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# Institutional Trades and Intra-Day Stock Price Behavior

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## Abstract

This paper examines the price impact of institutional stock trading, using a unique data set which reports the transactions (large and small) made by 37 large institutional money management firms. The direction of each trade and the identity of the management firm behind each trade are known. While institutional trades are associated with some price pressure, we find that the average price impact is small. There is also a marked asymmetry between the price impact of buys versus sells. We relate our findings to various hypotheses on the elasticity of the demand for stocks, the cost of executing transactions and the determinants of market impact. While market capitalization and relative trade size influence the market impact of a trade, the dominant influence is the identity of the money manager behind the trade.

This paper uses a unique data set to examine the effects of institutional trading on stock prices. This data set reports the transactions made by a sample of 37 large institutional money management firms over the course of two and a half years. Each transaction is explicitly identified as a purchase or sale by the money management firm in question; in addition, we are able to distinguish between the trades of different management firms. There are more than one million transactions, both small and large, involving issues listed on the New York and American Stock Exchanges. These transactions account for 5 percent of the dollar value traded on these two exchanges over the sample period. We compare the price at which each transaction is executed with a variety of benchmark price measures on the date of the trade. Tracking the intra-day behavior of prices around institutional trades allows us to evaluate the price impact of institutional trades and helps us to disentangle alternative explanations for the sources of such market impact.

Trading on equity markets has become increasingly dominated by institutional investors. Schwartz and Shapiro (1990) estimate that in 1989 about seventy percent of trading volume on the New York Stock Exchange is accounted for by member firms and institutional investors. In light of their importance, the impact of institutional trading on stock prices has been the subject of increased attention. Some have suggested, for example, that the increased concentration of trading increases intra-day price swings (Report of the New York Stock Exchange's Panel on Market Volatility and Investor Confidence, 1990).

Trades in a particular stock may be generated under a variety of investment styles (active or passive, value or growth) as well as a variety of order placement strategies (market or limit orders), on the part of both buyers and sellers. Most of these factors are not directly observable at the time of the trade. Nonetheless, the general perception is that institutional investors on average trade frequently in large amounts with accordingly large price impact.

Early studies on the effects of institutional trading are unable to distinguish between institutional and non-institutional transactions. Hence,

they focus on block trades, trades over 10,000 shares (e.g., Kraus and Stoll (1972)). These and later studies (Holthausen, Leftwich and Mayers (1987, 1990), Ball and Finn (1989)) also suggest several reasons why trades might affect prices. An impact of trades on prices is consistent with the presence of new information conveyed by transactions (Kyle (1985), Easley and O'Hara (1987)), or with the existence of various kinds of market frictions. Such frictions might reflect the existence of different forms of liquidity costs, including the costs of processing orders (Demsetz (1968)) or compensation for inventory imbalances (Amihud and Mendelson (1980), Ho and Stoll (1987)). Alternatively, the market price of a stock may be affected by shifts in excess demand because investors do not recognize the existence of close substitutes for an individual stock. Measuring the impact of trades on prices thus allows an evaluation of the importance of these different effects on the flow demand/supply schedules for stocks.

Numerous studies document the inability of portfolio managers to outperform various passive benchmarks, despite the considerable effort to analyze and select stocks (Brinson, Singer and Beebower (1991), Fama (1991), Lakonishok, Shleifer and Vishny (1992)). This "implementation shortfall" may be due to the costliness of actually executing trades (Perold (1988)). Indeed, the heavy expenditure of resources by institutions on trading facilities and personnel suggests that execution costs might be non-negligible and, moreover, that they are potentially controllable (Bodurtha and Quinn (1990)). There is, accordingly, great interest in comparing the execution performance of different money management firms. In evaluating the profitability of various trading rules, researchers also find it necessary to adjust for the costs of trading.

In comparison with the literature on block trades, our results provide evidence from a distinctive sample of trades. Previous studies use the tick test to classify trades as buyer- or seller-initiated. Block trades at a price below (above) the price prior to the block are considered to be seller- (buyer-) initiated. Zero tick trades are in general not classified. Holthausen, Leftwich and Mayers (1987) find that the tick rule properly classifies only 52.8 percent of a sample of trades known to be buyer-

initiated. Lee and Ready (1991) also explore the accuracy of the tick test. The earlier studies thus measure the impact of large trades from the perspective of the relatively more impatient party (i.e., the one willing to trade on an uptick or downtick). There are, of course, varying shades to a trader's impatience to trade. Our results capture the traces of institutional trading activity on stock prices, across the spectrum of degrees of impatience to trade, incorporating many different trading strategies and many different investment styles. What we are after in this paper, therefore, is the average market impact incurred by institutions when altering the composition of their portfolios. Moreover, our study of differences across managers can shed some light on the impact of the degree of impatience on execution costs.

Our findings suggest that both institutional purchases and sales are accompanied by some price pressure relative to the opening price on the trade date. However, there is a marked asymmetry between the behavior of prices after purchases and after sales. After buys, the stock price continues to appreciate; in contrast, the price almost fully recovers to its prior level. As a result, the average price change weighted by the dollar size of the trade (the principal-weighted average) from the open to the close on the trade day for buys is 0.34 percent, while the corresponding average price change for sells is -0.04 percent. This asymmetry is intriguing, and we provide several conjectures as to its source. The price impact of transactions is related to the market capitalization of the stock, and to the relative difficulty of the trade. But an even more dominant influence on the trade's price impact is the identity of the money management firm behind the trade, suggesting considerable differences across management firms.

While our findings indicate that institutional trades are associated with some impact on stock prices, the magnitude of the effect pales in comparison to the figures reported by previous authors. Kraus and Stoll (1972), for example, find that large buy blocks are associated with a price change (from the prior closing price to the close on the trade date) of 1.41 percent, while our findings (based on both small and large transactions) suggest that the open-to-close average price change for buys is only 0.34 percent. The low magnitude of the price impact also has strong

implications for the much-debated issue of the market impact cost of executing trades. A manager who gives up only an eighth of a point each way would incur a round-trip cost of 0.68 percent on a typical stock. In contrast, we are hard-pressed to find a round-trip market impact cost, in the aggregate over all trades, exceeding 0.36 percent. The modest estimates of market impact costs attest to the keenly competitive nature of the investment industry.

The remainder of the paper is organized as follows. Section 1 outlines alternative explanations for the price impact of trades, and describes the data. The empirical results are described in Section 2. Section 3 relates our results on the price impact of trades to the question of measuring the costs of executing trades. A final section provides the conclusions.

## 1. Preliminaries

### 1.1. Reasons for Price Impact

Scholes (1972), Mikkelson and Partch (1985), Harris and Gurel (1986), Shleifer (1986), Loderer, Cooney and Van Drunen (1991) examine the elasticity of the demand for stocks. Three potential explanations for price changes triggered by large trades are suggested in the literature: (i) short run liquidity costs, (ii) imperfect substitution, and (iii) information effects.

Short run liquidity costs arise because of the difficulty in finding immediately willing buyers or sellers. Efforts to attract buyers or sellers translate into price concessions. In many large trades, block traders provide some of the liquidity, and are compensated at least in part by a price concession. A timely return of prices following a trade to the prior equilibrium is consistent with this explanation.

Prices will also change around large trades if there are no perfect substitutes for a particular stock. Hence, a seller faces a downward sloping demand curve and a buyer an upward sloping supply curve. Thus, the seller in a large transaction has to offer a discount to induce buyers to absorb the extra shares. Similarly, a premium has to be offered by the buyer in a large transaction. It stands to reason that the slope of the demand and supply curves will depend on the length of the horizon, although this point has not been emphasized in the literature. The imperfect substitution hypothesis is

consistent with permanent price changes or much slower reversals following the trade, compared to the predictions of the short run liquidity hypothesis.

Permanent price changes caused by large trades are also expected if the trades reveal private information that is subsequently impounded into the new equilibrium price. Informed sellers believe that the stock is overpriced, and informed buyers that the stock is underpriced. The information effect depends on the identity of the buyer or seller and in many studies the size of a transaction is used as a proxy for the information content of the trade.

### 1.2. Transaction Data

The data set used in this study consists of the transactions made by 37 large money management firms from July 1986 until the end of 1988. The data are provided by SEI Corp., a large consulting firm in the area of financial services for institutional investors. For each transaction, the CUSIP number of the stock is recorded, along with the trade date, the number of shares, the dollar amount of the trade and dollar commissions. Each trade is identified as a purchase or a sale, and there is an indicator for the money management firm behind the trade. Each money management firm is identified to us only by a numeric code.

We match up the SEI data on trades with the record of transaction prices provided by the Francis Emory Fitch Co. Since the SEI data do not contain a time stamp, we cannot identify the transaction prices immediately before or after a specific trade by a money manager. In order to understand how trades are executed, however, what we would actually like to know are the market conditions when the portfolio manager actually decided to trade (which could be much earlier than the actual execution of the trade). Such information, of course, is not generally available.

Table 1 provides some description of our sample. We analyze 1,215,387 transactions, amounting to a value traded of 387.6 billion dollars. The sample is very large when compared to those used in previous studies and accounts for about 5 percent of the dollar value traded on the NYSE and AMEX. As Lakonishok, Shleifer, Thaler and Vishny (1991) find, most of the trading activity of institutions is in the largest stocks. The top decile by market

capitalization accounts for 48 percent of the trades and 61 percent of the dollar value traded. In contrast, the bottom 40 percent of the stocks by market capitalization account for 3.7 percent of the trades and only 0.6 percent of the dollar value traded.

Previous studies on price impact focus on trades exceeding 10,000 shares. Our results indicate that many of the institutional trades are actually quite small. From Panel A of Table 2, the average number of shares per trade is only 8400 for buys and 9100 for sells, and the medians are 2400 and 2700 for buys and sells, respectively. Moreover, 25 percent of the trades involve less than 1000 shares, and only about 20 percent of the trades involve more than 10,000 shares. The small size of a typical trade is surprising, given that our data come from large money managers who are expected to be involved in larger trades. The small trade sizes relative to typical holdings are consistent with the view that managers trade strategically in order to reduce the influence of short run liquidity costs, or information effects.

Previous studies find that the number of blocks traded on a downtick substantially exceeds the number of blocks traded on an uptick. One explanation suggested for this phenomenon is that it is easier to sell large amounts than to buy large amounts. Therefore, we expect to find that sells are larger than the corresponding purchases. This is indeed the case, although the differences are quite small. For example, in the largest stocks, the mean number of shares traded is 8200 and 8700 for buys and sells, respectively.

Panel B (Table 2) presents the distribution of the dollar value of trades. The median trade is less than $100,000 and only about 6 percent of the trades exceed $1,000,000. As the company size increases, the trades also get large. In Panel C, we report the distribution of trade size relative to normal daily trading volume. The median is only 2 percent, indicating that a typical institutional trade is not a major event. However, as the size of the companies decreases, the typical institutional trade becomes a more significant event. For example, the median for buys is 0.24 in group 1, relative to 0.01 in group 4. The largest 1 percent of trades are many times

larger than the typical daily volume in small stocks, whereas in the largest stocks such trades are typically less than 40 percent of the daily volume. Many studies focus on trades which are larger than the typical trading volume. Our results indicate that such trades are very uncommon, at least in the more liquid stocks where most institutional holdings are concentrated.

## 2. Empirical Results

### 2.1. The Price Impact of Institutional Purchases and Sales

Table 3 summarizes the price impact of institutional purchases (panel (A)) and institutional sales (panel (B)), together with the percentage commission cost. For each transaction, the percentage return is calculated from the day's opening price to the trade, and from the trade to the closing price; the percentage return from the opening to the closing is also reported.[1] These correspond, respectively, to the total, temporary and permanent effects on the stock price on the trade date, as discussed in Holthausen et al. (1987). Further, to determine whether a typical institutional trade is fundamentally distinguishable from other trades, we compare the transaction price in a stock to the volume-weighted average of all transaction prices in the same stock on the trade date. In the subsequent discussion, we focus on the principal-weighted average of each price impact measure. This procedure follows the norm in the investment industry, and permits evaluation of the overall dollar amount of the price impact.

Prices for institutional purchases are 0.22 percent higher than the opening price on the trade date on a principal-weighted average basis. Such a difference amounts to eight cents per share, less than one tick, on a stock with a price of $36.50 (the volume-weighted average price over our sample period). The price increase from the open to the trade is consistent with all three hypotheses outlined in section 1.1. In part, the rise also reflects the average daily upward drift in prices, although this component is small--the mean total percentage change from the open to the close on the Standard and Poor's Composite Index over this period is 0.06 percent. A final interpretation of the price movement from the open to the trade is that

institutional money managers may be responding passively to changes in the stock price before initiating transactions.

Sharply at odds with the reversal predicted by the short-run liquidity hypothesis, we find that there is a further principal-weighted average price increase of 0.12 percent from the trade to the closing price. It is possible that the price pressure after the trade is a result of follow-up trades in the same stock. These additional trades might be initiated by the same manager as part of a larger trading program, or by other managers, to the extent that they engage in "herding" behavior.

For institutional purchases, the permanent principal-weighted price change from the open to the close is 0.34 percent. The simple mean price change is lower (0.26 percent), and is considerably less than previous estimates of the price impact of block purchases. Kraus and Stoll (1972) and Holthausen et al. (1990) find that the average permanent price change is around one percent. There are several reasons why it is not surprising that earlier papers document larger price effects. These studies focus only on large block transactions. In addition, their reliance on the tick test to infer trade direction results in the exclusion of blocks associated with zero price ticks. Finally, it is also quite probable that the remaining transactions (those associated with an up or down tick) represent trades initiated by relatively less patient investors (i.e., those willing to pay a larger price concession in exchange for greater immediacy). Accordingly, the average price impact is likely to be larger in the case of purchases or sales selected on the basis of a non-zero tick, compared to purchases or sales in general (whether initiated by the investor or not). Another possible reason why we find lower price impact is that past studies of block trading use data from earlier periods (no later than 1983). Dramatic changes have since occurred in equity markets with respect to trading volume and technology, commission rates, and the growth of hedging instruments.

Table 3 also reports the median and other percentiles for each measure of price impact. Relative to the open or the close, the median impact for buys is zero while the median permanent change for buys is also zero. Evidently, the typical institutional purchase has little or no impact on

prices. However, the percentiles of the distribution of returns indicate that there is substantial dispersion across trades with respect to their price impact.

Another perspective on the price impact of institutional orders is obtained by comparing the trade price to an average of transaction prices from the same day. Berkowitz, Logue and Noser (1988) interpret the price impact relative to the volume-weighted average price as a measure of execution cost. Using this benchmark, the dollar-weighted average impact is very small, at 0.02 percent. Similar values are obtained if the calculation of the volume-weighted price excludes the trade under consideration, or if the simple average price is used as the benchmark. Indeed, the simple average impact is slightly negative, which would imply, under the interpretation of Berkowitz, Logue and Noser (1988), a negative execution cost on average to buying!

Turning to institutional sales (panel (B) of Table 3), there is a principal-weighted average drop in prices of 0.14 percent from the open to the trade. Many of the same factors as in the case for buys can account for this change. In marked contrast to the behavior of prices after buys, however, the initial price decline is almost fully reversed. As a result, there is only a small permanent change of -0.04 percent. The post-trade behavior of prices in the case of sells is thus more supportive of effects due to short-term liquidity costs, rather than imperfect substitution or information.

The results in panel (B) are reminiscent of the findings in Kraus and Stoll (1972) and Holthausen et al. (1990). However, we find much smaller price impacts than reported in these earlier studies. Overall, the evidence suggests that institutional sales are associated with some downward price pressure, although the market impact is generally small and temporary.

It might be argued that the differences between the findings in Table 3 and the findings of earlier research are due to differences in commission rates. If the specialist or block trader on the other side of the trade is compensated by a commission as well as a price concession, then a lower concession might be exchanged for a higher commission. Similarly, differences between the commission rates for purchases and sales might account for the differential price impact. In Table 3, however, the principal-weighted

commission rate is the same for buys and sells, at 0.17 percent of trade value (six cents per share on a stock with the average price of $36.50). Moreover, the simple average commission rate, 0.23 percent, is much smaller than the mean commission rate of 1.01 percent for the largest stocks over the period 1960 to 1979, reported by Stoll and Whaley (1983).

### 2.2. The Asymmetric Response of Prices to Purchases and Sales

A key puzzle emerges from Table 3: there is a marked asymmetry between the effect of institutional buying and selling activity on stock prices.[2] Purchases of a stock are accompanied by an increase in its price, which continues to rise after the trade; sales of a stock are accompanied by a drop in its price, but there is subsequently an almost complete recovery in the price.

Several factors, not mutually exclusive, might account for the differences between the effects of buying and selling activity. "Street wisdom" suggests that brokers are willing to accommodate customers' sales by purchasing shares and holding them in inventory in exchange for a short-term price concession. On the other hand, brokers are more reluctant to accommodate customers' purchases by undertaking short positions. Since an intermediary is less likely to be involved on the other side of an institutional purchase, it is less likely that the transaction price in the case of a buy incorporates a fee to the intermediary in the form of a temporary price concession.[3]

Information effects might also be stronger for purchases than for sales. Since an institutional investor typically does not hold the market portfolio, the choice of a particular issue to sell, out of the limited alternatives in a portfolio, does not necessarily convey negative information. Rather, the stocks which are sold may already have met the portfolio's objectives, or there may be other mechanical rules, unrelated to expectations about future performance, for reducing a position. As a result, there are many liquidity-motivated reasons to dispose of a stock. In contrast, the choice of one specific issue to buy, out of the numerous possibilities on the market, is likely to convey favorable firm-specific news.[4] The information content of

purchases might be diluted insofar as the portfolio receives net cash inflows. However, Table 1 suggests that purchases and sales by our sample of money managers are roughly equal. Moreover, net cash inflows to the typical money manager are a very small percentage relative to the manager's turnover.

The larger, positive impact of institutional purchases could also arise if institutions are positive feedback traders for buys but not for sells, i.e., they intensify their buying behavior on days when the market rises. This explanation, however, is not compatible with the data. For every day in the sample period, we measure the rate of return from the open to the close on the S&P 500 index. Moreover, for every day, we know the dollar value of buying and selling activity by our sample of money managers. We then calculate the dollar-weighted average return for buys and sells separately. This produces a principal-weighted average return on the index of 0.05 percent for buys, and 0.08 percent for sells. If anything, this finding suggests that money managers might stabilize markets through negative feedback strategies.

In summary, the price impact of sales is not merely the reverse of the impact of purchases. While the behavior of the stock price after buys reflects new information or inelastic excess demand curves, the price behavior after sells is more indicative of a liquidity-related reversal. In any case, the average and median price effects are not large, and execution prices for institutional trades do not differ very much from average prices over the course of the day.

### 2.3. Firm Size, Trade Difficulty and Price Impact

Prior theoretical and empirical research suggests that the price impact of a trade is affected by firm size (Loeb (1983), Stoll and Whaley (1983), Keim and Madhavan (1991)), and by the size of the transaction (Easley and O'Hara (1987), Glosten (1989)). Table 4 examines the behavior of the price impact of trades as both firm size and trade complexity (trade size relative to normal daily volume) vary. Within each of the four categories of firm size (described in Table 1), trades are divided into four groups by trade complexity, using the quartiles of the distribution of trade complexity (as reported in Table 2, panel c). In addition, the bottom panel of the table

aggregates across complexity groups within each size group, and the last column in the table aggregates across size groups. The table reports the principal-weighted averages.

In the bottom panel of Table 4, the return from the open for buys rises monotonically as firm size declines, except for the smallest firms.[5] The price continuation is also stronger after purchases of smaller firms. Taken together, the average price change from open to close for institutional purchases is positive and tends to be higher for smaller firms, ranging from 0.29 percent for the largest firms to 0.49 percent for the smallest. For sell orders, the drop from the opening price to the execution price is also stronger for smaller firms. However, the subsequent recovery is also stronger for smaller firms. As a result, there is no clear pattern across the four size groups with respect to the permanent price change--the price remains roughly unchanged or declines slightly from the open to the close for sells.

The larger permanent price change associated with purchases of smaller firms could be due to several reasons. Even a minor institutional stake in a small stock might involve several successive trades, so that the market impact of a purchase might be spread out over several days before a reversal occurs. Further, the market might interpret institutional purchases of smaller stocks as more reliable indicators of favorable private information. Unless an investment manager specializes in lower-capitalization stocks, the decision to purchase a small stock is generally risky for the manager. If the stock's performance is disappointing, the manager may be asked to account for his decision to depart from the norm and invest in small stocks (Lakonishok, Shleifer, Thaler and Vishny (1991)). Hence, a manager must have strong favorable beliefs about a small stock to justify its purchase. Sales by institutional money managers, on the other hand, need not convey much new information to the market, even for the smallest stocks. Such sales might represent "window dressing," attempts by managers to avoid potentially embarrassing questions from their clients by removing poorly performing small stocks from their portfolios. Investment policies regarding minimum levels of market capitalization, dividend yield, or the number of analysts following a

stock may prompt a manager to sell stocks even in the absence of unfavorable information.

When transactions are divided into four categories by complexity (the last column of Table 4), the results are generally similar to those obtained for trades ordered by firm size. In particular, the principal-weighted average permanent price change for purchases increases monotonically with trade complexity, rising from 0.17 percent for the easiest trades to 0.39 percent for the hardest trades. The permanent price change for sales is generally small, even in the category of the hardest trades.

The two polar cases in the body of Table 4 provide further detail on the association between price impact, firm size and trade complexity. In the case of the easiest trades in the largest firms, the price changes are small: the permanent impact for purchases (sales) is 0.11 percent (0.05 percent). At the other end of the scale, the permanent price change for the hardest purchases of the smallest stocks is 0.72 percent, comprising a return of 0.23 percent from the open and a price continuation of 0.49 percent after the trade. Sell transactions in this category are associated with a drop of 0.57 percent from the opening price, but there is a subsequent reversal of 0.71 percent to the close. Nonetheless, the price changes associated with even the hardest trades in the smallest stocks are not particularly large, compared to other researchers' estimates of the costs of trading small stocks in general. In particular, since the average stock price of trades in this group is only about $10, even a change of 0.72 percent is substantially less than one tick.

If the volume-weighted price is used as the benchmark, the price impact provides little basis for discriminating between trades with different characteristics: the average impact of the easiest purchases in the largest stocks is -0.02 percent, while the average impact of the most difficult purchases of the smallest stocks is, surprisingly, even more favorable at -0.08 percent. For the smallest firms, however, the size of the price impact of both buys and sells is sensitive to whether the trade is included in, or excluded from, the volume-weighted average. In the category of the most difficult trades in the smallest stocks, for example, excluding the trade from

the calculation of the volume-weighted average price yields a price impact of 0.01 percent for buys and -0.53 percent for sells.

The results in Table 4 confirm the asymmetry between buys and sells across every category of firm size and trade complexity. The positive permanent impact of buys is consistent with information effects or downward sloping demand curves due to imperfect substitution. In contrast, sell transactions are associated with only minor permanent price changes. Any initial downward pressure on prices is generally reversed by the end of the trading day, suggesting the existence of short-term liquidity costs.

### 2.4. Differences in Price Impact Across Money Managers

The market impact of a transaction can vary with the style of the money manager and the performance of the trading desk responsible for the trade. A central determinant of execution performance is the portfolio manager's instructions to the trading desk as to how an order is to be filled. For example, a value-oriented manager with low turnover will typically give much latitude to the trading desk, since urgency is not considered critical. On the other hand, a manager pursuing a short-term technical trading strategy will insist on speedy execution, thereby constraining the trading desk. Given the constraints imposed by the money manager, the trading desk still has considerable flexibility as to how a trade is carried out (Wagner (1989)). Its choices include: whether or not to employ a broker who is willing to commit capital to facilitate trades (a capital broker); how many brokers to employ; how much of an order to expose to each broker; the time frame within which the trade is to be executed; as well as the leeway given to the broker as to how to complete the trade (a market order, limit order or market-not-held order, for example) or how much information about an order is displayed to the public (as in a "sunshine trade"). In such a complicated process, different managers with varying styles and levels of expertise are likely to turn in different levels of execution performance.

An extended characterization of the various styles and trading strategies adopted by different money managers, together with their resulting impact on stock prices, is beyond the scope of this paper (see Lakonishok,

Shleifer and Vishny (1991, 1992)). Here we adopt the less ambitious tack of only documenting the existence of dispersion across money management firms with respect to the price impact of their trades. In Table 5, summary statistics are presented for the distribution across management firms of three of our measures of price impact. For each of the 37 money management firms, the different returns are calculated and then averaged (using trade principal as weights) across all the firm's trades. The summary statistics in Table 5 are based on these 37 observations for each price impact measure.

Considerable variation exists across managers for both buys and sells under each measure of price impact. The variation cannot be attributed simply to noise--the average price impact of each manager is based on tens of thousands of trades, so that the precision of each estimate is high. For example, the execution performance for buys relative to the opening price varies from -0.46 percent in the tenth percentile to 0.54 percent in the ninetieth percentile, yielding a difference of a full percentage point per transaction. The corresponding difference for sells is very similar, at 0.98 percent per transaction. Insofar as the opening price is known if and when a manager chooses to trade, the differences across managers in their execution performance relative to the open might reflect several sources: their differential skill in seeking out liquidity; ability in trading before the release of information; as well as differences in their responses to price movements subsequent to the opening. The dispersion across managers, in terms of the post-trade return till the close, is also notable but substantially lower. For buys (sells), the tenth percentile is -0.01 percent (0.01 percent) and the ninetieth percentile is 0.25 percent (0.26 percent), giving rise to a difference of 0.26 percent (0.27 percent) per transaction. Given that the manager has already traded, and given that a trading strategy cannot be based on the as yet unknown closing price on the trade date, the dispersion in managers' post-trade returns should be expected to be smaller than the dispersion in their pre-trade execution performance.

Our confidence that the differences across managers can be ascribed to differences in styles and trading strategy, rather than noise, would be heightened if a manager who obtains favorable execution for buys also fares

well for sells. This is indeed the case: the rank correlation across managers between performance for buys and sells relative to the opening price is -0.84, -0.10 for performance relative to the closing price and -0.74 for the permanent price change. In other words, a manager who buys low relative to the opening price (or relative to the closing price) also tends to sell high relative to the opening price (or relative to the closing price).

As another step in tracing the sources of the cross-sectional differences in price impact, we also obtained data from SEI on a subset of sixteen of the management firms in our sample. In particular, data are available on each of these managers' average turnover rate, and investment style (each manager is classified as pursuing either a value-oriented or growth-oriented style). Other things equal, a portfolio manager with low turnover would tend to be a more patient investor and would thus tend to have low price impact. In addition, an investor for whom timing is more critical (such as a growth-oriented manager) would be expected to have a larger impact. Based on the data for sixteen managers, a cross-sectional regression confirms that the principal-weighted average price impact relative to the open for buys increases with the turnover rate and is higher for a growth-oriented manager: the estimated intercept is -0.32, while the coefficient for turnover rate is 0.37 and the coefficient for the dummy variable representing the manager's style (zero for a value-oriented style and one for a growth-oriented style) is 0.31. The principal-weighted average price drop from the open for sells also tends to be larger for a manager with high turnover and with a growth-oriented style: the estimated intercept is 0.35, and the coefficients for turnover and style are -0.26 and -0.27, respectively.[6] Similar results are obtained if the principal-weighted return from the open to the close is used as the dependent variable. While the results from these regressions are only suggestive (given the small number of managers), they are consistent with the notion that the degree of urgency to trade, as reflected in different investment style or trading strategies, is associated with the level of price impact.

## 2.5 Regression Results

Following the lead of prior research, the previous sections confirm the influence of firm size and trade difficulty on the price impact of a trade. The unique features of our dataset enable us to suggest another potential influence, namely the identity of the manager behind each trade. It is thus natural to ask whether, after controlling for firm size and trade difficulty, the manager's identity is an important determinant of a trade's price impact. There may also be a trade-off between the commission cost and the market impact of the trade. These various influences are accommodated in the following regression model:

$$(1) \qquad r_i = \alpha + \beta c_i + \sum_{j=1}^{3} \delta_j S_{ij} + \sum_{j=1}^{4} \gamma_j D_{ij} + \sum_{j=1}^{36} \varphi_j M_{ij} + \varepsilon_i$$

For each trade i, $r_i$ is one of the three measures of price impact that we focus on: the percentage return from the open to the trade, from the trade to the close, and from the open to the close. The commission cost for the ith trade is denoted by $c_i$, and following the common practice in the investment industry, is measured in cents per share (Marshall, 1988). It is likely that the manager's trading desk perceives the trade-off (if any) in terms of the dollar commission cost, rather than in terms of the commission rate. In the U.S., unlike other countries, the commission cost for institutional investors is on a cents per share basis, irrespective of the stock price level, rather than in terms of the total value of the trade. Thus, for the same trade, a broker charging four cents per share will be cheaper than a broker charging eight cents per share. However, the cheaper broker, if assigned trades in lower-priced stocks, will appear to have a high percentage commission rate. In evaluating the relation between commission cost and price impact across trades with different prices, therefore, it is necessary to express the commission cost on a dollar basis rather than on a percentage basis. Expressing the commission cost relative to the trade price would also confound the effect of commissions with the effect of market capitalization (since smaller stocks tend to have lower prices). The effects of market

capitalization, trade difficulty and managerial strategy are captured by the dummy variables, $S_{ij}$, $D_{ij}$ and $M_{ij}$, respectively. For example, $M_{ij}$ takes the value of one if the ith trade is executed by the jth manager and is zero otherwise. To permit identification, the coefficients for the dummy variables for managers are normalized relative to the first manager in the data set. Similarly, the coefficients for the trade difficulty variables are expressed relative to the impact of trades in the first category (the easiest trades), while the coefficients for firm size are expressed relative to the impact of trades in the largest firms.

Separate regressions are fit for buy transactions and sell transactions. In addition, the marginal explanatory power of each set of dummy variables is assessed by excluding each set, one at a time, from the full model (1). Panel A of Table 6 reports the adjusted $R^2$ for each specification of the regression model. Most of the explanatory power of the model comes from the identity of the money manager behind the trade. In contrast, excluding the dummy variables for firm size and trade complexity has little or no effect on the $R^2$. In light of the importance of the manager dummies, it is perhaps not surprising that the model provides the best fit in the equation for the return from the open to the trade. This measure of price impact, to a larger extent than the others, reflects the effects of managerial trading strategy.

In panel B, the coefficients of the full model are reported for each of the three measures of price impact. Given the very large sample size, nearly all of the estimated coefficients are large relative to their standard errors. Therefore, the focus of the discussion will be on the economic significance of the coefficients.

One presumption is that favorable execution (lower price impact) is purchased from a broker in exchange for a higher commission fee. However, the coefficient for the commission cost variable for both buys and for sells (in parentheses) is very small. The most favorable evidence on substitution between the price impact of a trade and its commission cost emerges in the equation for the price impact of sells relative to the closing price. Even in this case, however, an increase in the commission of one cent per share (in itself a large jump in commissions) lowers the post-trade price reversal by

0.007 percent, yielding a dollar savings of only 0.3 cents per share on a stock with the average price of $36.50. We also estimated the regression with the commission cost measured relative to the trade price--as in the results reported in Table 5, no relation can be detected between price impact and commission rates. As Beebower (1989) points out, however, the commission includes payment for research services and other plan expenses. The presence of such services, not related to trade execution, would blur any association between price impact and the total commission cost. In addition, some brokers may be willing to commit their own capital to accommodate managers' trades, while others may simply process transactions.

With respect to the influence of firm size and complexity, the results in panel B confirm the findings of the previous sections. What is particularly noteworthy, however, is that the coefficients of the dummy variables for money managers still display considerable dispersion--for example, the spread between the tenth and ninetieth percentiles is 0.72 (0.85) when returns are measured from the open to the trade. While somewhat attenuated relative to the findings of Table 5, these spreads are still considerable.

### 3. The Execution Cost of Institutional Trades

The temporary and total price impact of institutional trades, and the impact relative to various intra-day averages, reported in the previous section, can also be interpreted as average execution costs for purchases and sales. In particular, the difference between the price at which an order is executed and the underlying true value of the stock amounts to a price concession which is a cost of trading, in addition to brokerage commissions. While considerable resources are expended within the investment community on monitoring and controlling such trading costs, there is little consensus as to the magnitude of execution costs. In practice, part of the disagreement stems from the different choices of a benchmark price; the closing price of the stock on the trade date, the opening price and the volume-weighted average price are all used. In Table 3, average round-trip costs include commissions (which are 0.34 percent of trade value), and market impact costs: these range

from 0.09 percent relative to the volume-weighted price to 0.36 percent relative to the opening price. If the closing price is used as the benchmark, the cost of sells is roughly offset, on average, by a benefit for buys, since there is a post-purchase average price continuation. Further, if the estimates of trading cost are disaggregated by market capitalization and trade complexity, the average market impact costs are smaller than the corresponding figures in Loeb (1983) or Stoll and Whaley (1983). In addition, the costs relative to the open tend to move with market capitalization and trade complexity in the expected direction. Assuming that the decision to trade is made before the open, and thus using the opening price as the benchmark, the round-trip cost, including commissions, for the hardest trades in the smallest stocks is 1.90 percent (from Table 4); the corresponding cost for the easiest trades in the largest stocks is 0.29 percent. Costs relative to the volume-weighted price, however, display very little variation across trades in large and small stocks, or across difficult and easy trades.

The various measures of execution cost are not without shortcomings. The opening price may not be a relevant benchmark price if the order is not submitted to the trader before trading begins. To one degree or another, each cost measure can be gamed by traders who are being evaluated. A trader can postpone trading until close to the end of the trading day and then choose to execute only those transactions whose prices are better than the open or the intra-day average price; the remaining orders are deferred. Similarly, a trader who carries out a large transaction will have a major influence on the volume-weighted price, distorting the cost calculation. None of these cost measures addresses the issue of opportunity cost (including the cost of unexecuted orders), or the potential adverse selection problem (the possibility that the trader may be "bagged" by buying cheaply a stock that subsequently experiences negative performance). It would thus seem advisable, in evaluating execution performance, to consider a broad range of cost measures, rather than a single number.

## 4. Summary and Conclusion

Analysis of the price impact of institutional trades sheds light on the elasticity of the excess demand curve for stocks, and on the magnitude of the cost of executing transactions. Previous studies on the price impact of trades, however, have focussed on the effects of block trades and in some cases, have considered only the largest blocks. In these studies, moreover, the change in the transaction price itself is used to infer whether a trade is initiated by the buyer or by the seller. In contrast, our sample covers a more recent period and contains more than one million trades, both large and small, by 37 large institutional money managers. Each trade is explicitly identified as a purchase or sale by the money manager, who is also identified.

The distinctive features of our data set enable us to generalize and extend previous studies on the price impact of block trades. Overall, the evidence suggests that institutional purchases and sales of a stock are associated with some pressure on prices. Relative to the opening price on the trade date, for example, buy transactions are associated with a principal-weighted average price increase of 0.22 percent while sell transactions are associated with a principal-weighted average price decline of 0.14 percent. The behavior of prices from the open to the trade can be attributable to short-run liquidity costs, prior release of information or positive feedback trading behavior by managers.

The post-trade behavior of prices is more perplexing, and displays a sharp difference between buys and sells. Specifically, the price continues to rise after purchases--the principal-weighted average return from the trade to the closing price is 0.12 percent--while the price tends to correct itself after sales--the reversal is 0.10 percent. The post-trade reversal for sells is consistent with the existence of short-run liquidity costs, while the post-purchase behavior of prices is consistent with information effects, or imperfectly elastic demand curves.

We find that institutional purchases are associated with a principal-weighted permanent price change from the open to the close on the trade date of 0.34 percent, while there is only a very small permanent impact (-0.04 percent) from institutional sales. The asymmetry is also noted in

Kraus and Stoll (1972) and Holthausen et al. (1987). The difference between the price impact of buys and sells cannot be attributed to managers concentrating their buying (selling) behavior on days when the market goes up (down). Rather, an analysis of the open-to-close price change on the Standard & Poor's Index provides some evidence that money managers might trade in a contrarian fashion.

Several conjectures are offered to account for the asymmetry between the price impact of buys versus sells. Institutional sales are more likely to involve an intermediary broker, compared to purchases. Hence the price impact of sells is more likely to reflect a temporary discount as compensation for the intermediary. In contrast, institutional purchases might be a stronger signal of favorable information, whereas there are many liquidity-motivated reasons to dispose of a stock. Further research, however, is called for to account for the differences between the effects of buys and sells.

Considerable attention in previous research has focused on the effects of market capitalization and relative trade size as determinants of the market impact of a trade. We find that the market impact of a trade is indeed related to these influences, although its magnitude is much smaller than in previous work on large block trades. For example, the principal-weighted average return from the open to the trade for the hardest trades in the smallest stocks is only 0.23 percent for buys and -0.57 percent for sells. In a multiple regression, the importance of market capitalization and trade difficulty pales in comparison to the influence of the money manager who is behind the trade. Considerable differences exist across managers with respect to the price impact of their trades. A preliminary analysis suggests that these differences are related to investment styles and trading strategies.

The results on the price impact of institutional trades provide some insight on the much debated topic of the cost of executing trades. Our highest estimates of round-trip costs are obtained if the opening price is used as the benchmark. Even in this case, however, the round-trip market impact cost is only 0.36 percent, which is definitely on the low side of previous estimates. To put this cost estimate in perspective, suppose that each purchase or sale results in giving up only one tick, so that round-trip

costs equal twenty-five cents. For a typical stock (price $36.50) the round-trip market impact cost should be in this case 0.68 percent; almost double our estimate. Keim (1989) finds that the relative bid-ask spread for the top decile of NYSE stocks is 0.58 percent on average. Given the competitiveness of the investment industry and the substantial resources expended on trading facilities, it should not come as a total surprise that money managers are loath to give up as much as an eighth every time they execute a trade.

## Footnotes

[1]Since some of the trades occur at the open or at the close, we may be biased towards finding no price impact relative to these two benchmarks. In general, however, trading at the open or close represents a small fraction of daily volume. For a sample of large NYSE-listed firms, for example, Forster and George (1991) find that volume at the open is on average about 6% of daily volume, while volume at the close is on average 3% of daily volume.

[2]Wood, McInish and Ord (1985), Harris (1989) document that returns on the closing transaction are on average positive and relatively large; Harris (1989) also finds an increase in both closing bid and ask prices, as well as an increase in the frequency of ask prices at the close. The day-end pattern in transaction prices may thus account for part of the post-trade price change. However, there is still evidence of a price continuation subsequent to buys and a reversal subsequent to sells when the next-to-closing price is used as the benchmark: the principal-weighted average is 0.09 percent for buys and 0.07 percent for sells.

[3]It is also possible that the pool of counterparties facing a buyer is more concentrated than the pool of possible counterparties facing a seller. Sellers can thus exploit the potential competition among a larger group of counterparties to obtain a smaller price concession, while buyers have a more limited set of parties on the other side (namely, existing shareholders). It may also be the case that existing holders of a stock tend to be more optimistic about its future prospects, relative to other investors. Shleifer and Summers (1990) argue that limitations on arbitrage can lead to differences between the price of a stock and its true value. The buyer of a stock must thus offer a higher premium to induce current holders to part with their shares.

[4]Another behavioral interpretation, suggested by money managers, is that most managers target for purchases stocks that they believe are undervalued. A slight increase in the price of such a stock might engender fears that the stock will "run away" from those managers interested in the stock. Hence the price increase might not deter managers from buying, perhaps contributing further price pressure. On the other hand such managers display more patience in selling; if the stock price falls, they are likely to defer selling, feeling that the price will ultimately rebound to its higher value.

[5]Trading strategies in the smallest stocks are likely to differ from trading strategies in larger stocks. Specifically, institutions that predominately trade in low capitalization stocks may choose to buy only if a favorable, inexpensive opportunity presents itself. Sellers of small stocks, on the other hand, are more likely to come from a larger, more diffuse group of institutions who do not specialize in small stocks. These managers may be selling stocks whose market values have declined in past periods.

[6]The t-statistics for the estimated coefficients are as follows. In the equation for buys, the t-statistic is -1.05 for the intercept; 0.80 for the coefficient for turnover rate and 1.06 for the coefficient for the manager's style. In the equation for sells, the intercept has a t-statistic of 1.62, while the t-statistics for turnover and style are -0.81 and -1.33, respectively. Note, however, that these t-statistics are based on a very small sample.

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Table 1

Description of trades by institutional money managers

The sample comprises all trades of NYSE and AMEX stocks made by 37 institutional money management firms from July 1, 1986 to December 30, 1988 (excluding October 1987).

Panel A. Number of trades and dollar value traded (in parentheses) for all buys and sells in the sample, and in each category of firm size. Number of trades is in thousands, while dollar value traded is in billions of dollars. Firm size is measured as market value of outstanding equity at the end of the prior quarter. Group 1 comprises firms in the smallest 40 percent of NYSE and AMEX stocks; group 2 comprises firms in the next 40 percent; group 3 comprises firms in the ninth decile; group 4 comprises firms in the top decile of firm size.

| | 1 (small) | | 2 | | 3 | | 4 (large) | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Trades | ($ value) | Trades | ($ value) | Trades | ($ value) | Trades | ($ value) | Trades | ($ value) |
| Buys | 28.7 | (1.3) | 167.8 | (32.3) | 138.0 | (42.2) | 301.1 | (117.7) | 635.6 | (193.5) |
| Sells | 17.2 | (1.2) | 147.7 | (31.5) | 127.2 | (41.2) | 287.7 | (120.2) | 579.8 | (194.1) |
| Total | 45.9 | (2.5) | 315.5 | (63.8) | 265.2 | (83.4) | 588.8 | (237.9) | 1,215.4 | (387.6) |

Panel B. Frequency distribution of trade size (number of shares traded, in thousands) for all buys (all sells in parentheses) in the sample.

| # shares traded (in thousands) | % of observations | | cumulative % of observations | | % of principal | | cumulative % of principal | |
|---|---|---|---|---|---|---|---|---|
| 0 - 2 | 44 | (42) | 44 | (42) | 4 | (4) | 4 | (4) |
| 2 - 5 | 20 | (19) | 64 | (61) | 8 | (7) | 12 | (11) |
| 5 - 10 | 13 | (15) | 77 | (76) | 11 | (11) | 23 | (22) |
| 10 - 20 | 12 | (12) | 89 | (88) | 19 | (19) | 42 | (41) |
| 20 - 30 | 5 | (5) | 94 | (93) | 14 | (13) | 56 | (54) |
| 30 - 50 | 3 | (3) | 97 | (96) | 13 | (13) | 69 | (67) |
| 50 + | 3 | (4) | 100 | (100) | 31 | (33) | 100 | (100) |

Table 2

## Mean, standard deviation and fractiles of distribution of trades by institutional money managers

The sample comprises all trades of NYSE and AMEX stocks made by 37 institutional money management firms from July 1, 1986 to December 30, 1988 (excluding October 1987). Summary statistics are reported for buys (sells in parentheses) in the entire sample, and in each category of firm size (market value of outstanding equity at the end of the prior quarter). Group 1 comprises firms in the smallest 40 percent of NYSE and AMEX stocks; group 2 comprises firms in the next 40 percent; group 3 comprises firms in the ninth decile; group 4 comprises firms in the top decile of firm size.

Panel A: Shares Traded (in thousands)

| | All | | 1 (small) | | 2 | | 3 | | 4 (large) | |
|---|---|---|---|---|---|---|---|---|---|---|
| Mean | 8.4 | (9.1) | 4.7 | (7.7) | 8.6 | (9.6) | 9.3 | (9.7) | 8.2 | (8.7) |
| Standard Deviation | 20.9 | (24.3) | 11.4 | (22.3) | 20.3 | (26.8) | 23.8 | (25.0) | 20.5 | (22.6) |
| Median | 2.4 | (2.7) | 1.8 | (2.9) | 3.0 | (3.5) | 2.6 | (3.0) | 2.0 | (2.1) |
| 10% | 0.2 | (0.3) | 0.2 | (0.4) | 0.3 | (0.4) | 0.3 | (0.3) | 0.2 | (0.2) |
| 25% | 0.7 | (0.8) | 0.6 | (1.0) | 1.0 | (1.0) | 0.8 | (0.9) | 0.6 | (0.6) |
| 75% | 8.5 | (9.4) | 4.9 | (7.5) | 10.0 | (10.0) | 10.0 | (10.0) | 7.6 | (8.0) |
| 90% | 20.0 | (20.0) | 10.0 | (15.5) | 20.0 | (20.0) | 21.1 | (21.7) | 20.0 | (20.0) |
| 95% | 32.5 | (34.7) | 18.2 | (27.2) | 31.3 | (35.4) | 38.0 | (39.7) | 34.0 | (35.8) |
| 99% | 91.7 | (100.0) | 50.0 | (86.1) | 87.2 | (100.0) | 100.0 | (100.0) | 100.0 | (100.0) |

Panel B: Dollar Value of Trade (thousand $)

| | All | | 1 (small) | | 2 | | 3 | | 4 (large) | |
|---|---|---|---|---|---|---|---|---|---|---|
| Mean | 304 | (335) | 44 | (68) | 192 | (213) | 306 | (323) | 391 | (417) |
| Standard Deviation | 763 | (862) | 111 | (198) | 430 | (517) | 707 | (791) | 936 | (1031) |
| Median | 79 | (94) | 16 | (25) | 67 | (76) | 89 | (103) | 100 | (112) |
| 10% | 8 | (10) | 2 | (3) | 7 | (9) | 9 | (11) | 11 | (12) |
| 25% | 23 | (27) | 6 | (9) | 20 | (23) | 25 | (30) | 29 | (31) |
| 75% | 275 | (300) | 41 | (66) | 196 | (209) | 303 | (318) | 357 | (379) |
| 90% | 730 | (777) | 95 | (145) | 462 | (480) | 784 | (752) | 962 | (998) |
| 95% | 1234 | (1365) | 162 | (241) | 751 | (809) | 1250 | (1275) | 1672 | (1756) |
| 99% | 3159 | (3666) | 444 | (700) | 1892 | (2182) | 3163 | (3387) | 4313 | (4721) |

Panel C: Trade Size Relative to Normal Trading Volume*

| | All | | 1 (small) | | 2 | | 3 | | 4 (large) | |
|---|---|---|---|---|---|---|---|---|---|---|
| Mean | 0.11 | (0.12) | 0.61 | (0.75) | 0.21 | (0.25) | 0.08 | (0.08) | 0.03 | (0.03) |
| Standard Deviation | 0.54 | (0.65) | 1.75 | (2.49) | 0.59 | (0.88) | 0.41 | (0.26) | 0.10 | (0.11) |
| Median | 0.02 | (0.02) | 0.24 | (0.26) | 0.07 | (0.08) | 0.02 | (0.02) | 0.01 | (0.01) |
| 10% | 0.00 | (0.00) | 0.03 | (0.03) | 0.01 | (0.01) | 0.00 | (0.00) | 0.00 | (0.00) |
| 25% | 0.00 | (0.00) | 0.09 | (0.09) | 0.02 | (0.02) | 0.01 | (0.01) | 0.00 | (0.00) |
| 75% | 0.08 | (0.08) | 0.58 | (0.69) | 0.21 | (0.22) | 0.07 | (0.08) | 0.02 | (0.02) |
| 90% | 0.26 | (0.24) | 1.27 | (1.55) | 0.50 | (0.54) | 0.19 | (0.19) | 0.07 | (0.07) |
| 95% | 0.42 | (0.44) | 2.09 | (2.55) | 0.81 | (0.92) | 0.32 | (0.32) | 0.12 | (0.13) |
| 99% | 1.11 | (1.27) | 5.73 | (7.62) | 2.11 | (2.63) | 0.79 | (0.85) | 0.34 | (0.38) |

*Normal daily volume is computed as the average daily volume over a prior 40 day interval.

Table 3

Mean, standard deviation and fractiles of distribution of price impact and commission cost for institutional purchases (Panel A) and institutional sales (Panel B)

Sample comprises all trades of NYSE and AMEX stocks made by 37 institutional money management firms from July 1, 1986 to December 30, 1988 (excluding October 1987). Price impact is measured as the return (in percent): from the opening price on the trade date to the trade; from the trade to the closing price on the trade date; from the opening to the closing price on the trade date; and from the volume-weighted average of all transaction prices in the stock on the trade date to the trade.

| | Return (in percent) from: | | | | |
|---|---|---|---|---|---|
| | Opening Price to trade | Trade to Closing Price | Opening to Closing | Same Day Volume-Weighted Price to trade | Commission Cost, % |
| **Panel A: Purchases** | | | | | |
| Principal-weighted average | 0.22 | 0.12 | 0.34 | 0.02 | 0.17 |
| Mean | 0.10 | 0.16 | 0.26 | -0.01 | 0.23 |
| Standard deviation | 1.46 | 1.39 | 2.02 | 0.81 | 0.25 |
| Proportion > 0 | 0.44 | 0.38 | 0.48 | 0.49 | 0.99 |
| Median | 0.00 | 0.00 | 0.00 | 0.00 | 0.17 |
| 10-percentile | -1.33 | -1.20 | -1.85 | -0.78 | 0.07 |
| 25-percentile | -0.49 | -0.44 | -0.78 | -0.31 | 0.11 |
| 75-percentile | 0.68 | 0.71 | 1.22 | 0.30 | 0.26 |
| 90-percentile | 1.61 | 1.61 | 2.60 | 0.75 | 0.43 |
| **Panel B: Sales** | | | | | |
| Principal-weighted average | -0.14 | 0.10 | -0.04 | -0.07 | 0.17 |
| Mean | -0.06 | 0.08 | 0.02 | -0.05 | 0.23 |
| Standard deviation | 1.52 | 1.44 | 2.05 | 0.86 | 0.25 |
| Proportion < 0 | 0.45 | 0.46 | 0.46 | 0.54 | 0.00 |
| Median | 0.00 | 0.00 | 0.00 | -0.04 | 0.17 |
| 10-percentile | -1.56 | -1.35 | -2.10 | -0.86 | 0.07 |
| 25-percentile | -0.69 | -0.52 | -1.01 | -0.38 | 0.11 |
| 75-percentile | 0.50 | 0.67 | 1.00 | 0.28 | 0.26 |
| 90-percentile | 1.42 | 1.55 | 2.30 | 0.75 | 0.42 |

Table 4

Principal-weighted average price impact and commission rate for institutional purchases and sales (in parentheses), classified by market value of outstanding equity at end of prior quarter, and complexity (trade principal value relative to average daily volume over a prior 40 day period). Price impact is measured as the return: from the opening price to the trade; from the trade to the closing price; from the opening to the closing; and from the volume-weighted price to the trade. Sample comprises all trades of NYSE and AMEX stocks made by 37 institutional money management firms from July 1, 1986 to December 30, 1988 (excluding October 1987).

| Return (in %) from: | Smallest Firms | | Size Group 2 | | Size Group 3 | | Largest Firms | | All Firms | |
|---|---|---|---|---|---|---|---|---|---|---|
| (a) Most difficult | | | | | | | | | | |
| Opening price to trade | 0.23 | (-0.57) | 0.37 | (-0.21) | 0.28 | (-0.19) | 0.22 | (-0.16) | 0.26 | (-0.18) |
| Trade to closing price | 0.49 | ( 0.71) | 0.27 | ( 0.26) | 0.13 | ( 0.16) | 0.11 | ( 0.08) | 0.14 | ( 0.13) |
| Opening to closing | 0.72 | ( 0.14) | 0.64 | ( 0.05) | 0.41 | (-0.03) | 0.33 | (-0.08) | 0.39 | (-0.05) |
| Volume-weighted price to trade | -0.08 | (-0.18) | 0.01 | (-0.09) | 0.03 | (-0.07) | 0.04 | (-0.07) | 0.03 | (-0.07) |
| Commission | 0.55 | ( 0.55) | 0.26 | ( 0.27) | 0.19 | ( 0.19) | 0.14 | ( 0.14) | 0.17 | ( 0.17) |
| (b) Complexity group 3 | | | | | | | | | | |
| Opening price to trade | 0.08 | (-0.56) | 0.28 | (-0.12) | 0.13 | (-0.01) | 0.10 | (-0.02) | 0.14 | (-0.04) |
| Trade to closing price | 0.30 | ( 0.24) | 0.21 | ( 0.17) | 0.14 | ( 0.09) | 0.08 | ( 0.06) | 0.12 | ( 0.09) |
| Opening to closing | 0.38 | (-0.32) | 0.49 | ( 0.05) | 0.27 | ( 0.08) | 0.18 | ( 0.04) | 0.27 | ( 0.05) |
| Volume-weighted price to trade | -0.03 | (-0.06) | 0.02 | (-0.07) | 0.02 | (-0.04) | 0.01 | (-0.04) | 0.01 | (-0.05) |
| Commission | 0.67 | ( 0.60) | 0.26 | ( 0.26) | 0.18 | ( 0.18) | 0.12 | ( 0.12) | 0.17 | ( 0.16) |
| (c) Complexity group 2 | | | | | | | | | | |
| Opening price to trade | -0.20 | (-0.62) | 0.15 | (-0.08) | 0.07 | ( 0.03) | 0.05 | ( 0.01) | 0.08 | (-0.02) |
| Trade to closing price | 0.38 | ( 0.15) | 0.20 | ( 0.14) | 0.17 | ( 0.07) | 0.10 | ( 0.02) | 0.15 | ( 0.06) |
| Opening to closing | 0.18 | (-0.47) | 0.35 | ( 0.06) | 0.24 | ( 0.10) | 0.15 | ( 0.03) | 0.23 | ( 0.04) |
| Volume-weighted price to trade | -0.14 | (-0.05) | -0.01 | (-0.06) | -0.01 | (-0.03) | -0.01 | (-0.03) | -0.01 | (-0.04) |
| Commission | 0.68 | ( 0.62) | 0.27 | ( 0.26) | 0.18 | ( 0.18) | 0.12 | ( 0.12) | 0.18 | ( 0.18) |
| (d) Easiest | | | | | | | | | | |
| Opening price to trade | -0.58 | (-0.48) | 0.06 | ( 0.00) | 0.02 | ( 0.01) | 0.03 | ( 0.01) | 0.03 | ( 0.00) |
| Trade to closing price | 0.48 | (-0.16) | 0.22 | ( 0.14) | 0.20 | ( 0.03) | 0.08 | ( 0.04) | 0.14 | ( 0.06) |
| Opening to closing | -0.10 | (-0.64) | 0.28 | ( 0.14) | 0.22 | ( 0.04) | 0.11 | ( 0.05) | 0.17 | ( 0.06) |
| Volume-weighted price to trade | -0.27 | ( 0.21) | -0.05 | (-0.03) | -0.04 | (-0.01) | -0.02 | (-0.03) | -0.03 | (-0.03) |
| Commission | 0.74 | ( 0.58) | 0.28 | ( 0.27) | 0.19 | ( 0.20) | 0.13 | ( 0.14) | 0.18 | ( 0.18) |
| (e) All Trades | | | | | | | | | | |
| Opening price to trade | 0.10 | (-0.57) | 0.32 | (-0.17) | 0.24 | (-0.14) | 0.19 | (-0.12) | | |
| Trade to closing price | 0.39 | ( 0.51) | 0.25 | ( 0.23) | 0.14 | ( 0.14) | 0.10 | ( 0.07) | | |
| Opening to closing | 0.49 | (-0.06) | 0.57 | ( 0.06) | 0.37 | ( 0.00) | 0.29 | (-0.05) | | |
| Volume-weighted price to trade | -0.08 | (-0.12) | 0.01 | (-0.08) | 0.03 | (-0.06) | 0.03 | (-0.06) | | |
| Commission | 0.60 | ( 0.57) | 0.26 | ( 0.26) | 0.18 | ( 0.19) | 0.13 | ( 0.14) | | |

Table 5

Mean, standard deviation and fractiles of distribution across managers of measures of price impact, for buys and sells (in parentheses)

Price impact is the return (in percent): from the opening price to the trade, from the trade to the closing price, and from the opening to closing. Data are all trades of NYSE and AMEX stocks made by 37 institutional money management firms from July 1, 1986 to December 30, 1988 (excluding October 1987). For each money manager, the weighted average price impact (using the dollar value of trades as weights) is calculated for all the manager's trades; summary statistics for each measure of price impact are based on this sample of 37 observations.

| | Return (in percent) from: | | | | | |
|---|---|---|---|---|---|---|
| | Opening price to trade | | Trade to closing price | | Opening to closing | |
| Principal-weighted average | 0.22 | (-0.14) | 0.12 | ( 0.10) | 0.34 | (-0.04) |
| Mean | 0.13 | (-0.04) | 0.12 | ( 0.12) | 0.24 | ( 0.08) |
| Standard deviation | 0.45 | ( 0.37) | 0.13 | ( 0.09) | 0.42 | ( 0.42) |
| Median | 0.20 | (-0.09) | 0.13 | ( 0.11) | 0.32 | ( 0.04) |
| 10-percentile | -0.46 | (-0.46) | -0.01 | ( 0.01) | -0.39 | (-0.36) |
| 25-percentile | 0.01 | (-0.31) | 0.04 | ( 0.05) | 0.04 | (-0.22) |
| 75-percentile | 0.37 | ( 0.14) | 0.17 | ( 0.15) | 0.53 | ( 0.27) |
| 90-percentile | 0.54 | ( 0.52) | 0.25 | ( 0.26) | 0.75 | ( 0.78) |
| Range between 10 and 90 percentiles | 1.00 | ( 0.98) | 0.26 | ( 0.27) | 1.14 | ( 1.14) |

Table 6

Regression estimates of the model,

$$r_i = \alpha + \beta C_i + \sum_{j=1}^{3} \delta_j S_{ij} + \sum_{j=1}^{4} \gamma_j D_{ij} + \sum_{j=1}^{36} \varphi_j M_{ij} + \varepsilon_i$$

where $r_i$ is the return (in %) from: the open to the trade, from the trade to the close, and from the open to the close. $C_i$ is the dollar commission cost; $S_{i\,j}$ is a dummy variable for the trade's classification by market capitalization; $D_{i\,j}$ is a dummy variable for the trade's classification by complexity; $M_{i\,j}$ is a dummy variable for the money manager. The equation is estimated separately for buys and for sells. The sample comprises all trades of NYSE and AMEX stocks made by 37 institutional money management firms from July 1, 1986 to December 30, 1988 (excluding October 1987). The 4 classifications by market capitalization are: firms in the bottom 40% when ranked by market capitalization of NYSE and AMEX stocks; firms ranked between 40% and 80%; firms ranked in the ninth decile; firms ranked in the top decile. The 5 classifications by trade complexity are: trades accounting for less than 10% of normal volume; trades between 10% and 25%; trades between 25% and 40%; trades between 40% and 80%; and trades accounting for above 80% of normal volume.

A. Adjusted $R^2$ (in percent) for full model, and models with each set of dummy variables excluded one set at a time. Results from the equation for sells are in parentheses.

| | Return (in %) from: | | |
|---|---|---|---|
| | Opening price to trade | Trade to Closing price | Opening to closing |
| Full model | 3.45 ( 3.36) | 0.70 ( 0.53) | 1.74 ( 1.39) |
| Excluding manager effects | 0.43 ( 0.26) | 0.35 ( 0.17) | 0.36 ( 0.10) |
| Excluding size effects | 3.45 ( 3.31) | 0.48 ( 0.51) | 1.61 ( 1.34) |
| Excluding complexity effects | 3.33 ( 3.34) | 0.70 ( 0.42) | 1.70 ( 1.38) |

B. Estimated coefficients for full model for buys and for sells (in parentheses)

| | Return (in %) from: | | |
|---|---|---|---|
| Explanatory variable | Opening price to trade | Trade to Closing price | Opening to closing |
| Intercept | 0.17 (-0.32) | 0.00 ( 0.15) | 0.18 (-0.18) |
| Commission | 0.00 (-0.00) | -0.00 (-0.01) | -0.00 (-0.01) |
| Size 1 (smallest) | 0.01 (-0.21) | 0.30 (-0.07) | 0.30 (-0.28) |
| 2 | 0.02 (-0.04) | 0.16 (-0.04) | 0.18 (-0.01) |
| 3 (large) | -0.00 (-0.00) | 0.07 ( 0.01) | 0.07 ( 0.01) |
| Complexity 2 (easy) | 0.08 (-0.03) | -0.02 ( 0.05) | 0.06 ( 0.02) |
| 3 | 0.15 (-0.07) | -0.06 ( 0.12) | 0.10 ( 0.05) |
| 4 | 0.20 (-0.09) | -0.05 ( 0.13) | 0.15 ( 0.04) |
| 5 (hardest) | 0.22 (-0.11) | -0.00 ( 0.29) | 0.22 ( 0.17) |
| Manager | | | |
| 10-percentile | -0.52 (-0.15) | 0.00 (-0.34) | -0.41 (-0.33) |
| 25-percentile | -0.25 (-0.04) | 0.07 (-0.26) | -0.14 (-0.19) |
| Median | -0.12 ( 0.15) | 0.12 (-0.18) | 0.01 ( 0.03) |
| 75-percentile | 0.03 ( 0.44) | 0.22 (-0.09) | 0.20 ( 0.22) |
| 90-percentile | 0.20 ( 0.70) | 0.26 ( 0.00) | 0.28 ( 0.54) |
| Range between 10 and 90 percentiles | 0.72 ( 0.85) | 0.26 ( 0.34) | 0.69 ( 0.87) |