case basis. Our paper provides the first evidence on significant cost savings of internal crosses, and thus offer justifications for the SEC to continue to allow such trading within mutual fund families, and add support to the debate at the DOL on whether to loosen the prohibition of cross trading for plan sponsors.

Second, currently there is no requirement for internal crosses to be publicly reported. This contrasts starkly with trading in dark pools. While conducted anonymously and out of the public eye of major exchanges, even dark pool trading is still publicly reported post-trade. Public reporting of internal crosses will serve at least two important purposes: 1) it will enhance the accuracy and transparency of market data, as it will present to market participants the complete record of trading that took place in a given security. Our results show a meaningful difference of the observed Amihud illiquidity measure based on publically report trading volume and the implied estimate incorporating internally crossed shares; 2) public reporting of internal crosses will also help ensure that they do not lead to abuses of the ability to trade outside the public markets. Improper internal cross trading could benefit investors of one fund at the expense of the investors of another, as pointed out by Gaspar, Massa, and Matos (2006). Since funds within the same fund family have fiduciary duties to their own respective investors, internal crosses should only happen if such trades are beneficial to investors of both funds involved, or alternatively, beneficial to one fund and at least neutral (not harmful) to the other fund. Public reporting of internal crosses post-trade would make it easier for investor watchdogs to monitor and confirm that internal crosses were being executed properly and fairly.

The reminder of the paper is organized as follows. In section 2, we discuss institutional background for internal crosses. Section 3 describes the data used in this study and Section 4 presents our empirical results. Section 5 concludes.

2. Institutional Background

The SEC allows investment managers to conduct internal crosses through exemptions provided by Rule 17a-7 under the Investment Company Act of 1940. This rule permits crosses between mutual funds and other accounts that have the same investment advisor so long as certain requirements are met. The central requirement is that the transaction occurs at an independent "current market price," which, depending on the security and exchange listing, is either the last transaction price or the most recent mid-point quote. The intuition behind this requirement is that such a price is an objective, fair and independent price that does not favor one crossing party over another. Therefore, investment managers with retail mutual funds or institutional accounts that are not subject to ERISA may conduct direct crosses without regulatory approval.[6]

If the investment management firm manages assets for a plan sponsor that is subject to ERISA, however, then the investment manager may not cross trades from such a plan sponsor with another account under the aegis of Rule 17a-7. This is because the DOL believes that crosses can be used to favor one account over another using a variety of mechanisms such as cherry-picking which securities to cross, or selectively choosing the timing of the cross, etc., which is a violation of section 406(b)(2) of ERISA.[7] However, recognizing that such a blanket prohibition may impose costs on plan sponsors,

[6] According to Pozen (2002), "[s]uch interfund trades are permitted under SEC rules as long as no commission is paid to any broker and the price at which the trades are executed correspond to the last independent price at which a trade in the relevant security has been carried out in the trading day; or, if no independent trades have occurred on that day, the price is midway between the highest independent bid and lowest independent offer. Consistent with the approach taken by the SEC to other potential conflict of interest situations, SEC rules governing interfund trading require a fund's board of directors to adopt procedures to govern such trading and to make quarterly determinations that such interfund trades meet the conditions in these rules."

[7] For details, see, e.g., Cross-Trades of Securities by Investment Managers, *Federal Register*, Volume 63, No. 54, 13696-13701, March 20, 1998, and Department of Labor (2006).

the DOL grants individual exemptions from prohibitions of this section of ERISA. These exemptions, referred to as Prohibited Transaction Exemptions (PTEs), are granted to the investment manager for specific plan sponsors' accounts that are subject to ERISA regulations.[8] Thus, an investment manager can conduct a direct cross under Rule 17a-7 or, if it has a PTE, for an account's plan sponsor. The benchmark prices for such direct crosses are established under Rule 17a-7, and by construction, no commissions are paid.

3. Data

We obtain proprietary transaction-level institutional trading data from Abel Noser Solutions, a leading execution quality measurement service provider for institutional investors. Abel Noser data are similar in nature to the SEI trade data used by Chan and Lakonishok (1993, 1995), and the Plexus data used by Keim and Madhavan (1995, 1997) and Conrad, Johnson, and Wahal (2001, 2003). Abel Noser data have been used in prior publications such as Chemmanur, He, and Hu (2009), Hu (2009), Chemmanur, Hu, and Huang (2010), Puckett and Yan (2011), Anand, Irvine, Puckett, and Venkataraman (2012, 2013), Edelen and Kadlec (2012), Brogaard, Hendershott, Hunt, and Ysusi (2014), and Hu, McLean, Pontiff, and Wang (2014). A complete list of publications using Abel Noser data is contained in Hu, Jo, Wang, and Xie (2018). Examples of working papers using Abel Noser data include Choi, Park, Pearson, and Sandy (2017) and Huang, Tan, and Wermers (2017).

Abel Noser data cover equity trading transactions by a large sample of institutions from January 1999 to December 2010.[9] For each transaction, the data include the date of the transaction, the stock traded (identified by both symbols and CUSIPs), the number of shares traded, the dollar principal traded, commissions paid by the institution, and whether it is a buy or sell by the institution. The data are provided to us under the condition that the names of all institutions are removed from the data. However, identification codes are provided enabling us to separately identify all institutions.

[8] For an example, see PTE 94-43, Fidelity Management Trust Company, *Federal Register*, Volume 59, 30041, June 10, 1994.

[9] We end our sample in 2010, because in 2011 Abel Noser stopped providing a code that separately identifies anonymous institutions in the data ("clientcode"). This change renders it impossible to implement our algorithm to identify internal crosses.

Sample institutions are either investment managers or plan sponsors. Investment managers are mutual fund families such as Fidelity Investments, Putnam Investments, and Lazard Asset Management. Examples of pension plan sponsors include the California Public Employees' Retirement System (CalPERS), the Commonwealth of Virginia, and United Airlines. See Hu, Jo, Wang, and Xie (2018) for detailed descriptions and related issues of Abel Noser data.

We identify internal crosses as pairs of trades conducted by a fund family for the same number of shares on the opposite side (buy and sell) of the same stock, on the same day, executed at exactly the same price, but from different funds/accounts and with zero commissions.[10] We match all trading records to security-specific information from CRSP and then impose the following screens to eliminate data errors and outliers. Specifically, we eliminate those securities for which the CRSP database has missing PERMNOs, exchange codes, opening and closing prices, volume, and returns on the date of the trade. We also eliminate securities with prices under $1 and securities which are not listed in NYSE/AMEX/NASDAQ, trades with closing price reported by Abel Noser as not within 1% of the closing price reported by CRSP, total trading volume reported by Abel Noser larger than that reported by CRSP, and those for which the number of shares traded is less than 100.[11] Finally, we eliminate trades for which the calculated implicit trading cost (or price impact) is less than -50% or greater than 50%, and those for which the explicit trading cost is greater than 10%. Altogether, there are 74.6 million buy trades and 66.4 million sell trades that meet our data requirements.

We conduct our analysis at the daily trade order level rather than the individual trade level, similar to Hu (2009). A daily trade order (henceforth, order) is defined as the aggregation of all similar trades (market trades or internal crosses) by a mutual fund family on the same stock on the same side (buy/sell) on the same day. Based on the

[10] Our method to identify internal crosses effectively classifies brokered crosses into the same category as market trades. However, brokered crosses are relatively unimportant in our sample, representing 0.27% of the total number of orders executed and only 0.05% of total trade value. Therefore, separating internal crosses into direct crosses and brokered crosses in the empirical analysis would not seem to add much value but would make the analysis less parsimonious. However, we have also conducted our analysis by classifying the trades into three categories: direct crosses, brokered crosses, and market trades, and our findings are similar to the results reported in this paper.

[11] We adjust the CRSP volume for NASDAQ firms following Appendix B in Gao and Ritter (2010).

above definition, our dataset consists of over 31 million orders (16.6 million buy orders and 14.8 million sell orders) that represent over $32 trillion in trade value during the 12-year sample period. Descriptive statistics of our dataset are presented in Table 1.

Panel A of Table 1 reports the number of orders and trade value by year. In general, the number of orders and trade value increases through time. The number of orders and trade value both increase sharply from 1999 through 2008, from 0.8 million to 4.0 million orders and from $1.6 trillion to $3.8 trillion in trade value. There are decreases in the trading activity of our sample of mutual fund families during the post-crisis period of 2009 and 2010. Within the whole sample period, the total number of buy orders is larger than the total number of sell orders, although the total buy value does not differ substantially from the total sell value. As a consequence, the average buy order size is smaller than the average sell order size in our sample.

Panel B of Table 1 shows that there are 388 fund families over our 12-year sample period. More than one-quarter of mutual fund families execute trades using internal crosses. Further, the number of mutual fund families using internal crossing increases throughout the sample period. The number of stocks employed in internal crosses also increases over time. Panel C shows the importance of internal crosses relative to market trades in terms of number of orders and trade value. Across all years, internal crosses represent 1.55% of the total number of orders and 3.14% of total trade value. Our sample of mutual fund families have conducted nearly half a million internal crosses with a total of over $1 trillion in trade value during the entire sample period. On the whole, trading by internal crossing is an important phenomenon in terms of the number of institutions and stocks involved as well as its contribution to the mutual fund families' trading activities; internal crosses are also of growing importance in our sample period.

In Table 2, we present the order and security characteristics of market trades and internal crosses. Internal crosses are larger than market trades in terms of average dollar trade size, average absolute trade size (number of shares traded) and average relative trade size (trade size as a proportion of the average daily CRSP volume of the respective stock during the past 20 days). While internal crosses tend to occur in stocks with larger market capitalization, there are no large differences in the volatility and turnover of stocks between market trades and internal crosses. In addition, the average stock return on the trading day and cumulative stock return prior to the trading day for market trades and internal crosses are not very much different between each other.

4. Empirical Results

Our analysis has four components. First, we estimate the savings in trading costs resulting from internal crosses, including price impact as well as commissions. Second, we examine institution-specific factors that affect the propensity to use internal crosses. Third, we investigate *potential* crosses: trades that a mutual fund family exposed to the market which, to an outside observer, appear eligible to be at least partially executed via an internal cross. This provides an estimate of (and perhaps an upper bound on) potential cost savings from internal crosses. In addition, by isolating situations where mutual fund families choose not to cross internally, it may provide more information on the trade-offs (and so the determinants) of internal crosses. Last, we assess the impacts of internal crosses on the external market.

4.1. Cost Savings from Internal Crosses

We calculate implicit costs for each order by scaling the execution price of the order by the opening price on the trading day:

$$\text{Implicit cost} = \text{side} \times \frac{P_t - P_o}{P_o}$$

where P_t is trade-volume-weighted average price, P_o is opening price, and side is an indicator variable that equals 1 for a buy order and -1 for a sell order. Our definition of implicit cost is similar to the price impact measure used in the institutional trading literature and it captures the costs associated with the bid-ask spread and price impact when executing a trade. Explicit costs for each order are calculated by scaling commissions per share by the opening price of the trading day:

$$\text{Explicit cost} = \frac{C_t}{P_o}$$

where C_t is volume-weighted-commissions per share. We calculate the total cost for each order by adding implicit cost and explicit cost. The trade value weighted average trading costs for market trades and internal crosses are in Table 3.

In Panel A of Table 3, we present the trading costs across all trading days in our sample period. The implicit costs of market trades are higher for sells (33 basis points) than buys (20 basis points), as is typically observed in prior studies. The implied implicit cost of internal crosses is 22 basis points. Compared with small stocks, large stocks have smaller reduction in implicit costs for buy trades and larger reduction in implicit costs for sell trades. Since there are no commissions involved, explicit costs for internal crosses always equal zero. Further, implicit costs for internal crosses for buy and sell orders always sum to zero by definition, since a pair of internal crosses consist of a buy and sell order in the same stock on the same day executed at the same price. This is related to the stream of literature on the buy-sell asymmetry of institutional trading costs discussed in Macey and O'Hara (1997), theoretically analyzed in Saar (2001), and empirically examined in Chiyachantana, Jain, Jiang, and Wood (2004), Hu (2009), Brennan, Chordia, Subrahmanyam, and Tong (2012), and Chiyachantana, Jain, Jiang, and Sharma (2017).

While Panel A gives us the overall picture of trading costs across the entire sample period, it is useful to examine the magnitude of (shadow) trading costs under different market conditions. This is because implicit costs can take positive or negative values, which depend on whether the order consumes or supplies liquidity and thus are primarily affected by the market conditions under which the order is executed. Accordingly, buys will have positive (negative) implicit costs and sells will have negative (positive) implicit costs on days with positive (negative) stock returns. To get a better understanding of trading costs under various market conditions, we divide our observations into days with either positive, negative or zero open-to-close returns of the stocks being traded and examine the trading costs in each of these scenarios.

As seen in Panel B through Panel D of Table 3, for buy orders, internal crosses have lower implicit costs than market trades regardless of whether the open-to-close returns are zero, positive or negative. The differences in implicit costs range from 12 basis points (on days with zero open-to-close returns) to 24 basis points (on days with either positive or negative open-to-close returns). Together with the savings in explicit costs, buy orders which are executed using internal crossing may have a reduction in total execution costs of between 26 and 34 basis points compared to benchmark trades that are executed on the exchange. On the other hand, the reduction in trading costs associated with the use of internal crossing for sell orders is somewhat smaller. In fact, the use of internal crosses for sell orders, on days with negative and zero open-to-close returns, is associated with higher implicit costs than using market trades. Nevertheless, when we also take into account the savings in explicit costs, internal crosses still have lower total trading costs than market trades by 5 basis points on days with negative returns and 15 basis points on days with positive returns. On the whole, Table 3 provides evidence that mutual fund families experience lower average transactions costs when trading through internal crosses for both large and small stocks; in addition, cost savings are more significant for buy orders.

4.2. Regression Analysis of Trading Costs

We estimate the cost savings associated with internal crosses, while controlling for the following order-specific and security-specific variables: (1) Market capitalization of the stock on the day prior to the trading day; (2) Relative trade size, calculated by dividing the number of shares of the order by the average daily CRSP volume of the stock during the past 20 days; (3) Inverse price which is defined as one divided by the closing price of the stock on the day prior to the trading day; (4) NYSE/AMEX which is a dummy variable that equals 1 if the stock is listed on NYSE/AMEX and equals 0 if the stock is listed on NASDAQ; (5) Return volatility, defined as the standard deviation of daily returns from day -20 to day -1 relative to the trade; (6) Cumulative stock return, again from day -20 to day -1 relative to the trade; (7) Average turnover (day -20 to -1) and (8) Volatility of turnover, calculated as the standard deviation of daily turnover from day -20 to day -1. Turnover is defined as the daily CRSP trading volume in the stock divided by number of shares outstanding in the firm. The last four variables are used to control for the price movement and trading activities of the stock during the past 20 days before the order execution.

We also aggregate the institution-specific variables from the Abel Noser database to capture the characteristics of the mutual fund family during the calendar month in which it executes the trade. These include total dollar trading volume, the total number of stocks traded and the number of orders executed during the calendar month. In addition, we include the positive open-to-close return and negative open-to-close return dummy variables to control for the effect of the underlying stock return on the trading cost measures.

The key variable of our regression model is the Internal cross dummy variable which equals 1 if our algorithm indicates that the order is executed by internal crossing and 0 if the order is executed by market trade. The sign and magnitude of this variable provides us with a measure of the net effect of internal crossing on the costs of executing the order.

We estimate our trading costs regressions separately for the buy and sell orders. Table 4 contains parameter estimates from Fama-MacBeth regressions estimated each month. Model 1 is a standard trading cost regression with institution fixed effect and Model 2 includes institution-specific variables.

We first look at the results of the regressions with implicit costs as the dependent variable. As expected, the positive (negative) open-to-close return dummy variable is positively (negatively) significant in all buy order regressions and negatively (positively) significant in all sell order regressions. On average, the implicit costs are different by 250 to 260 basis points between days of positive and negative underlying stock return. On the other hand, the estimation results of the institution-specific variables in Model 2 have consistent signs but are not always statistically significant in different regressions. That is, we do not find strong direct evidence on how the institution-specific factors affect the implicit cost of trading. Nevertheless, as shown in the later section, the institution-specific factors can affect implicit costs through their positive impacts on the probability of internal crossing.

The internal cross dummy variable is negative and statistically significant in all buy and sell order regressions. The implicit costs of buy orders are reduced by eleven basis points if they are executed using internal crossing. These figures are smaller than the univariate results reported in Table 3, which do not control for the effects of the order, security and institution characteristics, although the direction of the difference is the same. In the case of sell orders, the internal cross dummy is found to be statistically significant but takes a smaller value than the buy order regressions. This result is consistent with Table 3 that the cost saving from internal crossing is less for sell orders.

Nevertheless, our regression results indicate that the implicit costs of sell orders can still be lowered by 4 basis points by crossing the orders internally.

For the total cost regressions, the coefficient on the internal cross dummy variable is negative and statistically significant at the 1% level in all four regressions. The reported regression coefficients indicate that the buy orders have a reduction in total execution costs of between 19 to 21 basis points, while sell orders which are crossed internally have a reduction in total execution costs of 13 basis points, compared to market trades.

While the internal cross dummy variable reported in Table 4 are the time-series averages of the coefficients from the 144 monthly regressions, it is interesting to investigate the evolution of the monthly coefficients over our 12-year sample period. We calculate the yearly averages of the monthly coefficients on the internal cross dummy from the total cost regression with institution fixed effect and plot their pattern in Figure 1. As shown in Figure 1, all the yearly averages are found to have negative values. For buy orders, internal crossing works better in the earlier period. On the other hand, the performance of internal crossing for sell orders are more stable during the whole period and is better than buy orders during the latter part of our sample period.

While the regression results provide an estimate of the cost savings from internal crossing in basis points per trade, we are able to convert the cost savings into dollar terms to get an aggregate estimate of economic significance. Multiplying the total buy value in each year with the yearly average of the buy order internal cross dummy of the respective year as depicted in Figure 1, the sum of total cost savings from executing the buy orders with internal crossing in our whole sample period is equal $1.09 billion. Similarly, the cost savings from executing the sell orders with internal crossing is estimated to be $0.64 billion. Therefore, the total benefits from internal crossing for our sample of mutual fund families are estimated to be equal to $1.73 billion within our twelve year period.

4.3 Matched Sample Analysis of Trading Costs

An alternative method for estimating the cost savings from internal crosses is to compare the trading costs of market trades with internally crossed trades with similar order and security characteristics. The matched sample analysis has the advantages that it does not require linearity or any specific functional from in the relation between trading costs and trade characteristics. In this section, we compare the cost savings by matching internally crossed trades with market trades with characteristics used as the control variables in the trading costs regressions.

To conduct the matched sample analysis, we assign each daily trade order with the decile rank of market capitalization, relative trade size, stock price and return standard deviation (during the past 20 days before the trade). We use the breakpoints of the market capitalization distribution of NYSE stocks at the end of the previous month to assign the decile rank of market capitalization. The decile ranks of relative trade size, stock price and return standard deviation are based on all sample orders (all market trades and internally crossed trades) executed within the same month. Each internal cross is then matched with market trades on the following dimensions: buy or sell, exchange listing (NYSE/AMEX or NASDAQ), open-to-close return (positive, negative or zero), and the decile rank of market capitalization, relative trade size, stock price and return standard deviation. Where more than one market trade matches, the trade value weighted average trading cost of all market trades is calculated. We are able to match 230,691 buy orders and 228,259 sell orders. These represents 94.84% of buy orders and 93.84% of sell orders in the overall internal crosses sample.

Table 5 reports the average trading cost differentials (in basis points) between internal crosses and matched market trades weighted by the trade value of the internal cross. As shown in Table 5, for buy trades, internal crosses have lower implicit costs and total costs than similar market trades in all years. The savings in total costs ranges from 16 basis points (in 2010) to 43 basis points (in 2004) and the overall average cost savings equal 30 basis points. Compared with regression analysis, the cost savings from matched sample analysis are larger and more stable across years. On the other hand, the cost savings of internal crosses for sell trades are relatively smaller. This finding is consistent with the univariate analysis reported in Table 3 and the regression analysis reported in Table 4.

Similar to regression analysis, we can calculate dollar cost savings by multiplying the cost savings in basis points with the trade value. We do the multiplication for each year and sum up the yearly savings to compute the overall savings for the whole sample period. Our calculation indicates that the savings of total trading costs for buy orders equal \$1.51 billion and that for the sell orders equal \$0.43 billion. Thus, the total cost savings from all internal crosses equal \$1.94 billion and this figure is similar to what we have estimated from the regression analysis (\$1.73 billion).

4.4. Determinants of Internal Crossing

Given that internal crossing is associated with reductions in trading costs, it is important to gain a better understanding of the factors that determine the occurrence of internal crosses. In this section, we analyze the determinants of internal crossing by regression analysis.

In our analysis, the dependent variable is the propensity to cross, which is defined as the number of orders (both buy and sell) executed through internal crosses divided by the total number of orders (both buy and sell) from a mutual fund family in each calendar quarter. The explanatory variables include previous quarter's trading variables used in the trading cost regression together with mutual fund family characteristics variables reported at the end of the previous quarter in the 13F filings by money managers to the SEC. The data from the 13F filings are collected from Thomson Reuters 13F database and the variables compiled include each sample institution's total value of portfolio assets, number of stocks held, portfolio concentration, and churn rate. To calculate an institution's portfolio concentration, we first classify each stock held by an institution into one of the 25 (5×5) groups based on size and book-to-market ratio. We then calculate the percentage share of each group held by the institution and compute the Herfindahl index by summing up the squares of these percentage shares. As such, a higher value of the Herfindahl index indicates a higher concentration of asset portfolio in terms stock characteristics. We follow Gaspar, Massa, and Matos (2005) and Yan (2008) to calculate the churn rate which reflects how frequently the mutual fund family rotates its positions on all the stocks of its portfolio. To be specific, the churn rate $CR_{i,t}$ for institution i at quarter t is defined as:

$$CR_{i,t} = \frac{\sum_{j\in Q}\left|N_{j,i,t}P_{j,t} - N_{j,i,t-1}P_{j,t-1} - N_{j,i,t-1}\Delta P_{j,t}\right|}{\sum_{j\in Q}\frac{N_{j,i,t}P_{j,t} + N_{j,i,t-1}P_{j,t-1}}{2}}$$

where Q denotes the set of stocks held by institution i, and $P_{j,t}$, and $N_{j,i,t}$ denote the price and the number of shares of stock j held by institution i at quarter t. The higher the churn rate, the more frequent the institution buys and sells its assets and the shorter the horizon of its investment.

We estimate Fama-MacBeth quarterly regressions for the sample period between January 1999 and December 2010 during which the Abel Noser trading data are available. We have three model specifications with Model 1 using only trading variables from Abel Noser as explanatory variables, Model 2 using only variables from SEC 13F filings as explanatory variables, and Model 3 incorporating both sets of explanatory variables. We have 48 quarterly regressions for Model 2 and only 47 quarterly regressions for Model 1 and 3 since we miss one quarter for the lagged Abel Noser explanatory variables. However, since we are not able to match all Abel Noser investment managers to SEC 13F filings data, we have less available observations for Models 2 and 3 than Model 1. The total number of available institution-quarter observations for Model 1, Model 2, and Model 3 are 3,551, 2,318, and 2,059, respectively.

Table 6 reports the regression results. For Model 1, all explanatory variables are statistically significant at the 1% level. Our results indicate that the propensity to cross internally within a mutual fund family is positively related with its trading value and number of trading orders executed. This is intuitive as when there is more trading by the same mutual fund family, there will be a higher chance for opposite sides (buy versus sell) of trading orders to naturally occur for the same stock. In contrast, the number of stocks traded by the mutual fund family has a negative effect on the propensity to cross internally. One possible reason for this finding is that if a mutual fund family trades a large number of stocks, other things equal, there will be less chance for any particular stock to be simultaneously bought and sold by different funds or accounts in the same mutual fund family. Consequently, the probability of successfully crossing the order internally becomes lower.

For Model 2, both the variables of total value of portfolio assets and churn rate are positively significant while the variables of number of stocks held and portfolio concentration are statistically insignificant. The positive significance of the total value of portfolio assets variable suggests that internal crossing is more likely to occur in mutual fund families that are larger in scale. The results of Model 3 are mostly consistent with that of Models 1 and 2 except that churn rate becomes statistically insignificant though still positive. Overall, we can conclude from Table 6 that larger mutual fund families with bigger asset value and heavier trading activities have a higher proportion of internally crossed trades. On the other hand, we do not find evidence that the propensity to cross is significantly affected by the institution's portfolio concentration, and only weak evidence for the institution's investment horizon.

Given our earlier results that internally crossed trades have lower trading costs, we provide new evidence on one possible channel that generates economies of scale in asset management: the higher ability for larger fund families to internally cross trades thus saving trading costs in the process. This complements prior mutual fund literature that mainly focuses on diseconomies of scale in investment management (e.g., Berk and Green (2004), Chen, Hong, Huang, and Kubik (2004), and Yan (2008)).

4.5. Potential Internal Crosses

Potential internal crosses refer to situations where a mutual fund family has both buy and sell orders on the same stock on the same day but the orders are not crossed internally. Of course, since trade sizes for buy and sell orders may differ, even if all other conditions for crossing were entirely met, not all of these trades could be filled through an internal crossing mechanism. We define *realizable* crosses as the portion of potential crosses with trade size equals to the minimum of buy size or sell size. The remaining portion belongs to the non-realizable crosses. As an example, consider a case where a mutual fund family bought 5,000 shares of a stock and sold 7,000 shares of the same stock on the same day. Total shares traded are 12,000 shares, but it might have been possible for the mutual fund family to cross 5,000 shares on the buy side against 5,000 shares on the sell side. In this example, we calculate potential internal cross for buy as 5,000 shares and potential internal cross for sell as 7,000 shares, whereas realizable internal cross for buy and sell both equal 5,000 shares. There is no non-realizable potential cross for buy and the non-realizable potential cross for sell is 2,000 shares.

We provide our analysis of potential crosses in Table 7. Panel A shows that there are 4.1 million potential cross buy orders which by definition, is equal to the number of potential cross sell orders. The number of shares that can be potentially crossed on the buy (sell) side equals 155 billion (159 billion) with a trade value of $5.2 trillion ($5.5 trillion). Comparing these figures with the statistics of market trades reported in Table 2 (16.4 million market buy order with a trade value of $15.8 trillion and 14.6 million market sell order with a trade value of $15.7 trillion), approximately 25% (28%) of buy (sell) orders executed by market trades can be potentially crossed within the fund families. This represents more than 32% (35%) of the total buy (sell) value of market trades.

Panel B of Table 7 compares the trading costs of potentially crossed market trades to that of non-crossable market trades. Note that the implicit costs of crossable buy trades are lower than that of non-crossable market buy trades; in contrast, there is little difference in the implicit costs of crossable and non-crossable market sell trades. Not surprisingly, the explicit costs of crossable buy and sell trades are all lower than their non-crossable market trade counterparts. These results suggest that when a mutual fund family submits both buy and sell orders on the same stock on the same day, the commissions can be reduced because the transactions have natural counterparty liquidity and brokers are able to spend less effort to execute these trades.

As mentioned above, not all potentially crossable market trades can be filled through the internal crossing mechanism. Panel C of Table 7 shows that out of the $5,171 billion ($5,473 billion) potentially crossable buy (sell) value, only $1,113 billion ($1,112 billion) are realizable. Therefore, the realizable portion equals about 22% (20%) of total potentially crossable buy (sell) value.

We estimate the dollar cost savings that can be achieved if the mutual fund families are able to fill the realizable potentially crossable market trades using an internal crossing mechanism. To conduct such an estimation, first consider how implicit costs are measured. The sum of the implicit costs (without scaling by opening price) for buying and selling one share of a particular stock simultaneously equals its buying price minus selling price. If the orders can be crossed internally, the price impacts are internalized and all implicit costs can be saved. In other words, the difference between the buying and selling prices are absorbed within the same mutual fund family and any possible price benefits can be shared by the buying and selling accounts.

Panel C of Table 7 shows that for the realizable portion of potential crosses, the buy side has a trade value of $1,112.76 billion and the sell side has a trade value of $1,111.91 billion. That means that mutual fund families have paid $0.85 billion more in buying than what they have received from selling the same stock on the same day during the 12-year sample period. If these trades can be crossed internally, these $0.85 billion cost saving can be shared between different accounts within the same mutual fund family. Together with the saving from explicit costs of $1.58 billion, the cost savings of potential crosses can be amounted to a total of $2.43 billion.

As noted in Table 1, around 60% of mutual fund families in our sample have not executed any internally crossed trades and they may not be able or have no interests to cross the potentially crossable market trades internally. In Panel D of Table 7, we separate our analysis into the sample that have conducted at least one internally crossed trade and another sample that have never conducted any internally crossed trades. We find that for the latter sample, the buy value of realizable potential crosses is actually slightly smaller than the sell value while at the same time their explicit costs are not that large. Therefore, there is not much benefit for them to cross these trades internally. In contrast, for the mutual fund families that have experience in executing internally crossed trades, they are able to achieve the total cost saving of $2.40 billion from crossing the potentially crossable orders.

4.6. Effects of Internal Crosses on External Market Liquidity

Internally crossed trades are executed within the mutual fund family and not exposed to the public market. Furthermore, they are not reflected in the reported trading volume and do not move market prices directly. However, if mutual fund families submit these orders to the public market, the market trading volume will increase and there will be temporary price impacts when the buy and sell orders are executed in different time periods of the trading day. As a first approximation, it is perhaps reasonable to assume that the permanent price impacts of these buy and sell trades if executed externally would net to zero since they do not affect the net order imbalance in the public market. On the other hand, to the extent that trading by internal crossing reduces publicly reported trading volume, internal crosses will increase the observed Amihud (2002) illiquidity measure based on publicly reported trading volume, which reflects the price impact of public market order flow. In this section, we investigate the extent to which the presence of internally crossed trades would have affected this important and widely used proxy for stock market liquidity.

From our dataset we gather the sample of stock-day observations that our sample institutions have conducted at least one internally crossed trade in the stock on that day. For each stock-day observation in the sample, we use CRSP volume data to calculate the observed Amihud illiquidity measure which is defined as the ratio of daily absolute return (in percentage) to dollar trading volume (in million dollars) on that day. We also compute the implied Amihud illiquidity measure by assuming that all internally crossed trades are executed in the external market but have no effects on the daily returns. As such, the implied Amihud illiquidity measure is calculated by dividing the absolute stock return by the sum of CRSP and internal crossing dollar volume.

Table 8 reports the observed and implied Amihud measures and their percentage differences. The reported average Amihud measures are weighted by the market capitalization of the stock on the trading day. We separately report these two measures for large stocks and small stocks, and for different years.

Results in Table 8 show that there is a decrease in Amihud measures starting from 2003. This is consistent with Chordia, Roll, and Subrahmanyam (2011), who find an uptrend in trading activity and turnover, and also consistent with Fong, Holden, and Trzcinka (2017), who find that the average slope of Kyle's (1985) price function "lambda" declines gradually from 2003 for both NYSE and NASDAQ stocks.[12] Across all years, the average observed and implied Amihud measures for large stocks equal 0.008 and 0.007, respectively, while those for small stocks equal 0.460 and 0.347, respectively. These figures represent an 8% difference between the two measures for large stocks, and a 25% difference for small stocks. In addition, there are larger differences between the two measures during the earlier part of our sample period. It is

[12] Fong, Holden, and Trzcinka (2017) also find that the Amihud illiquidity measure is highly correlated with lambda.

worth noting that impact of internal crosses on the differences between the observed and implied Amihud measures are understated in Table 8, because we can only observe internal crosses contained in Abel Noser data, which cover a subset of institutional investors.

Our findings in Table 8 indicate that internal crossing exerts an impact on the external market by increasing the observed Amihud illiquidity measure. Since it is well documented that expected stock returns are positively related with stock illiquidity especially for small stocks (e.g., Amihud (2002)), our findings suggest that internal crossing creates a negative externality in external public stock market liquidity. This is intuitive as trades executed inside fund families take away extra liquidity that would have been available in the public market to other market participants. We note that the findings documented in this section only apply to those stock-days when our sample fund families executed internally crossed trades. Nevertheless, these findings can still give us some ideas about how internal crossing trades affect external market liquidity.

5. Conclusion

In this study, using transaction-level institutional trading data, we have shown that it is commonplace for fund families to buy and sell the same stock for different accounts on the same day. While many of these trades are executed through the external market, there is also a considerable amount executed by internal crosses, which is a way for institutions to execute some naturally-occurring opposite side transactions without exposing them to the external marketplace. Internal crosses are not publicly reported anywhere, and represent one of the "unobserved actions of mutual funds" analyzed in Kacperczyk, Sialm, and Zheng (2008). Thus, ours is a comprehensive study of actual trading transactions that are truly invisible to the marketplace.

Internally crossed trades incur lower explicit and implicit costs of trading. We estimate that the total trading cost savings enjoyed by our sample fund families amount to \$1.9 billion during our sample period. If fund families are able to profitably exploit opportunities of executing those market trades that are potentially crossable through an internal crossing mechanism, there could be a further saving of trading costs of \$2.4 billion. Since fund families with larger trading value and more assets under management are more likely to trade by crossing internally, our findings identify a new channel and provide concrete evidence for a source of economies of scale in asset management.

Our findings complement prior findings of diseconomies of scale in investment management and the dark side of using internal crosses for strategic cross-fund subsidization. Our study has important policy and regulatory implications. Our findings on the significant cost savings of internal crosses provide justifications for the SEC to continue to allow internal cross trading within mutual fund families, and add support to the debate at the DOL on whether to loosen the prohibition of cross trading for plan sponsors. In addition, our paper also calls for post-trade transparency and public disclosure of internal crosses.

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Table 1
Data Descriptive Statistics

The sample covers institutional trades from Abel Noser Solutions during the period from January 1999 to December 2010. We classify each trade in the database into either market trade or internal cross. An internal cross is identified as a trade conducted by a mutual fund family for the same number of shares on the opposite side of the same stock, executed at the same price, with zero commissions but from different accounts/funds. The analyses are done at the daily trade order level where a daily trade order is defined as the aggregation of all similar trades (market trades or internal crosses) by a mutual fund family on the same stock on the same side on the same day. In panel C, figures in parentheses represent the relative importance of each type of trades out of all trades.

Panel A: Number of orders and trade value covered in dataset

	Number of orders (in million)			Trade value (in billion dollar)		
	Buy	Sell	Total	Buy	Sell	Total
1999	0.484	0.324	0.808	832.79	800.99	1,633.78
2000	0.609	0.433	1.043	1,107.40	1,082.10	2,189.50
2001	0.755	0.531	1.286	1,101.37	1,028.32	2,129.69
2002	1.009	0.786	1.795	1,143.07	1,117.01	2,260.08
2003	1.191	0.879	2.071	1,061.35	1,065.91	2,127.25
2004	1.417	1.126	2.542	1,245.43	1,201.85	2,447.28
2005	1.534	1.321	2.856	1,457.40	1,476.41	2,933.82
2006	1.912	1.775	3.687	1,846.41	1,865.72	3,712.13
2007	1.921	1.753	3.674	1,930.03	1,977.78	3,907.81
2008	1.998	2.017	4.015	1,907.23	1,931.70	3,838.92
2009	1.961	1.931	3.892	1,380.12	1,396.50	2,776.61
2010	1.841	1.939	3.781	1,263.75	1,283.42	2,547.17
All years	16.633	14.816	31.449	16,276.36	16,227.71	32,504.06

Panel B: Number of mutual fund families and stocks classified by types of trade

	Number of mutual fund families			Number of stocks		
	All trades	Market trades	Internal crosses	All trades	Market trades	Internal crosses
1999	37	37	8	6,148	6,148	1,272
2000	43	43	11	6,070	6,070	1,283
2001	63	63	20	5,687	5,685	1,297
2002	80	80	26	5,388	5,388	1,485
2003	85	85	21	5,490	5,490	1,324
2004	116	116	26	6,183	6,182	1,550
2005	133	133	30	6,253	6,253	3,288
2006	157	157	37	6,445	6,445	3,132
2007	157	157	38	6,556	6,556	2,505
2008	151	151	41	5,968	5,967	2,923
2009	145	145	41	5,301	5,301	2,788
2010	140	140	33	5,440	5,440	3,147
All years	388	388	145	11,891	11,891	5,565

Panel C: Number of orders and trade value classified by types of trades

	No of orders (in million)		Trade value (in billion dollar)	
	Market trades	Internal crosses	Market trades	Internal crosses
1999	0.789	0.018	1,564.13	69.65
	(97.73%)	(2.27%)	(95.74%)	(4.26%)
2000	1.017	0.026	2,046.35	143.15
	(97.55%)	(2.45%)	(93.46%)	(6.54%)
2001	1.260	0.026	2,014.27	115.43
	(97.98%)	(2.02%)	(94.58%)	(5.42%)
2002	1.773	0.022	2,172.12	87.96
	(98.76%)	(1.24%)	(96.11%)	(3.89%)
2003	2.053	0.018	2,081.41	45.84
	(99.13%)	(0.87%)	(97.85%)	(2.15%)
2004	2.525	0.017	2,404.86	42.42
	(99.34%)	(0.66%)	(98.27%)	(1.73%)
2005	2.795	0.061	2,820.01	113.81
	(97.86%)	(2.14%)	(96.12%)	(3.88%)
2006	3.615	0.072	3,597.91	114.22
	(98.04%)	(1.96%)	(96.92%)	(3.08%)
2007	3.616	0.057	3,816.56	91.26
	(98.44%)	(1.56%)	(97.66%)	(2.34%)
2008	3.952	0.063	3,739.78	99.15
	(98.43%)	(1.57%)	(97.42%)	(2.58%)
2009	3.832	0.060	2,715.29	61.32
	(98.46%)	(1.54%)	(97.79%)	(2.21%)
2010	3.735	0.046	2,512.31	34.86
	(98.78%)	(1.22%)	(98.63%)	(1.37%)
All years	30.962	0.487	31,484.99	1,019.07
	(98.45%)	(1.55%)	(96.86%)	(3.14%)

Table 2
Order and Security Characteristics

The sample covers institutional trades from Abel Noser Solutions during the period from January 1999 to December 2010 and the trades are classified into either market trades or internal crosses. The unit of analysis is daily trade order which is defined as the aggregation of all similar trades (market trades or internal crosses) by a mutual fund family on the same stock on the same side on the same day. Large (small) stocks are those stocks with market capitalization on the trading day falling into the upper (lower) half of market capitalization distribution of NYSE stocks as at the end of the previous month. Relative trade size is trade size divided by the average daily CRSP volume of the respective stock during the past 20 days. Daily turnover of the stock is the daily CRSP volume divided by number of shares outstanding.

Panel A: Internal crosses

	Large stocks			Small stocks			All stocks		
	1999 – 2004	2005 – 2010	1999 – 2010	1999 – 2004	2005 – 2010	1999 – 2010	1999 – 2004	2005 – 2010	1999 – 2010
Number of buys (in million)	0.06	0.13	0.18	0.01	0.05	0.06	0.06	0.18	0.24
Total buy value (in billion dollar)	244.25	229.83	474.08	7.97	27.48	35.45	252.22	257.31	509.53
Number of sells (in million)	0.06	0.13	0.18	0.01	0.05	0.06	0.06	0.18	0.24
Total sell value (in billion dollar)	244.25	229.83	474.08	7.97	27.48	35.45	252.22	257.31	509.53
Average trade value (in million dollar)	4.37	1.82	2.60	1.03	0.52	0.58	3.97	1.43	2.09
Average trade size (in thousand share)	118.75	54.66	74.29	78.07	33.42	39.08	113.80	48.36	65.46
Average relative trade size (%)	7.78	1.66	3.54	60.97	8.97	15.56	14.25	3.83	6.55
Average daily return standard deviation (day -20 to -1, in %)	3.39	2.30	2.64	3.91	3.11	3.21	3.46	2.54	2.78
Average daily turnover (day -20 to -1, in basis point)	0.88	1.28	1.16	1.18	1.41	1.38	0.91	1.32	1.21
Stock return on trading day (%)	-0.11	0.05	0.00	-0.44	0.08	0.02	-0.15	0.06	0.01
Cumulative stock return (day -20 to -1, in %)	1.18	1.07	1.10	-0.54	1.55	1.29	0.97	1.21	1.15

Panel B: Market trades

	Large stocks			Small stocks			All stocks		
	1999 – 2004	2005 – 2010	1999 – 2010	1999 – 2004	2005 – 2010	1999 – 2010	1999 – 2004	2005 – 2010	1999 – 2010
Number of buys (in million)	3.68	6.62	10.31	1.72	4.36	6.08	5.40	10.99	16.39
Total buy value (in billion dollar)	5,729.64	8,216.57	13,946.21	509.55	1,311.07	1,820.62	6,239.19	9,527.64	15,766.82
Number of sells (in million)	2.85	6.92	9.77	1.16	3.64	4.80	4.02	10.56	14.57
Total sell value (in billion dollar)	5,603.56	8,457.48	14,061.04	440.40	1,216.74	1,657.14	6,043.96	9,674.22	15,718.17
Average trade value (in million dollar)	1.73	1.23	1.40	0.33	0.32	0.32	1.30	0.89	1.02
Average trade size (in thousand share)	51.57	39.96	41.72	22.76	19.13	20.09	42.75	30.34	34.11
Average relative trade size (%)	3.83	1.34	2.15	19.75	6.68	10.14	8.70	3.32	4.96
Average daily return standard deviation (day -20 to -1, in %)	2.49	2.23	2.31	3.28	3.08	3.14	2.73	2.55	2.60
Average daily turnover (day -20 to -1, in basis point)	0.77	1.31	1.13	0.86	1.34	1.21	0.80	1.32	1.16
Stock return on trading day (%)	0.07	0.07	0.07	0.07	0.03	0.04	0.07	0.06	0.06
Cumulative stock return (day -20 to -1, in %)	1.62	1.09	1.26	1.38	0.32	0.60	1.55	0.81	1.03

Table 3
Trading Cost Statistics

This table reports the average trading costs (in basis points) for market trades and internal crosses. Implicit costs are calculated by scaling the execution price of the trade with the opening price on the trading day. Explicit costs are calculated by scaling commissions per share by the opening price on the trading day. Large (small) stocks are those stocks with market capitalization on the trading day falling into the upper (lower) half of market capitalization distribution of NYSE stocks as at the end of the previous month. The reported average trading costs are weighted by trading value. ***, ** and * denotes statistical significance at the 1%, 5% and 10% level, respectively for the testing of difference in weighted average trading costs between internal crosses and market trades.

Panel A: All trading days

		Buys				Sells			
		No of orders	Implicit costs	Explicit costs	Total costs	No of orders	Implicit costs	Explicit costs	Total costs
Large stocks	Internal crosses	182,273	-20.24	0.00	-20.24	182,273	20.24	0.00	20.24
	Market trades	10,305,425	19.97	9.12	29.08	9,770,236	31.57	9.20	40.77
	Difference		-40.21***	-9.12***	-49.33***		-11.33***	-9.20***	-20.52***
Small stocks	Internal crosses	60,977	-40.12	0.00	-40.12	60,977	40.12	0.00	40.12
	Market trades	6,084,034	18.28	16.59	34.87	4,802,357	41.62	17.43	59.05
	Difference		-58.40***	-16.59***	-74.98***		-1.51	-17.43***	-18.94***
All stocks	Internal crosses	243,250	-21.63	0.00	-21.63	243,250	21.63	0.00	21.63
	Market trades	16,389,459	19.77	9.98	29.75	14,572,593	32.63	10.06	42.70
	Difference		-41.40***	-9.98***	-51.38***		-11.01***	-10.06***	-21.07***

Panel B: On days with positive open-to-close return

		Buys				Sells			
		No of orders	Implicit costs	Explicit costs	Total costs	No of orders	Implicit costs	Explicit costs	Total costs
Large stocks	Internal crosses	89,619	116.00	0.00	116.00	89,619	-116.00	0.00	-116.00
	Market trades	5,194,913	136.29	9.17	145.46	4,775,558	-107.61	9.22	-98.39
	Difference		-20.29***	-9.17***	-29.46***		-8.39***	-9.22***	-17.61***
Small stocks	Internal crosses	30,340	130.41	0.00	130.41	30,340	-130.41	0.00	-130.41
	Market trades	3,043,893	178.50	16.82	195.32	2,214,410	-150.81	17.24	-133.57
	Difference		-48.10***	-16.82***	-64.92***		20.40***	-17.24***	3.16**
All stocks	Internal crosses	119,959	116.96	0.00	116.96	119,959	-116.96	0.00	-116.96
	Market trades	8,238,806	141.07	10.04	151.10	6,989,968	-112.25	10.08	-102.17
	Difference		-24.10***	-10.04***	-34.14***		-4.71***	-10.08***	-14.79***

Panel C: On days with negative open-to-close return

		Buys				Sells			
		No of orders	Implicit costs	Explicit costs	Total costs	No of orders	Implicit costs	Explicit costs	Total costs
Large stocks	Internal crosses	90,593	-149.53	0.00	-149.53	90,593	149.53	0.00	149.53
	Market trades	4,981,160	-122.29	8.98	-113.31	4,878,085	141.57	9.11	150.68
	Difference		-27.24***	-8.98***	-36.22***		7.96***	-9.11***	-1.15
Small stocks	Internal crosses	29,493	-190.49	0.00	-190.49	29,493	190.49	0.00	190.49
	Market trades	2,902,326	-169.91	16.11	-153.81	2,481,798	201.37	17.38	218.75
	Difference		-20.57***	-16.11***	-36.68***		-10.89***	-17.38***	-28.26***
All stocks	Internal crosses	120,086	-152.47	0.00	-152.47	120,086	152.47	0.00	152.47
	Market trades	7,883,486	-127.87	9.82	-118.06	7,359,883	147.72	9.96	157.68
	Difference		-24.59***	-9.82***	-34.41***		4.75***	-9.96***	-5.21***

Panel D: On days with zero open-to-close return

		Buys				Sells			
		No of orders	Implicit costs	Explicit costs	Total costs	No of orders	Implicit costs	Explicit costs	Total costs
Large stocks	Internal crosses	2,061	-15.28	0.00	-15.28	2,061	15.28	0.00	15.28
	Market trades	129,352	-2.40	12.27	9.87	116,593	0.33	12.19	12.51
	Difference		-12.88***	-12.27***	-25.15***		14.95***	-12.19***	2.77
Small stocks	Internal crosses	1,144	-14.23	0.00	-14.23	1,144	14.23	0.00	14.23
	Market trades	137,815	-4.38	22.46	18.08	106,149	6.52	24.15	30.67
	Difference		-9.85***	-22.46***	-32.31***		7.70**	-24.15***	-16.45***
All stocks	Internal crosses	3,205	-15.19	0.00	-15.19	3,205	15.19	0.00	15.19
	Market trades	267,167	-2.71	13.88	11.16	222,742	1.26	13.99	15.25
	Difference		-12.48***	-13.88***	-26.35***		13.93***	-13.99***	0.06

Table 4
Trading Cost Regressions

This table reports the Fama-MacBeth regressions results with implicit cost or total cost (in basis points) as the dependent variable. The sample covers institutional trades obtained from Abel Noser Solutions during the period from January 1999 to December 2010. The unit of analysis is daily trade order which is defined as the aggregation of all similar trades (market trades or internal crosses) by a mutual fund family on the same stock on the same side on the same day. Implicit cost is calculated by scaling the execution price of the trade with the opening price on the trading day. Total cost is the sum of implicit cost and explicit cost where explicit cost is calculated by scaling commissions per share by the opening price on the trading day. Internal cross is a dummy variable which equals 1 (0 otherwise) if the order is executed by internal crossing. Positive (negative) open-to-close return is a dummy variable which equals 1 (0 otherwise) if the open-to-close return of the stock on the trading day is greater (less) than zero. Market capitalization of the stock is calculated using the closing price on the day prior to the trading date. Relative trade size is trade size divided by the average daily CRSP volume of the respective stock during the past 20 days. Inverse price is one divided by the closing price on the day prior to the trading day. NYSE/AMEX is a dummy variable which equals 1 if the stock is listed on NYSE/AMEX and equals 0 if the stock is listed on NASDAQ. Daily turnover of the stock is the daily CRSP volume divided by number of shares outstanding. Trading value of institution during calendar month, number of stocks traded by institution during calendar month and number of orders of institution during calendar month are compiled from the Abel Noser Solutions database. The reported figures are the time-series averages of the coefficients from the 144 monthly cross-sectional regressions and figures in parentheses are the t-statistics. ***, **, and * denotes statistical significance at the 1%, 5%, and 10% level, respectively.

	Implicit costs				Total costs			
	Buys		Sells		Buys		Sells	
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
Internal cross	-11.571***	-10.893***	-3.893**	-3.802**	-20.789***	-18.769***	-13.197***	-12.565***
	(-6.35)	(-5.91)	(-2.20)	(-2.28)	(-10.47)	(-9.43)	(-7.72)	(-7.70)
Positive open-to-close return	139.288***	140.139***	-123.041***	-123.017***	138.848***	139.657***	-123.963***	-123.986***
	(33.65)	(33.71)	(-32.11)	(-32.13)	(33.60)	(33.62)	(-32.09)	(-32.17)
Negative open-to-close return	-128.622***	-128.564***	130.992***	131.948***	-129.200***	-129.200***	130.136***	131.042***
	(-31.82)	(-31.75)	(30.88)	(30.83)	(-31.90)	(-31.87)	(30.97)	(30.88)
Log (market capitalization)	0.441**	0.478***	0.805***	0.975***	0.481***	0.684***	0.553***	0.878***
	(2.49)	(2.67)	(5.22)	(6.22)	(2.71)	(3.71)	(3.66)	(5.83)
Log (relative trade size)	1.094***	0.711***	2.841***	2.265***	1.998***	1.620***	3.390***	2.630***
	(9.20)	(6.23)	(21.72)	(18.71)	(16.39)	(13.92)	(25.82)	(21.26)
Inverse price	33.564***	25.846***	67.941***	60.623***	170.762***	164.301***	241.173***	236.637***
	(4.37)	(3.42)	(8.34)	(7.65)	(17.70)	(17.49)	(24.14)	(25.41)
NYSE/AMEX	-3.879***	-4.216***	-1.490	-1.605*	-1.171	-1.526*	2.111**	2.289***
	(-5.37)	(-5.70)	(-1.52)	(-1.66)	(-1.46)	(-1.84)	(2.54)	(2.70)
Return standard deviation	-0.131	0.108	2.452***	2.624***	0.279	0.552	2.896***	3.040***
(day -20 to -1)	(-0.35)	(0.29)	(6.35)	(6.76)	(0.75)	(1.46)	(7.34)	(7.66)
Cumulative stock return	-0.060*	-0.017	-0.185***	-0.219***	-0.071**	-0.032	-0.198***	-0.234***
(day -20 to -1)	(-1.67)	(-0.49)	(-4.99)	(-5.82)	(-2.00)	(-0.89)	(-5.35)	(-6.16)
Average turnover	1.033***	1.142***	0.922***	1.027***	1.171***	1.334***	0.976***	1.063***
(day -20 to -1)	(3.22)	(3.54)	(3.56)	(3.92)	(3.64)	(4.12)	(3.76)	(4.06)

Turnover standard deviation	-2.160***	-2.253***	0.391	0.277	-2.220***	-2.331***	0.277	0.182
(day -20 to -1)	(-5.35)	(-5.54)	(1.05)	(0.74)	(-5.47)	(-5.71)	(0.73)	(0.48)
Log (trading value of institution		1.112***		1.473***		0.974**		0.475
during calendar month)		(3.04)		(3.91)		(2.54)		(1.11)
Log (number of stocks traded by		1.580		2.927***		1.093		1.445
institution during calendar month)		(1.54)		(2.99)		(1.11)		(1.63)
Log (number of orders of		-1.351		-3.818***		-3.558***		-3.863***
institution during calendar month)		(-1.55)		(-4.09)		(-4.26)		(-4.26)
Institution fixed effect	Yes	No	Yes	No	Yes	No	Yes	No
Average R^2	0.348	0.344	0.326	0.321	0.351	0.346	0.331	0.325

Table 5
Matched Sample Trading Cost Differentials

We assign each daily trade order with the decile rank of market capitalization, relative trade size, stock price and return standard deviation during the past 20 days before the trade. We use the breakpoints of the market capitalization distribution of NYSE stocks at the end of the previous month to assign the decile rank of market capitalization. The decile ranks of relative trade size, stock price and return standard deviation are based on all sample orders executed within the same month. Each internal cross is then matched with market trades on the following dimensions: buy or sell, exchange listing (NYSE/AMEX or NASDAQ), open-to-close return (positive, negative or zero), and the decile rank of market capitalization, relative trade size, stock price and return standard deviation. Where more than one market trade matches, the trade value weighted average trading cost of all market trades is calculated. We are able to match 94.84% of buy order and 93.84% of sell orders from internal crossing. The table reports the average trading cost differentials (in basis points) between internal cross and matched market trades weighted by the trade value of the internal cross. Figures in parentheses are standard errors. ***, ** and * denotes statistical significance at the 1%, 5% and 10% level, respectively.

	Buy			Sell		
	Implicit costs	Explicit costs	Total costs	Implicit costs	Explicit costs	Total costs
1999	-20.38***	-6.43***	-26.81***	8.78***	-6.72***	2.05
	(2.53)	(0.07)	(2.53)	(2.38)	(0.07)	(2.39)
2000	-31.73***	-5.49***	-37.21***	4.12	-5.58***	-1.45
	(2.84)	(0.06)	(2.84)	(2.92)	(0.06)	(2.92)
2001	-20.13***	-8.90***	-29.04***	2.59	-8.76***	-6.17**
	(2.95)	(0.10)	(2.95)	(2.99)	(0.09)	(2.99)
2002	-24.53***	-16.36***	-40.89***	14.92***	-16.48***	-1.56
	(2.36)	(0.16)	(2.36)	(2.44)	(0.16)	(2.45)
2003	-20.36***	-16.70***	-37.06***	3.02	-16.83***	-13.81***
	(2.01)	(0.16)	(2.02)	(1.92)	(0.16)	(1.92)
2004	-28.57***	-14.11***	-42.68***	18.96***	-14.58***	4.38**
	(1.94)	(0.13)	(1.95)	(1.95)	(0.15)	(1.94)
2005	-9.40***	-10.18***	-19.58***	-5.95***	-10.35***	-16.29***
	(0.71)	(0.05)	(0.72)	(0.69)	(0.05)	(0.69)
2006	-15.75***	-7.32***	-23.07***	-1.42**	-7.37***	-8.79***
	(0.72)	(0.03)	(0.72)	(0.71)	(0.04)	(0.71)
2007	-13.19***	-6.49***	-19.68***	-0.96	-6.69***	-7.66***
	(0.91)	(0.04)	(0.91)	(0.91)	(0.04)	(0.91)
2008	-27.99***	-7.21***	-35.20***	-9.66***	-7.47***	-17.13***
	(1.79)	(0.04)	(1.79)	(1.72)	(0.04)	(1.72)
2009	-20.13***	-9.53***	-29.65***	-7.95***	-9.90***	-17.84***
	(1.32)	(0.05)	(1.32)	(1.32)	(0.06)	(1.32)
2010	-7.23***	-8.47***	-15.69***	-17.54***	-8.59***	-26.13***
	(1.15)	(0.05)	(1.15)	(1.18)	(0.06)	(1.18)
All years	-20.44***	-9.06***	-29.50***	0.53	-9.21***	-8.68***
	(0.49)	(0.02)	(0.49)	(0.48)	(0.02)	(0.48)

Table 6
Determinants of Internal Crosses

This table reports the Fama-MacBeth regression results with propensity to cross as the dependent variable. Propensity to cross is defined as the number of orders for internal cross divided by the total number of orders from a mutual fund family in each calendar quarter and is expressed in percentage. The sample covers institutional trades obtained from Abel Noser Solutions during the period from January 1999 to December 2010. The explanatory variables include the previous quarterly trading variables collected from the Abel Noser Solutions database and the mutual fund family characteristics variables reported at the end of the previous quarter in the 13F filings of money managers to the SEC. Portfolio concentration of institution is the Herfindahl index compiled from the percentage share of institution's asset value in the 5×5 groups of stocks classified by size and book-to-market ratio. Churn rate of an institution follows the definition in Gaspar, Massa, and Matos (2005) and Yan (2008). The reported figures are the time-series averages of the coefficients from the quarterly cross-sectional regressions and figures in parentheses are the t-statistics. ***, **, and * denotes statistical significance at the 1%, 5%, and 10% level, respectively.

	Model 1	Model 2	Model 3
Intercept	-1.086***	-2.840***	-2.942***
	(-16.86)	(-16.00)	(-9.89)
Variables from Abel Noser			
Log (trading value of institution)	0.165***		0.189***
	(12.23)		(3.95)
Log (number of stocks traded by institution)	-0.131***		-0.354***
	(-4.65)		(-6.36)
Log (number of orders of institution)	0.122***		0.267***
	(4.23)		(3.46)
Variables from 13F			
Log (total value of portfolio assets of institution)		0.388***	0.170***
		(12.87)	(4.21)
Log (number of stocks held by institution)		-0.039	0.063
		(-0.90)	(0.88)
Portfolio concentration of institution		-0.098	-0.038
		(-0.47)	(-0.15)
Churn rate of institution		0.303***	0.114
		(2.83)	(0.69)
Number of quarterly observations	47	48	47
Average R^2	0.111	0.199	0.257

Table 7
Potential Crosses

Potential crosses refer to the cases that the same mutual fund family has both buy and sell orders (not necessarily at the same order size) on the same stock on the same day and the orders have not been crossed internally. Realizable potential crosses are the portion of potential crosses with trade size equals to the minimum of buy size or sell size and non-realizable potential crosses are the remaining portion of potential crosses. The reported average trading costs in panel B are trade value weighted and figures in parentheses are standard errors.

Panel A: Descriptive statistics of potential crosses

	Buys	Sells
Number of orders (in million)	4.083	4.083
Total trade value (in billion dollar)	5,171.36	5,472.74
Total number of shares (in billion)	155.34	159.07

Panel B: Trading costs of potentially crossable and non-crossable market trades

	Buys		Sells	
	Crossable	Non-crossable	Crossable	Non-crossable
Implicit cost (in basis point)	13.67	22.75	33.72	32.05
	(0.12)	(0.07)	(0.12)	(0.07)
Explicit cost (in basis point)	8.18	10.86	8.33	10.99
	(0.00)	(0.00)	(0.00)	(0.00)
Total cost (in basis point)	21.85	33.61	42.05	43.04
	(0.12)	(0.07)	(0.12)	(0.07)

Panel C: Realizable and non-realizable fraction of potential crosses

	Realizable fraction		Non-realizable fraction	
	Buys	Sells	Buys	Sells
Total trade value (in billion dollar)	1,112.76	1,111.91	4,058.60	4,360.83
Total number of shares (in billion)	32.732	32.732	122.61	126.34
Actual explicit cost (in billion dollar)	0.780	0.800	3.446	3.780

Panel D: Realizable potential crosses from mutual fund families which have and have not conducted internal crossing

	From mutual fund families which have conducted at least one internally crossed trade		From mutual fund families which have never conducted internally crossed trades	
	Buys	Sells	Buys	Sells
Total trade value (in billion dollar)	1,084.12	1,083.26	28.646	28.649
Total number of shares (in billion)	31.919	31.919	0.814	0.814
Actual explicit cost (in billion dollar)	0.760	0.781	0.020	0.020

Table 8
Internal Crosses and External Market Liquidity

This table reports the Amihud illiquidity measures from the stock-day observations that the sample mutual fund families have conducted at least one internal crossing. For each stock-day observation in the sample we calculate the observed Amihud illiquidity measure which is defined as the ratio of the daily absolute return (in percentage) to the CRSP dollar trading volume (in million dollars) on that day. Implied Amihud illiquidity measure is defined as the ratio of the daily absolute return to the sum of CRSP and internal crossing dollar trading volume. Large (small) stocks are those stocks with market capitalization on the trading day falling into the upper (lower) half of market capitalization distribution of NYSE stocks as at the end of the previous month. The reported average Amihud measures are weighted by the market capitalization of the stock on the trading day.

		N	Observed Amihud illiquidity measure	Implied Amihud illiquidity measure	Percentage difference
1999	Large stocks	8,368	0.016	0.013	13.28
	Small stocks	790	2.321	1.483	36.08
	All stocks	9,158	0.018	0.015	16.61
2000	Large stocks	11,973	0.014	0.012	15.06
	Small stocks	727	2.502	1.079	56.89
	All stocks	12,700	0.016	0.013	19.79
2001	Large stocks	11,616	0.013	0.012	13.64
	Small stocks	1,358	1.825	0.814	55.40
	All stocks	12,974	0.017	0.013	22.72
2002	Large stocks	9,257	0.013	0.011	10.11
	Small stocks	1,814	2.651	1.009	61.94
	All stocks	11,071	0.023	0.015	33.08
2003	Large stocks	7,691	0.009	0.009	7.63
	Small stocks	1,251	0.730	0.450	38.40
	All stocks	8,942	0.012	0.010	14.32
2004	Large stocks	6,570	0.006	0.005	7.25
	Small stocks	1,786	0.304	0.232	23.77
	All stocks	8,356	0.008	0.007	11.30
2005	Large stocks	21,858	0.006	0.006	3.75
	Small stocks	7,820	0.404	0.335	17.19
	All stocks	29,678	0.010	0.010	9.12
2006	Large stocks	25,176	0.005	0.005	3.51
	Small stocks	9,819	0.233	0.196	15.84
	All stocks	34,995	0.008	0.008	7.94
2007	Large stocks	21,772	0.004	0.004	2.69
	Small stocks	6,103	0.154	0.111	27.75
	All stocks	27,875	0.005	0.005	9.74
2008	Large stocks	19,426	0.007	0.007	2.43
	Small stocks	11,105	0.375	0.342	8.77
	All stocks	30,531	0.013	0.012	5.39

2009	Large stocks	20,619	0.008	0.008	2.00
	Small stocks	8,282	0.744	0.677	9.05
	All stocks	28,901	0.016	0.015	5.59
2010	Large stocks	13,199	0.005	0.005	2.05
	Small stocks	9,416	0.407	0.360	11.47
	All stocks	22,615	0.015	0.014	8.04
All years	Large stocks	177,525	0.008	0.007	8.00
	Small stocks	60,271	0.460	0.347	24.62
	All stocks	237,796	0.012	0.011	13.76

Figure 1
Magnitudes of the Yearly Averages (× -1) of the Internal Cross Dummy Variable in the Total Trading Costs Regressions with Institution Fixed Effect