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The Dynamics of Institutional and Individual Trading

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ABSTRACT

We study the daily and intradaily cross-sectional relation between stock returns and the trading of institutional and individual investors in Nasdaq 100 securities. Based on the previous day's stock return, the top performing decile of securities is 23.9% more likely to be bought in net by institutions (and sold by individuals) than those in the bottom performance decile. Strong contemporaneous daily patterns can largely be explained by net institutional (individual) trading positively (negatively) following past intradaily excess stock returns (or the news associated therein). In comparison, evidence of return predictability and price pressure are economically small.

RECENT STUDIES EXAMINING THE RELATION between institutional ownership and stock returns document three main findings. First, institutions are momentum investors and tend to follow past prices (Grinblatt, Titman, and Wermers (1995)).[1] Second, mutual funds sometimes tend to move together or engage in herding (Wermers (1999)).[2] Third, the contemporaneous relation between changes in institutional ownership and stock returns is much stronger than the trend chasing effect (Nofsinger and Sias (1999) and Wermers (1999)). We explain the positive contemporaneous relation between returns and changes in institutional ownership found at quarterly intervals in previous studies and, more importantly, provide new daily and intradaily evidence on the role of short-term

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[1] Nofsinger and Sias (1999) find somewhat weaker evidence of positive feedback trading for all institutions.

[2] Pirinsky (2002) finds that institutions herd within their own investment group types.

cross-sectional price movements in the trading behavior of institutional and individual investors.

The previous literature on institutional trading behavior in the United States is predominantly forced to rely on quarterly ownership data to compute changes in institutional holdings. In contrast, using daily and intradaily data from Nasdaq 100 firms, we are able to separately examine the relative importance of institutional and individual trading activity in: (a) predicting future price movements, (b) moving contemporaneous prices, and (c) following past stock return movements.

Although some brokerage houses have diversified to accept both retail and institutional order flow, most brokerage houses specialize in dealing with either institutional or individual clients. We use proprietary, qualitative analysis for Nasdaq 100 securities over the 10-month period from May 1, 2000 to February 28, 2001 to classify both sides of all trades as originating from an individual, an institution, or a market maker. Although this classification system is not perfect, we find that the assignment of trading volume correlates well with trade size by investor type. For instance, trades classified as institutional make up 85.99% of block trades (10,000 shares and over) but only 18.14% of small trades (less than 500 shares). For brevity, we discuss our findings in terms of institutional and individual investor activity, thus avoiding the more accurate but cumbersome statement that we are examining the activity of brokerage houses that primarily deal with individuals or institutions. It is also important to note that our analysis deals exclusively with cross-sectional ownership and return relations as we extract market-wide effects from both imbalances and returns.

Our results can be summarized as follows. First, there is a strong contemporaneous relation between changes in institutional ownership and stock returns at the daily level. Second, institutional trading largely follows past stock returns. The difference in returns between the high and low imbalance portfolios is a statistically significant 3.36% on the day prior to ranking and a significant 0.80% 2 days prior to ranking. A vector autoregression (VAR) analysis indicates that a one standard deviation increase in returns leads to a 0.15 standard deviation increase in institutional imbalance on the following day. Third, we find equally strong evidence of persistence in institutional and individual trading. We find no evidence that imbalances predict future daily returns.

Fourth, institutional orders are executed after intradaily return movements as well. The 5-minute intervals with the largest institutional buying (selling) activity are preceded by large positive (negative) abnormal stock returns in the previous 30-minute period. Furthermore, these periods of extreme institutional trading activity are associated with flat contemporaneous and future returns. In a VAR analysis with 5-minute intervals, there is a positive relation between institutional buy–sell imbalances and past returns and individual buy–sell imbalances are negatively related to past returns. Finally, we find that price movements ahead of large institutional trades are not caused by market makers accumulating inventory for their institutional clients. Institutional buy (and individual sell) orders are generally executed in the same direction as past daily and intradaily price movements. These patterns could be driven by institutional

and individual investors trading on different information and/or perceiving past stock return moves differently.

Several other studies also examine the cross-sectional relation between ownership and returns on a daily basis. Our findings are most consistent with daily patterns found in Korea by Choe, Kho, and Stulz (1999), who find daily herding and trend chasing by Korean and foreign institutional investors but contrarian investment by individual investors. Our results contrast to the lack of daily institutional trend chasing found in NYSE securities over a three-month period (in 1990 to 1991) by Nofsinger and Sias (1999) and the contrarian investment strategies of Finnish institutions documented by Grinblatt and Keloharju (2000). This highlights the important differences in the nature of institutional trading activity across exchanges and countries. It is important to note that the patterns we observe here may not be representative of NYSE, foreign, smaller, or less liquid stocks, or other less volatile time periods.

The paper proceeds as follows. Section I briefly discusses our relation to the current literature. Section II describes the data and the methodology used to assign trades to individual and institutional brokerage houses. Section III examines the daily relation between institutional trading and contemporaneous and past returns and the ability of institutional trading activity to forecast future returns. Section IV uses intradaily data to distinguish between intradaily institutional and individual trading activity predicting return movements, contemporaneous price pressure, and trading following price movements. We examine competing interpretations of our results in Section V and reversals in Section VI. A brief conclusion follows in Section VII.

I. Related Research

There is an extensive and growing literature on the relation between institutional and individual trading activity and stock prices. In general, this literature falls into three main groups: (1) studies examining the relation between past stock returns and institutional and individual trades, (2) papers investigating the forecasting ability of individual and institutional trades, and (3) those studying the contemporaneous relation between ownership changes and stock returns.

The first group of papers examines the relation between past stock returns and institutional and individual trading activity as well as the interaction between traders (herding). Momentum investing (also known as trend chasing or positive feedback trading) occurs when traders buy tomorrow in response to an increase in today's price. Models of investor behavior (e.g., DeLong et al. (1990a)) often posit uninformed individuals as the culprit, while others (e.g., DeLong et al. (1990b)) allow for rational speculators (or institutional investors) to follow prices. Other models demonstrate that managers may trade with the herd due to slowly diffusing private information (Froot, Scharfstein, and Stein (1992), Hirshleifer, Subrahmanyam, and Titman (1994), and Hong and Stein (1999)), career concerns (Scharfstein and Stein (1990)), or because of information inferred from other traders (Bikhchandani, Hirshleifer, and Welch (1992)).

The empirical literature examining momentum investing and herding by institutions primarily utilizes quarterly changes in institutional holdings. Lakonishok, Shleifer, and Vishny (1992) find only weak evidence of quarterly trend chasing and herding for pension funds. However, Grinblatt et al. (1995) find much stronger evidence of momentum investing by mutual funds and Badrinath and Wahal (2001) find that the propensity of momentum trading varies substantially across institution types and is primarily limited to new equity positions. Wermers (1999) also documents strong evidence of herding by mutual funds in small and growth-oriented stocks.

Opposing trading patterns are found for individuals.[3] Odean (1998) finds that individual investors sell stocks that were past winners and hold on to past losers. Similarly, Barber and Odean (2000) find that individual investors are "anti-momentum" investors.[4] Grinblatt and Keloharju (2000) find that Finnish individuals and institutions are contrarian investors.

A second group of papers examines the predictability of individual and institutional trades.[5] Chen, Jegadeesh, and Wermers (2000) find that stocks that managers buy outperform stocks managers sell by 2% per year after controlling for various characteristics.[6] Odean (1999) also finds that stocks purchased by individual investors consistently underperform the stocks they sell. However, Coval, Hirshleifer, and Shumway (2001) find that individuals who have performed well in the past earn superior returns.

The third group examines the cause of the strong contemporaneous relation between stock returns and quarterly (Wermers (1999)) and annual (Nofsinger and Sias (1999)) changes in ownership.[7] The relation could result from institutional trading activity predicting future price movements, contemporaneous

[3] It does not necessarily follow that individual trading patterns should be opposite to mutual funds, since many other types of institutions trade (e.g., banks, hedge funds, insurance companies, investment advisors, pension funds).

[4] Barber and Odean (2002) find that individuals execute relatively more buy trades than sell trades following extreme positive returns but the value of the positions they are selling are larger, so in terms of market value they are net sellers following large daily positive return movements.

[5] A similar question is whether foreign investors have superior information for future stock returns. Grinblatt and Keloharju (2000), Froot, O'Connell, and Seasholes (2001), Seasholes (2000), and Froot and Ramadorai (2001) find evidence of foreign investors' trades leading price movements, while Choe, Kho, and Stulz (2001) find no evidence of better-informed foreign investors in Korea. At the market level, Griffin, Nardari, and Stulz (2002) find that after controlling for the contemporaneous relation between flows and returns, foreign investors are generally not able to time the market at the daily frequency.

[6] This finding is also supported by Daniel et al. (1997) and Wermers (2000), who show that before accounting for managerial expenses, institutional investors outperform benchmark stocks with similar characteristics (size, BE/ME, and momentum).

[7] A related literature examines the microstructure relation with trader identity. For example, Barclay and Warner (1993) find that most of the price impact is concentrated in medium-size (500 to 10,000 shares) trades and Chakravarty (2001) finds that this activity is due to medium-size institutional trades. Chan and Lakonishok (1995) find that a sequence of institutional block trades leads to a significant impact on stock prices in NYSE and AMEX securities.

price pressure, and/or intraquarter institutional trend chasing. The price pressure hypothesis implies that institutional buy trades move prices more than individual sell trades. Sias et al. (2001) use a covariance decomposition method to estimate the relation between changes in quarterly ownership and daily returns and conclude that institutional price pressure is the predominant explanation. Cai, Kaul, and Zheng (2000), however, find that returns lead aggregate ownership changes, but ownership changes do not forecast returns. While both papers provide insight into the relation between quarterly returns and change in ownership, the precise nature of the intraquarter relation cannot be known without intraperiod ownership data. Our daily and intradaily analyses allow us to examine the competing explanations for the contemporaneous relation found at longer horizons and in the process, provide new evidence on daily and intradaily trading and past stock returns, price pressure, and the short-term predictability of institutional or individual trading activity.

II. Data

A. Data Description

The primary data set for this paper consists of all the trades and quotes in Nasdaq 100 stocks from May 1, 2000 to February 28, 2001 for a total of 210 trading days. We choose the Nasdaq 100 because they are the most liquid and actively traded stocks on Nasdaq with a diverse set of brokerage houses trading in each stock. We obtain bid and ask quotes directly from Nasdaq computer systems. The quote data are essentially the same as that reported on the Consolidated Tape via the NYSE's Trade and Quote (TAQ) data.

We collect proprietary trade data directly from Nasdaq's transaction confirmation service. The Nasdaq Stock Market uses this facility to aid in the settlement process and for trade reporting to the Consolidated Tape.[8] In this regard, the integrity of the data appears to be strong. Like the data reported in TAQ, the data include the date, time, ticker symbol, trade size, and price of each transaction. In addition to these standard fields, these proprietary data also include additional identifying fields (related to the settlement process) about the parties involved in each trade.

These additional fields include three main features that allow us to assign trading volume to institutions and individuals. First, each trade is linked to the parties (market maker or Electronic Communication Network (ECN)) on both sides of the trade. For trades occurring on ECNs, two records typically appear in the data that identify the two parties to the trade—one record indicating a seller with the ECN as counterparty and the second indicating a buyer with the same ECN as counterparty. These identifiers are used to assign the parties of the trade as retail or institutional, ignoring ECN identifiers that are simply placeholders marking the venue of the trade.

[8] Reported trades comprise the basis for TAQ data. For a detailed description of the Nasdaq data, see Smith, Selway, and McCormick (1998).

Second, each side of each trade is classified as to whether the parties are trading for their own account (as a market maker) or are simply handling a trade for a retail or institutional client (agency trading). Third, each trade is marked as to which party is buying and selling. This designation helps us to avoid erroneous trade classifications that commonly result from tick-test rules. With these three additional pieces of proprietary information, we assign trading volume to brokerage houses that primarily deal with individual investors, to brokerage houses primarily handling institutional order flow, or to market makers. We discuss the details of this classification in the Appendix.

B. An Examination of the Relation with Trade Size

Table I reports the average number of trades, trade size, percentage of trades, and percentage of volume that can be explained by each trade assignment over the May 1, 2000 to February 28, 2001 period. It is important to note that our data consist of executed trades, not the underlying orders. Using the trade assignment mechanism above, market maker trades with other market makers have an average trade size of 712 shares, which represents 11.03% of the trades and 11.93% of trading volume. Individual-to-market maker trades average around 386 shares per trade as compared to institution-to-market maker trades with an average trade size of 1,450 shares. Individual-to-market maker and individual-to-individual trading represents approximately 58.11% (36.58% + 21.53%) of trades, yet only 32.22% (21.47% + 10.75%) of total volume. In contrast, institution-to-market maker and institution-to-institution trading represent 19.65% of trades, yet 43.21% of the total volume. A note of caution is in order as the percent of volume by all parties is understated due to 8.98% of the data that we are unable to classify (as described in the Appendix).

In Panel B of Table I, we report the same characteristics for various trade-size groups. The trade-size breakdowns are the same as those reported by Barclay and Warner (1993), where trades for less than 500 shares are designated as small trades, medium-size trades range from 500 to 10,000 shares, and trades for greater than 10,000 shares are classified as large trades. Using these classifications, small trades constitute 67.74% of all trades but only 18.22% of volume. Medium-size trades represent 31.47% of the total number of trades but 53.71% of volume. Large trades represent only 0.79% of trades but, with an average trade size of 23,481 shares, account for 28.07% of volume.

Figure 1 reports the classifications in Table I as a percentage of the total volume in the small and large trade groups. Individual-to-individual and individual-to-market maker trades together account for 62.99% of volume in trades for less than 500 shares, whereas institutional trades with either other institutions or market makers account for 18.14% of all small-size trade volume. Conversely, for large trades, individuals trading with market makers or other individuals account for 3.58% of trading volume and institutional trading accounts for 85.99% of trading volume. If large share blocks are more likely to be originated by institutions, these findings support the proposition that the institutional trading volume is correctly assigned.

Table I

Distribution of Trades According to the Investor Type

Panel A reports the number of trades (in 1,000s), the average trade size, the percent of the trades, and the percent of volume that can be explained by each trade assignment for the Nasdaq 100 stocks over the May 1, 2000 to February 28, 2001 period. The market maker (dealer) on each side of each trade is trading for its own account or is simply acting as an agent and handling a trade for a customer. All agent trades are classified into institutional (Inst.) or individual (Indiv.) based on whether the market maker primarily deals with institutions or individuals. All principal trades are simply regarded as market maker trading (MM), irrespective of whether the market maker primarily deals with institutional or individual clients. In this way, both sides of the trades are classified as to whether they trade with an institution, an individual, or a market maker. The trades with inconsistencies in assigning whether a market maker acted as a principal or an agent for each leg of the trade form the nonclassified group. Panel B reports the same statistics for various trade-size groups. Trade sizes of less than 500 shares are designated as small trades, medium-size trades are from 500 to 10,000 shares, and share increments of greater than 10,000 shares are classified as large trades.

	MM to MM	Indiv. to MM	Indiv. to Indiv.	Indiv. to Inst.	Inst. to MM	Inst. to Inst.	Nonclassified	Total
Panel A: All								
No. of trades	27,398	90,831	53,467	10,664	47,924	879	17,175	248,338
Avg. trade size	712	386	329	560	1,450	1,302	855	658
% of trades	11.03	36.58	21.53	4.29	19.30	0.35	6.92	100.00
% of volume	11.93	21.47	10.75	3.66	42.51	0.70	8.98	100.00
Panel B: Various Trade-size Groups								
Small								
No. of trades	15,267	67,010	41,156	6,259	29,205	306	9,028	168,230
Avg. trade size	167	168	182	196	183	207	203	177
% of trades	6.15	26.98	16.57	2.52	11.76	0.12	3.64	67.74
% of volume	1.56	6.90	4.57	0.75	3.27	0.04	1.12	18.22
Medium								
No. of trades	11,992	23,737	12,304	4,390	17,136	562	8,032	78,154
Avg. trade size	1,239	938	812	1,028	1,452	1,560	1,294	1,123
% of trades	4.83	9.56	4.95	1.77	6.90	0.23	3.23	31.47
% of volume	9.09	13.63	6.11	2.76	15.23	0.54	6.36	53.71
Large								
No. of trades	140	84	7	15	1,583	11	115	1,954
Avg. trade size	14,938	18,209	15,675	16,207	24,803	18,343	21,446	23,481
% of trades	0.06	0.03	0.00	0.01	0.64	0.00	0.05	0.79
% of volume	1.28	0.94	0.07	0.14	24.02	0.12	1.50	28.07

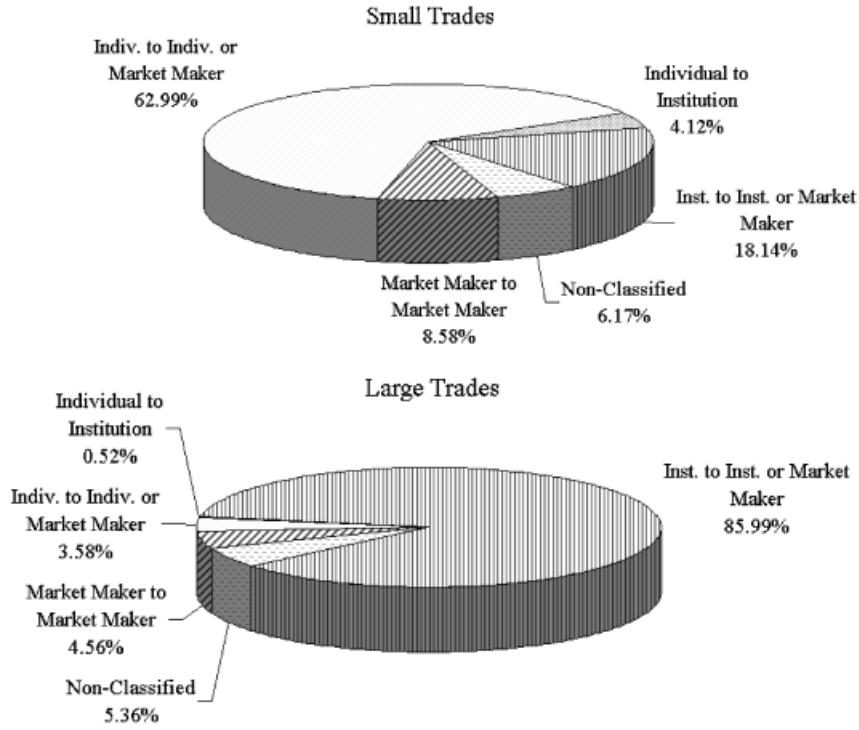

Figure 1. Distribution of trades by trade size. This figure plots the percentage of volume that can be explained by each trade assignment over the May 1, 2000 to February 28, 2001 period for small and large trades. The market maker (dealer) on each side of each trade is trading for his/her own account (as a market maker) or is simply acting as an agent and handling a trade for a customer. All agent trades are classified into institutional (Inst.) or individual (Indiv.) based on whether the market maker primarily deals with institutions or individuals. Both sides of the trades are classified as to whether they trade with another institution, an individual, or a market maker. The trades with inconsistencies in assigning whether a market maker acted as a principal or an agent for each leg of the trade form the nonclassified group. Trade sizes of less than 500 shares are designated as small trades and share increments of greater than 10,000 shares are classified as large trades.

From these classifications, we construct a measure of institutional trading imbalance. For each stock, we calculate the difference between the buy and sell volumes each day, and, to obtain a relative measure of the magnitude, scale by the number of shares outstanding. Unless otherwise noted, we refer to this as the imbalance throughout the paper.[9] If market makers go home exactly flat, net institutional buying activity would be perfectly offset by individual selling activity, since for every buyer there must be a seller. However, since we are only able to

[9] The average daily cross-sectional correlation between this measure and the institutional buy–sell volume as a percent of total volume is 0.74.

assign approximately 91% of the trading volume and market makers do not maintain exactly the same amount of inventory, the institutional and individual imbalances are not perfectly negatively correlated. We calculate the average daily cross-sectional correlation between the institutional and individual buy–sell imbalances and find a correlation of -0.69. Thus, while we focus on the institutional buy–sell imbalance measure, one could also interpret findings from the individual sell-buy imbalance perspective.

C. Relation to Spectrum Data

We compare quarterly changes in institutional and individual ownership calculated from our data to those computed from the 13F filings compiled on the widely used Spectrum database. The Spectrum data classifies institutions into five groups: (1) banks, (2) insurance companies, (3) mutual funds (or investment companies), (4) investment advisors, and (5) other (including pension and endowment funds).[10] We calculate quarterly imbalance measures from Spectrum as the quarterly change in holdings as a fraction of the total shares outstanding at the beginning of the quarter. Note that 13F filings are not required for state pension funds, hedge funds, institutions with less than $100 million under management, or for individual security positions below 10,000 shares or $200,000. Given these limitations, changes in quarterly holdings from Spectrum form a close, but imperfect proxy for the true changes in quarterly holdings.

Table II presents simple pooled correlations among the measures for the two full quarters that fall within our sample period.[11] We find that the correlation between institutional (individual) imbalances from our data and total institutional ownership changes from Spectrum is a statistically significant 0.53 (-0.64). Further analysis shows that this is primarily driven by the correlation between institutional imbalances in our data and trading by mutual funds (0.44), investment advisors (0.37), and other institutions (0.28). Changes in holdings for banks and insurance companies bear no significant relation to our measure of institutional imbalance, suggesting that these groups do not dominate the institutional trading in Nasdaq 100 stocks.

In Panel B, we examine the relation between the level of Spectrum holdings by institution type, turnover, and institutional and individual volume. Del Guercio (1996) shows that (compared to mutual funds) bank managers tilt their positions towards stocks that are viewed as more prudent. Similarly, in our sample, bank and mutual fund ownership is correlated with total institutional volume,

[10] The other category includes foundations, trusts, endowments, financial institutions, government, miscellaneous, non-financial companies, and pension funds. Del Guercio (1996), Wermers (1999), Gompers and Metrick (2001), and Cohen, Gompers, and Vuolteenaho (2002) discuss the details and potential limitations of the Spectrum data.

[11] The quarterly changes are calculated from June 30, 2000 to September 30, 2000 and from September 30, 2000 to December 31, 2000. We also compute correlations separately for each quarter and obtain similar results. Because of problems in Spectrum classification groups beginning in 1998, we use the classifications as of December 1997.

Table II

Correlations between Institutional Imbalances and Spectrum Imbalances

For the quarters from June 30, 2000 to September 30, 2000 and from September 30, 2000 to December 31, 2000, Panel A reports the correlations among quarterly changes in institutional and individual ownership calculated from Nasdaq data (Inst. Imbal. and Ind. Imbal.) and those computed using the Spectrum database. Quarterly change in institutional (individual) ownership is the difference between the institutional (individual) buy and sell volumes for that quarter scaled by the total number of outstanding shares at the beginning of the quarter. Quarterly imbalance measures from Spectrum are calculated as the quarterly change in holdings as a fraction of the total shares outstanding at the beginning of the quarter. Spectrum imbalances are computed for all the institutions and different institution types as classified by Spectrum. Panel B reports the correlations among the level of institutional holdings as obtained from Spectrum, turnover, and institutional and individual volume. The % Institutional ownership is the percentage of shares held by the institutions at the start of the quarter as obtained from Spectrum. Turnover is the total number of shares traded divided by the total shares outstanding at the beginning of the quarter. Institutional volume (% Inst. vol.) is the percentage of total number of shares traded by institutions. Individual volume (% Ind. vol.) is the percentage of total number of shares traded by individuals. Total trades is the total number of trades scaled by the total number of outstanding shares at the beginning of the quarter. Institutional trades (% Inst. Trades) is the percentage of total number of trades by institutions. Individual trades (% Ind. Trades) is the percentage of total number of trades by individuals. Any firm-quarter for which the number of shares outstanding changed by more than 10% is dropped from the sample.

Panel A

			Institutional Imbalance from Spectrum				
	Inst. Imbal.	Ind. Imbal.	Total	Banks	Insurance Co.	Mutual Funds	Investment Advisor
Ind. Imbal.	−0.76[a]						
Spec. Total Imbal.	0.53[a]	−0.64[a]					
Spec. Banks Imbal.	0.03	−0.11	0.24[a]				
Spec. Insurance Co. Imbal.	0.05	−0.11	0.43[a]	0.05			
Spec. Mutual Funds Imbal.	0.44[a]	−0.50[a]	0.71[a]	−0.05	0.00		
Spec. Investment Adv. Imbal.	0.37[a]	−0.43[a]	0.53[a]	0.02	−0.02	0.09	
Spec. Other Imbal.	0.28[a]	−0.30[a]	0.28[a]	0.01	0.05	0.14	0.09

Panel B

			% Institutional Ownership					
	Inst. Imbal.	Ind. Imbal.	Total	Banks	Insurance Co.	Mutual Funds	Investment Advisor	Other
Turnover	0.26[a]	0.05	0.17[b]	−0.13	0.20[b]	0.19[b]	0.19[b]	−0.16
% Inst. Vol.	−0.17[b]	−0.02	0.22[a]	0.17[b]	0.02	0.21[a]	0.13	0.27[a]
% Ind. Vol.	0.22[a]	0.03	−0.06	−0.15	0.07	−0.05	0.01	−0.30[a]
Total Trades	0.32[a]	−0.03	0.17[b]	−0.16	0.16	0.19[b]	0.23[a]	−0.23[a]
% Inst. Trades	−0.22[a]	−0.01	−0.10	0.20[b]	−0.18[b]	−0.13	−0.13	0.23[a]
% Ind. Trades	0.23[a]	0.05	0.16	−0.09	0.22[a]	0.16	0.19[b]	−0.22[a]

[a]Significance at 1%.
[b]Significance at 5%.

perhaps because banks view it as more prudent to hold stocks where other institutions trade.[12]

In sum, the reasonably large quarterly correlation between our measure of institutional imbalance and that reported by Spectrum and the strong relation between institutional/individual imbalances and trade size give us confidence that, while not a perfect measure, our assignment of institutional and individual trading volume appears quite useful. In Section IV, we further examine the sensitivity of our intradaily VAR results to a stricter classification of institutional trading.

III. Daily Institutional Trading Imbalances

In this section, we investigate the daily relation between institutional trading and contemporaneous and past returns, the persistence of institutional activity, and whether institutional or individual trading activity forecasts future daily stock returns.

A. The Contemporaneous Relation

Wermers (1999) and Nofsinger and Sias (1999) document a strong positive contemporaneous relation between institutional buying activity and quarterly and annual returns. However, with the exception of a brief analysis in Nofsinger and Sias, little is known about the daily relation in the U.S. market.

To examine the relation between the institutional trading activity and stock returns, we sort the Nasdaq 100 stocks each day into 10 groups of 10 stocks each based on the magnitude of the daily institutional buy–sell imbalance. Table III examines the daily contemporaneous returns to the 10 portfolios formed according to institutional buy–sell imbalance. On day zero, stocks with the largest institutional sell imbalances experience an extremely low excess return of -4.29%, whereas stocks with the largest institutional buying activity experience a 3.69% excess return. The difference between the high and low imbalance deciles is a striking 7.98% per day.[13] It is also interesting to note the large number of shares that change hands between the institutions and individuals. For stocks with the most institutional buying pressure, 0.329% of the shares are bought by institutions and for the portfolio with the most selling pressure 0.291% of the shares are sold by institutions.[14]

[12] In unreported results, the level of beginning of the quarter aggregate institutional ownership as a percent of the outstanding shares has a correlation of 0.23 with our measure of changes in institutional ownership over the quarter.

[13] Nofsinger and Sias (1999) compute similar measures on a daily basis with 114 NYSE firms from November 1, 1990 to January 31, 1991 and find a difference of just 2.68%. Our results for the recent Nasdaq period are almost three times stronger, likely due to differences in firm characteristics, time period, and stock return volatilities.

[14] In unreported results, we also perform cross-sectional regressions of returns on contemporaneous institutional imbalances and firm size, volume, percent institutional volume, and percent individual volume and find that the strong relation between institutional imbalances and returns is not affected by controlling for these other variables.

Table III

Lagged Returns and Institutional Buy–Sell Imbalances for Portfolios Classified by Institutional Buy–Sell Imbalance

On each day from May 8, 2000 to February 21, 2001, the Nasdaq 100 stocks are ranked by their daily institutional buy–sell imbalances and assigned to one of 10 portfolios with 10 stocks each. For each stock, institutional buy–sell imbalance (expressed in percent) is the difference between the institutional buy and sell volumes for that day scaled by the total number of outstanding shares. This table reports the time-series averages of lagged and contemporaneous institutional buy–sell imbalances and the difference between the return and the equal-weighted Nasdaq 100 return (Return — EW Nasdaq 100) for each portfolio. Returns are expressed in percent per day. The last row reports the mean difference between the high and low portfolios (H-L) for each variable. The statistical significance reported in the last row is computed from a paired *t*-test estimated from the time series of the difference between the high and the low portfolios. The statistical significances reported in the first 10 rows are computed from a paired *t*-test estimated from the time series of the difference between the corresponding portfolio return and the mean across all 10 portfolios.

	Return–EW Nasdaq 100						Institutional Buy–Sell Imbalance					
Rank	−5	−4	−3	−2	−1	0	−5	−4	−3	−2	−1	0
L	−0.33[b]	−0.29[b]	−0.53[a]	−0.59[a]	−1.92[a]	−4.29[a]	−0.010[a]	−0.013[a]	−0.016[a]	−0.027[a]	−0.071[a]	−0.291[a]
2	−0.07	0.23[b]	−0.07	−0.20	−0.98[a]	−2.24[a]	0.014	0.015	0.013	−0.004[a]	−0.021[a]	−0.103[a]
3	0.15	−0.02	0.09	−0.14	−0.74[a]	−1.52[a]	0.013	0.012	0.009[a]	0.007[a]	−0.009[a]	−0.052[a]
4	0.13	0.07	0.11	0.04	−0.41[a]	−0.79[a]	0.019	0.019	0.012	0.013	0.005[a]	−0.021[a]
5	0.04	0.10	−0.04	0.18	0.15	−0.21[b]	0.014	0.020	0.015	0.017	0.016	0.003[a]
6	0.24[b]	0.26[b]	0.08	0.21[b]	0.21[b]	0.47[a]	0.026[a]	0.019	0.021	0.018	0.021	0.026[a]
7	0.16	−0.03	0.21[b]	0.19	0.37[a]	1.08[a]	0.017	0.021	0.028[a]	0.030[a]	0.025[b]	0.052[a]
8	−0.13	−0.18	0.17	0.19	0.88[a]	1.59[a]	0.021	0.016	0.025[b]	0.034[a]	0.048[a]	0.088[a]
9	0.04	0.16	0.14	0.00	1.07[a]	2.25[a]	0.028[b]	0.031[a]	0.030[a]	0.035[a]	0.065[a]	0.145[a]
H	−0.19	−0.24	−0.13	0.20	1.44[a]	3.69[a]	0.037[a]	0.036[a]	0.044[a]	0.061[a]	0.103[a]	0.329[a]
H-L	0.14	0.04	0.39	0.80[a]	3.36[a]	7.98[a]	0.047[a]	0.049[a]	0.060[a]	0.088[a]	0.174[a]	0.620[a]

[a]Significance at 1%.
[b]Significance at 5%.

B. Returns Prior to Institutional Buy–Sell Imbalances

Table III also examines the institutional imbalances and returns in the 5 days before the ranking day for the 10 portfolios formed according to cross-sectional variation in institutional activity. If one assumes that institutional trading in a stock is not dominated by any particular institution (we explore this assumption in Section V), then the persistence in institutional trading is consistent with herding behavior. Stocks with the highest institutional imbalances on the ranking day have significantly higher imbalances in all of the previous 5 days.

For the portfolio of stocks with the largest institutional selling imbalances on day 0, there is a -1.92% abnormal return (relative to the equal-weighted market) on the day prior to ranking. There is a nearly monotonic ordering in prior day returns increasing with the imbalance ranking—the portfolio with the highest net buy imbalance has an excess return of 1.44%. The difference in returns between the high and low imbalance portfolios is a highly significant 3.36% on the day prior to ranking and 0.80% 2 days prior to ranking.

In unreported results, we also calculate average cross-sectional correlations of 0.29 and 0.14 between today's institutional imbalances and lagged 1- and 2-day buy–sell imbalances, respectively. Institutional (individual) imbalances have an average cross-sectional correlation with lagged 1- and 2-day returns of 0.19 (-0.13) and 0.04 (-0.02), respectively. Institutional and individual buy–sell imbalances are autocorrelated and execution of institutional trades seems to positively follow stock price movements.

C. Return Sorts

We rank stocks into 10 deciles based on their daily returns and then examine net institutional activity on the following day in Figure 2. Stocks within the top decile of daily stock return performance are bought more than they are sold by institutions on the following day 65.2% of the time. In contrast, those stocks in the lowest decile of daily stock return performance experience net buying by institutions the following day for only 41.3% of the stocks. Institutions are 23.9% (65.2% − 41.3%) more likely to be net buyers in stocks that have experienced large previous day returns as compared to those with low previous day returns.

D. Daily VAR Results

We use vector autoregressions to jointly examine the time-series behavior of buy–sell imbalances and returns for individual stocks on a daily basis. For each of the 82 stocks that is a member of the Nasdaq 100 for the whole sample period from May 1, 2000 to February 28, 2001, we calculate the daily returns and institutional buy–sell imbalances. To remove common market-wide effects, both variables are adjusted by subtracting the equal-weighted Nasdaq 100 average return or the institutional imbalance, respectively. To facilitate interpretation, we standardize both variables using their own time series and then estimate the

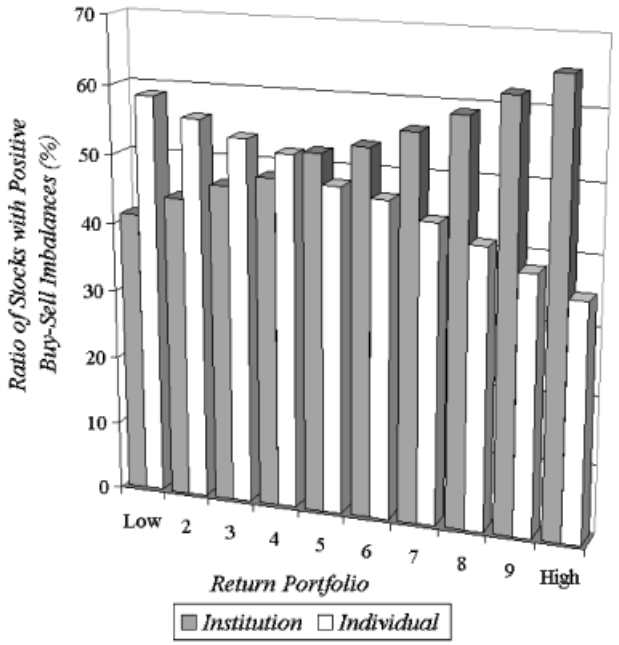

Figure 2. Institutional and individual trading activity following classification by daily returns. On each day from May 8, 2000 to February 21, 2001, the Nasdaq 100 stocks are ranked by their daily returns and assigned to one of 10 portfolios with 10 stocks each. For each portfolio, the proportion of stocks for which institutions are net buyers the following day is computed. If institutional selling activity is more than institutional buying activity then the stock is classified as a net individual buy. The time series average of these proportions is calculated for each portfolio on the day following the ranking day.

following system of equations with five lags for each security:

$$R_t = \alpha + \sum_{i=1}^{5} \beta_i R_{t-i} + \sum_{i=1}^{5} \lambda_i I_{t-i} + \delta_{t,R} \tag{1}$$

$$I_t = \alpha + \sum_{i=1}^{5} \beta_i R_{t-i} + \sum_{i=1}^{5} \lambda_i I_{t-i} + \delta_{t,I}, \tag{2}$$

where R_t is the adjusted return at time t and I_t is the adjusted institutional buy–sell imbalance at time t.

Table IV reports the cross-sectional averages of the coefficient estimates, the adjusted R^2s, and the percentage of stocks with positive and negative coefficients that are significantly different from zero at the 5% confidence level. Panel A of Table IV shows several interesting findings. First, the institutional buy–sell imbalances are positively related to the previous day's returns. In the institutional imbalance equation, the average coefficient for the previous day's return is 0.12, indicating that a 1 standard deviation increase in the daily return leads to a 0.12

Table IV

Daily VAR Estimates for Individual Stocks

For each of the 82 stocks that is a member of the Nasdaq 100 for the whole sample period from May 1, 2000 to February 28, 2001, the following daily vector autoregressions (VARs) with five lags are estimated:

$$R_t = \alpha + \sum_{i=1}^{5} \beta_i R_{t-i} + \sum_{i=1}^{5} \lambda_i I_{t-i} + \delta_{t,R} \quad \text{(A)}$$

$$I_t = \alpha + \sum_{i=1}^{5} \beta_i R_{t-i} + \sum_{i=1}^{5} \lambda_i I_{t-i} + \delta_{t,I}, \quad \text{(B)}$$

where R_t is the daily adjusted return and I_t is the daily adjusted institutional buy–sell imbalance for a given stock. Results for the VAR are reported in Panel A. Both variables are adjusted by subtracting the equal-weighted average for the stocks comprising the Nasdaq 100 index for the corresponding day. For each stock, the institutional buy–sell imbalance is the difference between the institutional buy and sell volumes for that day scaled by the total number of outstanding shares. To facilitate interpretation, both variables are standardized prior to estimation of the VAR. Panel B reports results for a structural VAR with contemporaneous excess returns in the institutional imbalance equation. This table reports the cross-sectional averages of the coefficient estimates and adjusted R^2s first. Second, the percentage of stocks with positive and negative coefficients that are significantly different from 0 at the 5% confidence level (% pos. sig. and % neg. sig.) are shown.

			Return					Inst. Imbal.					
Dep. Var.	α	β_0	β_1	β_2	β_3	β_4	β_5	λ_1	λ_2	λ_3	λ_4	λ_5	Adj. R^2
Panel A													
Return	0.00		−0.05	−0.08	0.02	−0.02	0.00	0.01	0.02	−0.02	0.01	−0.01	0.009
% pos. sig.	0.0		3.7	0.0	2.4	1.2	1.2	4.9	3.7	4.9	1.2	1.2	
% neg. sig.	0.0		8.5	14.6	2.4	2.4	2.4	3.7	3.7	6.1	1.2	0.0	
Inst. Imbal.	0.00		0.12	−0.04	−0.03	−0.03	−0.01	0.17	0.07	0.03	0.02	0.03	0.091
% pos. sig.	0.0		34.1	1.2	2.4	0.0	2.4	53.7	17.1	6.1	2.4	4.9	
% neg. sig.	0.0		2.4	11.0	8.5	6.1	2.4	0.0	1.2	2.4	1.2	3.7	
Panel B													
Return	0.00		−0.05	−0.08	0.02	−0.02	0.00	0.01	0.02	−0.02	0.01	−0.01	0.009
% pos. sig.	0.0		3.7	0.0	2.4	1.2	1.2	4.9	3.7	4.9	1.2	1.2	
% neg. sig.	0.0		8.5	14.6	2.4	2.4	2.4	3.7	3.7	6.1	1.2	0.0	
Inst. Imbal.	0.00	0.52	0.15	0.00	−0.04	−0.02	−0.01	0.16	0.05	0.04	0.01	0.03	0.374
% pos. sig.	0.0	100.0	57.3	6.1	2.4	0.0	4.9	59.8	15.9	9.8	2.4	6.1	
% neg. sig.	0.0	0.0	0.0	2.4	11.0	6.1	2.4	0.0	1.2	2.4	0.0	2.4	

standard deviation increase in the next day's institutional net buying activity. More than 34% of the stocks have significantly positive coefficients. However, the effect dissipates quickly with the 2- through 5-day lagged coefficients being slightly negative.

Second, abnormal institutional buy–sell imbalances are more strongly related to past institutional imbalances. The average coefficient on the previous day's

institutional imbalance is 0.17, and 53.7% of the stocks have statistically significant positive coefficients. The lagged 2- through 5-day institutional imbalance coefficients are positive as well. These daily results are consistent with the Sias and Starks (1997) finding that U.S. institutional investors have persistence in their daily trading patterns.[15] Third, there is no evidence that past institutional trading imbalances forecast daily returns. The average coefficients for past institutional imbalances in the return equation are close to 0 and only approximately 5% of the lagged institutional imbalances are significant at the 5% level.

In Panel B of Table IV, we estimate a structural VAR with the contemporaneous returns in the institutional imbalance equation.[16] The average coefficient for the contemporaneous return is 0.52, that is, a 1 standard deviation increase in today's return is associated with a 0.52 standard deviation increase in today's buy–sell imbalance on average. All the stocks have significantly positive coefficients at the 5% level and the average adjusted R^2 for the imbalance equation increases from 0.091 to 0.374. The average coefficient on the lagged return is now 0.15 with statistical significance for 57.3% of the coefficients.[17] This strong daily contemporaneous relation is consistent with both price pressure and institutions and individual traders following intradaily prices (or the news associated with these price movements). We next turn to intradaily analysis to help distinguish between these hypotheses.

IV. Intradaily Analysis

We investigate competing explanations for the strong daily contemporaneous relation between imbalances and returns in three different ways. First, we examine returns and buy–sell imbalances around extreme institutional and individual trading imbalance events. Second, we examine returns and trading activity surrounding extreme excess returns. Third, for a more general examination, we use an intradaily VAR analysis.

[15] Sias and Starks (1997) document that return autocorrelations are increasing in institutional ownership,which is consistent with correlated institutional trading driving return autocorrelations.

[16] We are not assuming that returns cause imbalances, but rather including returns here to compare the contemporaneous relation between returns and imbalances to the effect of lagged returns on institutional imbalances. We also estimate a system with contemporaneous institutional imbalances in the return equation and obtain similar results.

[17] We also decompose the quarterly covariance between excess institutional imbalances and excess returns in a manner similar to Froot et al. (2001). While the VAR controls for the past relation with imbalances, the covariance decomposition only analyzes the simple covariance between imbalances and returns. The average fraction of the quarterly covariance between excess imbalances and lagged daily excess returns in days -6 to -60 is -4.05%, days -2 to -5 is 42.84, and 31.65% is due to day -1. The fraction of the quarterly covariance due to the contemporaneous daily relation is 72.16%, and -42.60% is due to imbalances and future returns. Especially given the short time series of our data, the longer-run covariance ratios are less precise than short-term covariance ratios.

A. Intradaily Sample

We divide each trading day into 78 5-minute intervals from 9:30 a.m. to 4:00 p.m. We use the prevailing inside bid and ask quotes to calculate the bid-ask midpoints and construct returns from these bid-ask midpoints at 5-minute intervals. Because trades are reported with an average lag of 2 seconds, we lag the bid-ask midpoints by 2 seconds before computing the returns.[18] Note that 99.19% of our 5-minute intervals have recorded trades. Thus, the impact of infrequent trading should be minimal.

The buy–sell imbalance is the difference between the buy and sell volumes for each 5-minute interval scaled by the total number of shares outstanding. As shown previously, the daily institutional and individual buy–sell imbalances are highly negatively correlated. However, the average cross-sectional correlation between individual and institutional buy–sell imbalances is only -0.31 at the intradaily 5-minute frequency. Therefore, we examine both institutional and individual imbalances for our intradaily analysis.[19]

B. Extreme Institutional and Individual Imbalance Periods

We first seek to examine institutional and individual trading and returns around periods of abnormal institutional activity. This intradaily event-study approach is similar in spirit to that used in Choe et al.'s (1999) examination of large foreign trading activity. For each stock, we select 50 5-minute intervals with the largest net institutional buying activity and 50 such intervals with the largest net selling activity. To avoid crossing day boundaries while examining the previous and subsequent 30-minute periods, the events are selected from the seventh interval (10:00–10:05) through the 72nd interval (15:25–15:30). Figure 3 reports the cumulative excess returns and excess institutional and individual imbalances from the 30 minutes prior to and following the event.[20] The scale for the cumulative returns is on the right-hand side, while the scale for the buy–sell imbalances is on the left-hand side of the graph. Panel A examines the activity around the largest institutional buy imbalances. The returns range from 0.06 to 0.24% and are significantly positive in each of the six 5-minute intervals preceding the extreme institutional buy imbalance for a cumulative total of 0.64%. However, the actual 5-minute interval with the extreme buy imbalance is associated with an excess return that is positive but close to zero (0.02%). For the 30-minute interval after

[18] Trades are required to be reported within 90 seconds and quotes are instantaneously reported. Recent Nasdaq analysis suggests that the average trade reporting time is 2 seconds. We replicate our key results with a 90-second lag and without a lag and find that they yield similar inferences.

[19] To control for market-wide effects across stocks, we adjust returns and individual and institutional buy–sell imbalances by subtracting the equal-weighted averages for the stocks comprising the Nasdaq 100 index for the corresponding 5-minute interval.

[20] We also examine raw returns and raw imbalances around periods of abnormal individual and institutional trading activity. Because only a small fraction of the events are clustered in time, these findings are nearly identical. We also scale buy–sell volume by total volume for the corresponding 5-minute interval. This measure yields similar inferences as well.

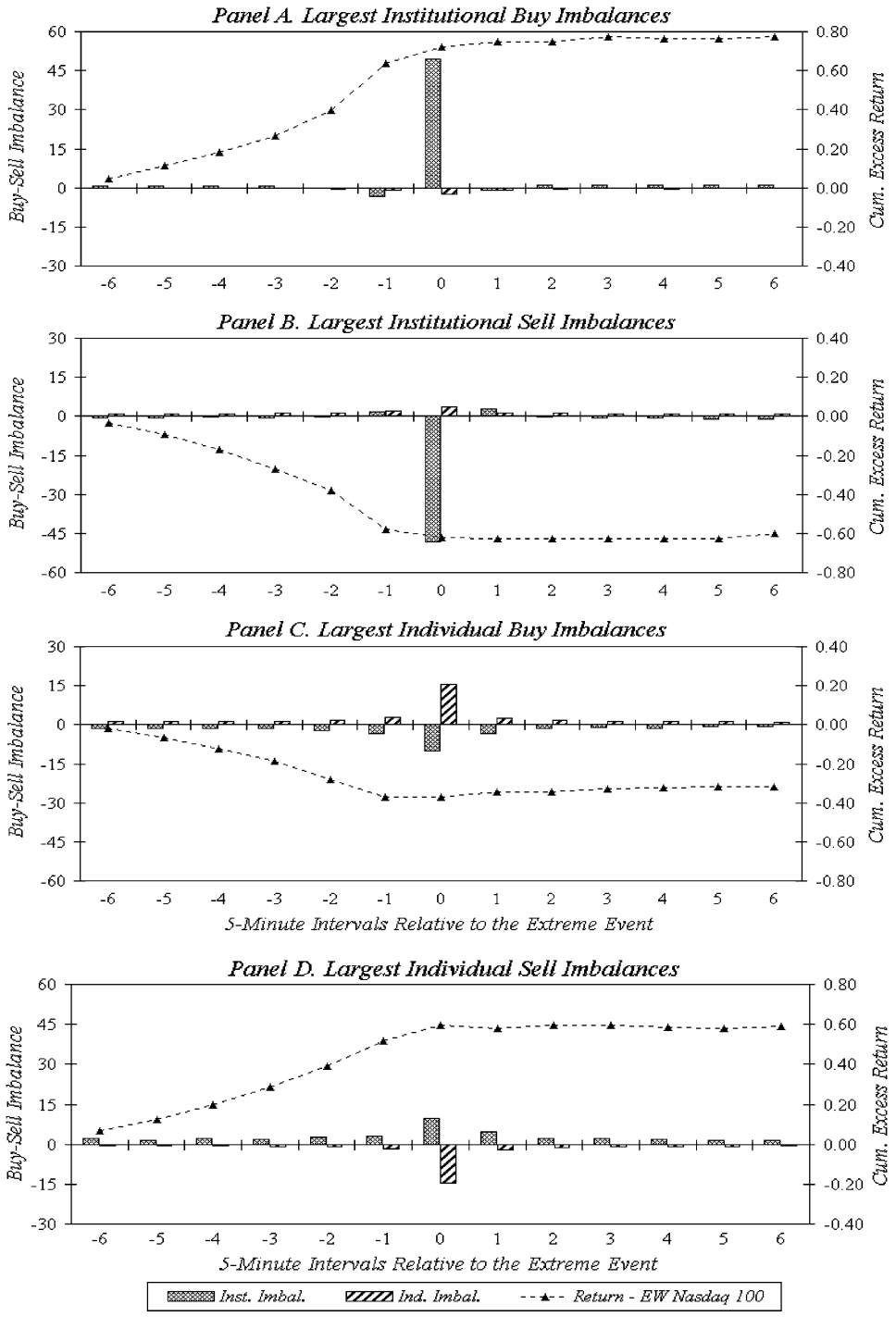
Panel A. Largest Institutional Buy Imbalances
Buy-Sell Imbalance
Cum. Excess Return
Panel B. Largest Institutional Sell Imbalances
Buy-Sell Imbalance
Cum. Excess Return
Panel C. Largest Individual Buy Imbalances
Buy-Sell Imbalance
Cum. Excess Return
5-Minute Intervals Relative to the Extreme Event
Panel D. Largest Individual Sell Imbalances
Buy-Sell Imbalance
Cum. Excess Return
5-Minute Intervals Relative to the Extreme Event
Inst. Imbal.
Ind. Imbal.
Return - EW Nasdaq 100

Figure 3.

the extreme imbalance, the returns are also small with a cumulative 30-minute return of only 0.04%.

A similar relation holds for periods of large institutional sell imbalances. Panel B shows that large institutional sell imbalances are preceded by negative excess returns ranging from -0.03 to -0.20 for a cumulative return of -0.58% in the 30 minutes prior to the event. However, the returns are near zero (0.01%) in the period of the large institutional sell imbalance and in the 30-minute period following the large institutional selling activity. These results indicate that large institutional imbalances do not forecast subsequent stock price movements. Institutional trading activity follows price movements and prices move little in the 5-minute interval in which the large imbalances occur.

Panels C and D examine trading activity surrounding the largest 50 individual net buy and net sell imbalance periods, respectively. The largest individual buy imbalances are smaller than the largest institutional buy imbalances in Panel A. Unlike the patterns for institutions, the cumulative excess return for the 30-minute period prior to the extreme individual buy imbalance is a highly significant -0.37%. Panel D shows that the cumulative excess return for the 30-minute period prior to the largest individual selling activity period is 0.52%. Large individual buying (and institutional selling) activity follows stock price decreases while individual selling (and institutional buying) follow stock price increases. The contemporaneous stock price movements during the 5-minute intervals with the large imbalances are small compared to the stock price movements over the previous 30-minute period.

C. Extreme Return Intervals

To examine more thoroughly if individual and institutional trading activity forecast, drive, or follow stock returns, we isolate the 50 5-minute intervals with the largest excess returns for each security and then examine institutional and individual trading activity in the 30 minutes on either side of the event. Panels A and B of Figure 4 display the results for the largest positive and negative excess

Figure 3. Intradaily returns and buy–sell imbalances around 5-minute intervals of extreme buy–sell imbalances. Each trading day is divided into 78 5-minute intervals from 9:30 a.m. to 4:00 p.m. For each interval for each of the 82 stocks that is a member of the Nasdaq 100 for the whole sample period from May 1, 2000 to February 28, 2001, excess returns and institutional and individual buy–sell imbalances (Inst. Imbal. and Ind. Imbal., expressed in 1/1000 of a percent) are computed. For each stock, institutional (individual) buy–sell imbalance is the difference between the institutional (individual) buy and sell volumes for that 5-minute interval scaled by the total number of outstanding shares. Excess return, expressed in percentages, is the difference between the return on the stock and the equal-weighted Nasdaq 100 return. The 50 intervals with the largest (smallest) buy–sell imbalances are then selected for each stock. This figure plots the cumulative excess returns and institutional and individual imbalances for the 30-minute periods (-6 to $+6$) surrounding the event. To avoid crossing day boundaries while examining -6 to $+6$ intervals, the events are selected from the seventh interval (10:00–10:05 a.m.) through the 72nd interval (3:25–3:30 p.m.).

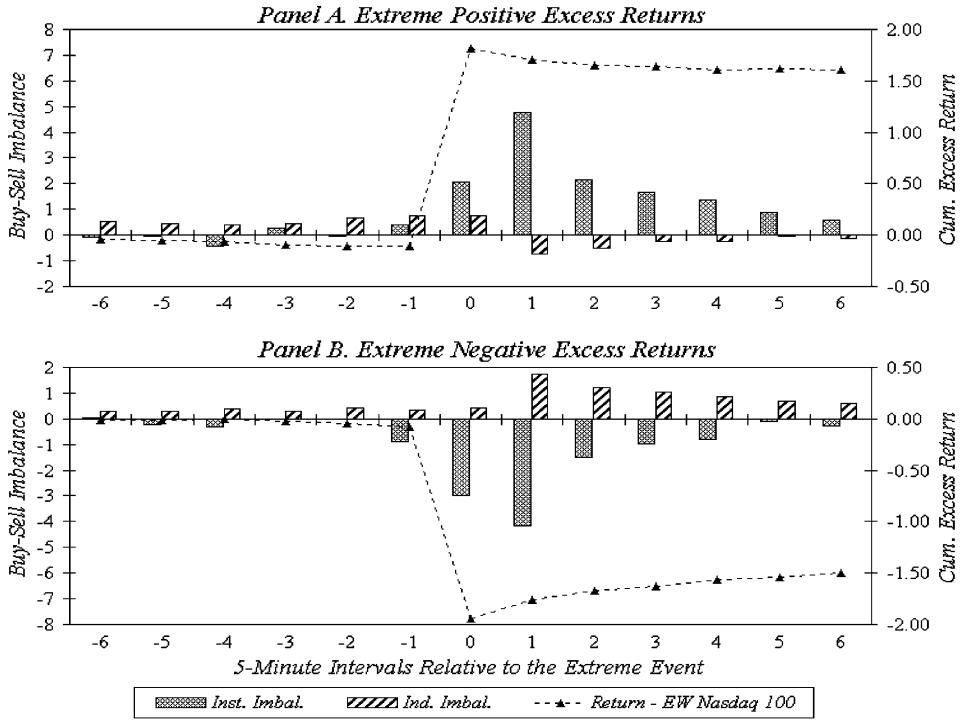

Figure 4. Intradaily returns and buy–sell imbalances around 5-minute intervals of extreme returns. Each trading day is divided into 78 5-minute intervals from 9:30 a.m. to 4:00 p.m. For each interval for each of the 82 stocks that is a member of the Nasdaq 100 for the whole sample period from May 1, 2000 to February 28, 2001, excess returns and institutional and individual buy–sell imbalances (Inst. Imbal. and Ind. Imbal., expressed in 1/1000 of a percent) are computed. For each stock, institutional (individual) buy–sell imbalance is the difference between the institutional (individual) buy and sell volumes for that 5-minute interval scaled by the total number of outstanding shares. Excess return, expressed in percentages, is the difference between the return on the stock and the equal-weighted Nasdaq 100 return. The 50 intervals with the largest (smallest) excess returns are then selected for each stock. This figure plots the cumulative excess returns and institutional and individual imbalances for the 30-minute periods (-6 to $+6$) surrounding the event. To avoid crossing day boundaries while examining -6 to $+6$ intervals, the events are selected from the seventh interval (10:00–10:05 a.m.) through the 72nd interval (3:25–3:30 p.m.).

returns, respectively. Both the extreme positive and negative excess returns average around 2% in absolute value. Note that the scales are different than those presented in Figure 3.

Panel A shows that, prior to the extreme positive abnormal return, individuals are statistically significant net buyers in each 5-minute interval. However, individuals are also statistically significant net buyers prior to the extreme negative abnormal return in Panel B. Institutions are net sellers in the 5-minute interval prior to large negative excess return (in Panel B), but they buy less than individuals prior to the extreme positive excess returns (in Panel A). Net institutional

activity prior to the extreme abnormal return is small in magnitude compared to activity after the abnormal return.

During the 5-minute interval with the extreme positive excess return, institutions and individuals are net buyers and market makers are net sellers. However, the cumulative institutional net buying activity in the 30-minute period following the extreme positive return is nearly 12 times as large as the institutional net buying activity in the extreme positive return interval. The institutional net buying activity is persistent and statistically significant in all six 5-minute intervals following the event.

In the case of extreme price increases (in Panel A), individuals are statistically significant net sellers in the three 5-minute periods following the price increase. However, this activity is small compared to the buying activity by institutions. A different picture emerges in Panel B, as there is a much larger increase in individual buying activity subsequent to extreme negative returns. In sum, these results suggest that the institutional and individual trading imbalances after stock price movements are much larger than the activity before or simultaneous with the return move.

D. Intradaily VAR Analysis

Following procedures similar to those in the daily VAR analysis, we estimate intradaily VARs with six lags for returns and institutional and individual buy–sell imbalances. To avoid crossing day boundaries for lagged returns and buy–sell imbalances, the first half hour of each trading day is excluded from the analysis. Table V reports the cross-sectional averages of the coefficient estimates and adjusted R^2s and the percentage of stocks with positive and negative coefficients that are significantly different from 0 at the 5% level.

Panel A of Table V shows several interesting findings. First, institutional buy–sell imbalances are positively related to past returns. The average coefficient of 0.15 on the lagged 5-minute return indicates that a 1 standard deviation increase in intradaily 5-minute returns leads to a 0.15 standard deviation increase in next period's institutional buying activity. One hundred (98.8%) percent of the stocks have statistically significant coefficients on the lagged one (two) period returns. Even at the lagged five-period return, 36.6% of the stocks have statistically significant positive coefficients.

Second, outside of the immediately preceding 5-minute period, institutional imbalances are positively related to past institutional imbalances and negatively related to lagged values of individual imbalances. The only exception is the coefficient for the institutional imbalance for the previous interval. This negative relation could be induced by inventory smoothing on the part of the market maker as found by Reiss and Werner (1998) for the London Stock Exchange. As we show in the next section, the negative relation disappears with the exclusion of block trades. Since inventory smoothing is likely to be more prevalent around block trades, these findings suggest that this is a likely explanation.

Third, individual imbalances are negatively related to past returns, but the relation is not quite as strong (as shown by smaller coefficients in absolute value) as

Table V

Intradaily VAR Estimates for Individual Stocks

For each of the 82 stocks that is a member of the Nasdaq 100 for the whole sample period from May 1, 2000 to February 28, 2001, the following intradaily vector autoregressions (VARs) with six lags are estimated:

$$R_t = \alpha + \sum_{i=1}^{6} \beta_i R_{t-i} + \sum_{i=1}^{6} \lambda_i I_{t-i} + \sum_{i=1}^{6} \gamma_i J_{t-i} + \delta_{t,R} \quad \text{(A)}$$

$$I_t = \alpha + \sum_{i=1}^{6} \beta_i R_{t-i} + \sum_{i=1}^{6} \lambda_i I_{t-i} + \sum_{i=1}^{6} \gamma_i J_{t-i} + \delta_{t,I} \quad \text{(B)}$$

$$J_t = \alpha + \sum_{i=1}^{6} \beta_i R_{t-i} + \sum_{i=1}^{6} \lambda_i I_{t-i} + \sum_{i=1}^{6} \gamma_i J_{t-i} + \delta_{t,J}, \quad \text{(C)}$$

where R_t is the 5-minute adjusted return and I_t (J_t) is the 5-minute adjusted institutional (individual) buy–sell imbalance for a given stock. All three variables are adjusted by subtracting the equal-weighted average for the stocks comprising the Nasdaq 100 index for the corresponding 5-minute interval. For each stock, the institutional (individual) buy–sell imbalance is the difference between the institutional (individual) buy and sell volumes for that 5-minute interval scaled by the total number of outstanding shares. To avoid crossing day boundaries for lagged returns and buy–sell imbalances, the first half hour of each trading day is excluded from the analysis. To facilitate interpretation, all variables are standardized prior to estimation of the VAR. A structural VAR is also estimated with the assumption that institutional and individual buy–sell imbalances are influenced by the contemporaneous returns. This table reports the cross-sectional averages of the coefficient estimates and the adjusted R^2s first. Second, the percentage of stocks with positive and negative coefficients that are significantly different from 0 at the 5% confidence level are shown.

			Return						Inst. Imbal.						Ind. Imbal						
Dep. Var.	α	β_0	β_1	β_2	β_3	β_4	β_5	β_6	λ_1	λ_2	λ_3	λ_4	λ_5	λ_6	γ_1	γ_2	γ_3	γ_4	γ_5	γ_6	Adj. R^2
Panel A																					
Return	0.00		−0.01	−0.02	−0.01	0.00	0.00	0.00	0.02	0.01	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.005
% pos. sig.	0.0		23.2	7.3	7.3	13.4	14.6	6.1	68.3	28.0	23.2	9.8	8.5	1.2	30.5	12.2	9.8	4.9	8.5	4.9	
% neg. sig.	0.0		46.3	46.3	32.9	25.6	11.0	8.5	1.2	2.4	0.0	1.2	0.0	3.7	6.1	3.7	1.2	1.2	6.1	4.9	
Inst. Imbal.	0.00		0.15	0.07	0.04	0.02	0.01	0.01	−0.04	0.01	0.03	0.03	0.03	0.03	−0.12	−0.04	−0.02	−0.02	−0.01	−0.01	0.074
% pos. sig.	0.0		100.0	98.8	92.7	78.0	36.6	17.1	13.4	46.3	64.6	74.4	68.3	76.8	0.0	1.2	3.7	3.7	6.1	6.1	
% neg. sig.	0.0		0.0	0.0	0.0	0.0	2.4	3.7	68.3	18.3	9.8	7.3	2.4	1.2	100.0	82.9	61.0	50.0	42.7	32.9	

Ind. Imbal.	0.00		−0.08	−0.05	−0.03	−0.02	−0.01	−0.01	−0.03	−0.02	−0.01	−0.01	−0.01	−0.01	0.20	0.09	0.07	0.05	0.05	0.05	0.133
% pos. sig.	0.0		0.0	1.2	1.2	1.2	1.2	2.4	2.4	4.9	8.5	2.4	2.4	3.7	100.0	100.0	98.8	96.3	97.6	93.9	
% neg. sig.	0.0		96.3	95.1	87.8	76.8	41.5	26.8	76.8	67.1	46.3	40.2	32.9	37.8	0.0	0.0	0.0	1.2	1.2	0.0	
Panel B																					
Return	0.00		−0.01	−0.02	−0.01	0.00	0.00	0.00	0.02	0.01	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.005
% pos. sig.	0.0		23.2	7.3	7.3	13.4	14.6	6.1	68.3	28.0	23.2	9.8	8.5	1.2	30.5	12.2	9.8	4.9	8.5	4.9	
% neg. sig.	0.0		46.3	46.3	32.9	25.6	11.0	8.5	1.2	2.4	0.0	1.2	0.0	3.7	6.1	3.7	1.2	1.2	6.1	4.9	
Inst. Imbal.	0.00	0.05	0.15	0.07	0.04	0.03	0.01	0.01	−0.04	0.01	0.03	0.03	0.03	0.03	−0.12	−0.04	−0.02	−0.02	−0.01	−0.01	0.079
% pos. sig.	0.0	79.3	100.0	100.0	92.7	81.7	37.8	18.3	12.2	45.1	65.9	74.4	67.1	78.0	0.0	1.2	3.7	3.7	4.9	6.1	
% neg. sig.	0.0	4.9	0.0	0.0	0.0	0.0	2.4	3.7	69.5	19.5	9.8	7.3	2.4	1.2	100.0	81.7	61.0	51.2	43.9	35.4	
Ind. Imbal.	0.00	0.00	−0.08	−0.05	−0.03	−0.02	−0.01	−0.01	−0.03	−0.02	−0.01	−0.01	−0.01	−0.01	0.20	0.09	0.07	0.05	0.05	0.05	0.136
% pos. sig.	0.0	30.5	0.0	1.2	1.2	1.2	1.2	1.2	2.4	4.9	8.5	2.4	2.4	3.7	100.0	100.0	98.8	96.3	97.6	93.9	
% neg. sig.	0.0	41.5	95.1	95.1	86.6	78.0	43.9	28.0	78.0	67.1	45.1	39.0	31.7	37.8	0.0	0.0	0.0	1.2	1.2	0.0	

the positive relation between institutional imbalances and past returns. Fourth, individuals tend to herd within the trading day as well. Individual imbalances are strongly related to past individual imbalances. Interestingly, the relation between individual buy–sell imbalances and past individual trading imbalances is much stronger than the relation between institutional trading activity and its past values. As expected, individual activity is negatively related to past institutional imbalances.

There is also some evidence of a small but statistically significant short-term return predictability for lagged individual and institutional imbalances. In the return equation, the lagged one-period institutional (individual) trading imbalances have a positive and statistically significant influence on the next 5-minute interval's stock price for 68.3% (30.5%) of the stocks. The magnitude of the effect is not large, however, as a one standard deviation increase in institutional net buying activity leads only to a 0.02% increase in next-period's return. The magnitude of the explained variation is also small as the adjusted R^2 for the return equation is 0.005, compared with 0.074 and 0.133 for the institutional and individual imbalance equations.

Panel B of Table V contains similar regressions except that contemporaneous returns are also included for the imbalance equations. The contemporaneous coefficients have little effect on other variables in the system. The average coefficient on contemporaneous returns in the institutional imbalance equation is 0.05, one-third of the coefficient (0.15) on lagged returns. The coefficient on the contemporaneous return in the individual imbalance equation is 0, indicating that price pressure is not the predominant force driving the strong relation between returns and imbalances found at the daily level.

One check of the classification method of institutions and individuals would be to examine block trades that are likely to be from institutions. To reexamine our findings with this alternative classification method, we examine VAR results similar to Panel B of Table V, with institutional trades greater than 10,000 shares and individual trades less than 10,000 shares. In unreported results, we find that the magnitude of past returns in the imbalance equation is slightly lower than with small- and medium-size institutional trades in Panel A at lag one, but the patterns are more persistent. Contemporaneous price pressure effects are again only a fraction of the momentum effect.

To more thoroughly examine the relation between imbalances and returns over the entire trading day, we decompose the daily covariance between institutional imbalances and excess stock returns in 5-minute increments. The fraction of the daily covariance due to the 5-minute contemporaneous covariance between excess institutional imbalances and returns is 5.03%. The fraction of the daily covariance between institutional imbalances and returns in the previous 5-minute period is 16.19%, 24.23% from -30 to -5 minutes, and 47.15% for all other previous intradaily returns. The covariance between institutional imbalances and future returns in the next half hour is 4.74% of the daily covariance and 2.65% over the rest of the trading day. The strong daily positive (negative) correlation between changes in institutional (individual) ownership and returns can almost entirely be explained by net trading imbalances occurring subsequent to return moves.

V. Interpretation

Our evidence indicates that institutional trades follow prices and the impact of institutional trading on prices is minimal. However, what appears to be institutional trades following past stock returns may actually be due to price impact. Perhaps institutions submit limit buy orders and then, in an attempt to accumulate the appropriate number of shares to fill the orders, the market maker bids up the stock's price prior to execution of the trade. Conversely, prices may move with institutions and individuals subsequently trading in the same direction either because of trading on common information or because they are simply trading based on past price movements. We examine the possibility of these explanations in several ways both intradaily and daily.

A. Intradaily Activity

A.1. Market Maker Activity Surrounding Block Trades

Abnormal return movements may cause institutional trading activity, but trading activity may also drive price movements. Unfortunately, our data does not include order characteristics and we only identify executions.[21] Even order data, however, has limitations, as large orders are commonly submitted to brokers piecemeal. Large orders may be filled in small pieces as well and may be canceled or revised based on price impact costs as trading interests are revealed. We examine the price impact from market makers buying up shares on behalf of the institutions by examining the activity of individual market makers.

Examining the net buying and selling behavior of the market maker that is responsible for most of the trading activity in a large trading imbalance is also informative. In Figure 5, we examine market maker behavior around periods of large institutional buy and sell imbalances (as reported in Panels A and B of Figure 3). Most of the institutional imbalances go through one market maker and we examine whether the price run-up in the 30-minute interval prior to the imbalance is due to the leading market maker accumulating inventory to sell to his institutional clients. Figure 5 shows that the buying activity of this market maker is trivial compared to the size of the position he eventually sells. We find symmetric results for large sell imbalances.

It is possible that prior to a large institutional buy order other market makers accumulate inventory and hence drive up prices. However, Figure 5 shows that, on average, other market makers do not increase their inventory positions prior to large buy trades (nor decrease their positions prior to large sell trades), suggesting that they do not consistently learn of these trades in advance. Furthermore, information leakage cannot explain the patterns observed for individual investors. As previously shown in Panels C and D of Figure 3, net buying activity for individual investors is larger than selling activity by institutions around the

[21] Using Plexus data from January 1991 to March 1993, Keim and Madhavan (1995) find that institutions that use technical analysis have a propensity to submit more buy orders following past positive 1- and 8-week returns.

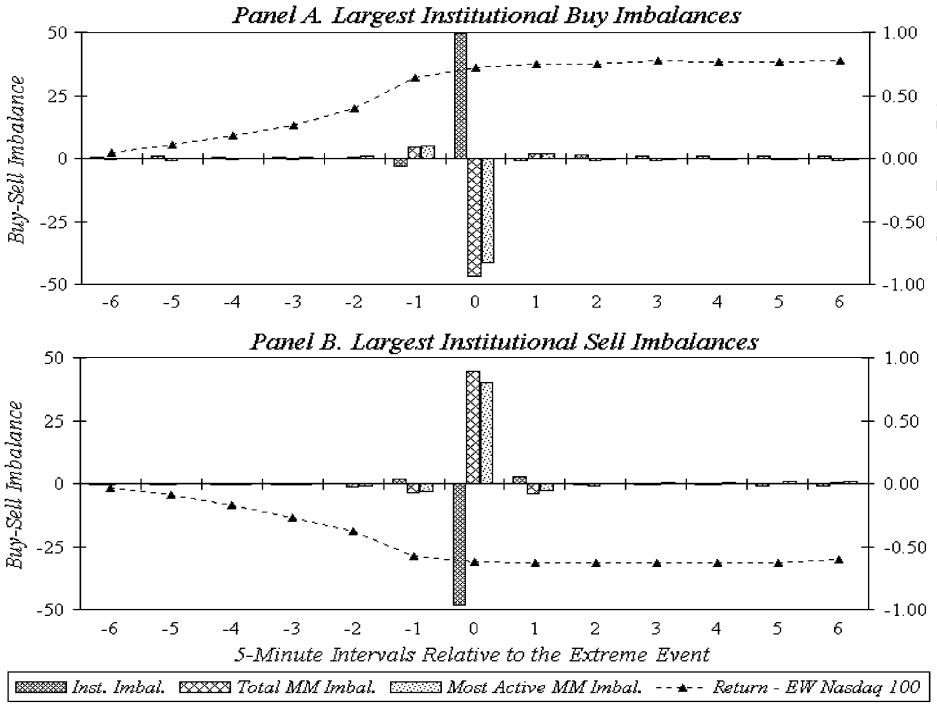

Figure 5. Intradaily market maker trading activity around 5-minute intervals of extreme institutional buy–sell imbalances. Each trading day is divided into 78 5-minute intervals from 9:30 a.m. to 4:00 p.m. For each interval for each of the 82 stocks that is a member of the Nasdaq 100 for the whole sample period, excess returns and institutional and market maker buy–sell imbalances (Inst. Imbal. and MM Imbal., expressed in 1/1000 of a percent) are computed. For each stock, institutional (market maker) buy–sell imbalance is the difference between the institutional (market maker) buy and sell volumes for that 5-minute interval scaled by the total number of outstanding shares. Excess return, expressed in percentages, is the difference between the return on the stock and the equal-weighted Nasdaq 100 return. The 50 intervals with the largest (smallest) institutional imbalances are then selected for each stock. This figure plots the cumulative excess returns and institutional and market maker imbalances for the 30-minute periods (-6 to $+6$) surrounding the event. The buy–sell imbalances for the most active market maker in interval 0 are also shown. To avoid crossing day boundaries while examining -6 to $+6$ intervals, the events are selected from the seventh interval (10:00–10:05 a.m.) through the 72nd interval (3:25–3:30 p.m.).

time of a large return move, but is preceded by negative return movements. These negative returns cannot be driven by net buying activity from market makers.

A.2. Market Maker Activity Surrounding Positive Excess Returns

Panels A and B of Figure 4 demonstrate that large institutional imbalances follow extreme returns. In fact, the largest buying and selling activity occurs in the 5-minute interval immediately following the large abnormal return. For

positive returns, we locate the market maker who is responsible for selling the most shares in the 5 minutes following (period 1) the large price move. If the positive return is due to this market maker accumulating inventory prior to selling to the institutions, we might expect large buying activity by this market maker during or before the period of the contemporaneous price movement.

Figure 6 details imbalances for institutions, all market makers, and the market maker who sells the most during the 5-minute interval following the extreme return. We find that on average the most active market maker is responsible for approximately 101% of the institutional imbalance in the period following the large return, but he buys almost no inventory during the period of the 5-minute price increase. Contrary to the explanation that the institutional price impact is disguised as market makers accumulating inventory for them, the most active market maker contemporaneously buys only 7.43% of the shares that this same market maker will sell during the next 5-minute interval. We observe similar findings around periods of extreme negative returns.

A.3. VAR Results

If the relation between institutional (individual) trading and past returns is simply driven by market makers accumulating inventory prior to block trades, we might expect our results to disappear after excluding block trades. Block trades represent 28.07% of total trading volume and 55.85% of institutional trading volume. To the extent that some institutional brokerage houses handle some trades for individuals, focusing on trades less than 10,000 shares may be a weaker test of institutional trading activity. To mitigate problems with this partition, we eliminate all institutional and individual block trades and for institutions eliminate small trades for less than 500 shares.

Table VI presents intradaily VAR results with the contemporaneous returns in the institutional and individual imbalance equations (analogous to Panel B of Table V). First, although the magnitude of the trading activity is diminished, the results in Table VI for medium-size institutional trades indicate that institutional trades strongly follow past returns. Second, there is even more evidence of persistent trading behavior by institutions. In the institutional imbalance equation, the coefficient on lagged one-period institutional imbalances is 0.16 as compared to -0.04 in Panel B of Table V.

Third, the contemporaneous 5-minute relation between returns and institutional imbalances is nearly unchanged. Even though the importance of past returns in influencing institutional imbalances is somewhat weaker, the coefficient on lagged one-period return (0.09) is still more than two times greater than that on the contemporaneous return (0.04). In sum, it appears that the basic conclusion remains—intradaily institutional trades following prices and persistence in institutional trading are more important than contemporaneous price pressure.

B. Daily Evidence

The competing hypotheses about what is driving institutional trades in the same direction as price movements also have testable implications at the daily

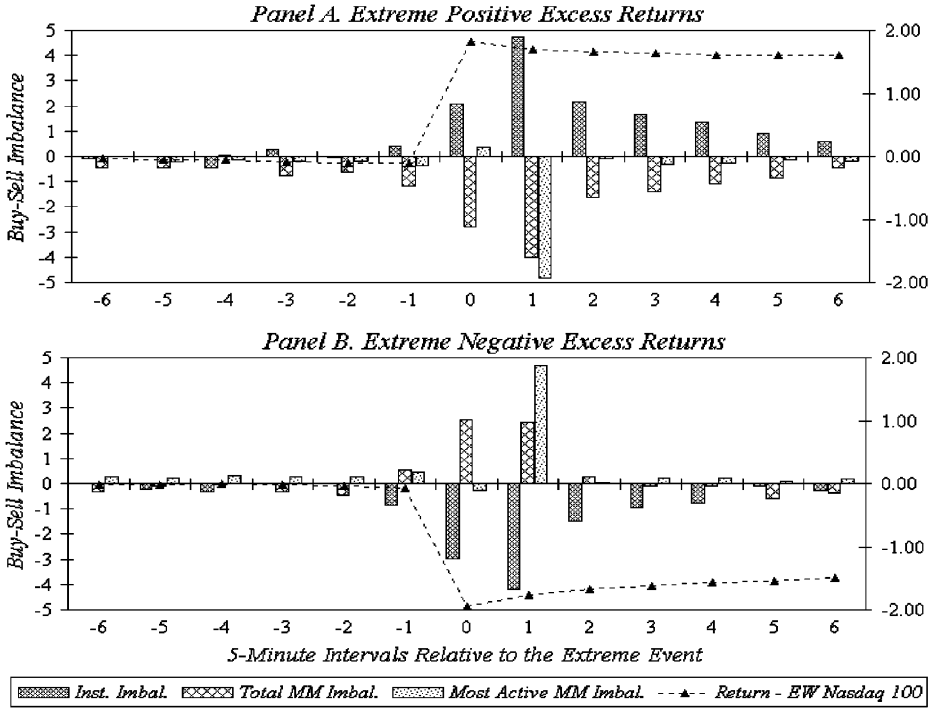

Figure 6. Intradaily market maker trading activity around 5-minute intervals of extreme returns. Each trading day is divided into 78 5-minute intervals from 9:30 a.m. to 4:00 p.m. For each interval for each of the 82 stocks that is a member of the Nasdaq 100 for the whole sample period, excess returns and institutional and market maker buy–sell imbalances (Inst. Imbal. and MM Imbal., expressed in 1/1000 of a percent) are computed. For each stock, institutional (market maker) buy–sell imbalance is the difference between the institutional (market maker) buy and sell volumes for that 5-minute interval scaled by the total number of outstanding shares. Excess return, expressed in percentages, is the difference between the return on the stock and the equal-weighted Nasdaq 100 return. The 50 intervals with the largest (smallest) excess returns are then selected for each stock. This figure plots the cumulative excess returns and institutional and market maker imbalances for the 30-minute periods (-6 to $+6$) surrounding the event. The buy–sell imbalances for the most active market maker in interval $+1$ are also shown. To avoid crossing day boundaries while examining -6 to $+6$ intervals, the events are selected from the seventh interval (10:00–10:05 a.m.) through the 72nd interval (3:25–3:30 p.m.).

horizon. Institutions could be submitting trades in the same direction as previous-day price moves or alternatively, institutions could be working orders over several days. While it may not be possible to completely separate out these competing explanations, we examine them in several ways.

First, if an institution is working a large order over several days, then one might expect these trades as more likely to be due to large block orders. Thus, we examine whether there is evidence of institutional trades following past stock returns for medium-size trades. Panel A of Table VII presents daily VAR results (similar to Panel B of Table IV) with institutional trades for greater than or equal

Table VI

Intradaily VARs with Medium-Size Trades

For each of the 82 stocks that is a member of the Nasdaq 100 for the whole sample period from May 1, 2000 to February 28, 2001, the following intradaily structural vector autoregressions (VARs) with six lags are estimated:

$$R_t = \alpha + \sum_{i=1}^{6} \beta_i R_{t-i} + \sum_{i=1}^{6} \lambda_i I_{t-i} + \sum_{i=1}^{6} \gamma_i J_{t-i} + \delta_{t,R} \quad \text{(A)}$$

$$I_t = \alpha + \beta_0 R_t + \sum_{i=1}^{6} \beta_i R_{t-i} + \sum_{i=1}^{6} \lambda_i I_{t-i} + \sum_{i=1}^{6} \gamma_i J_{t-i} + \delta_{t,I} \quad \text{(B)}$$

$$J_t = \alpha + \beta_0 R_t + \sum_{i=1}^{6} \beta_i R_{t-i} + \sum_{i=1}^{6} \lambda_i I_{t-i} + \sum_{i=1}^{6} \gamma_i J_{t-i} + \delta_{t,J}, \quad \text{(C)}$$

where R_t is the 5-minute adjusted return and I_t (J_t) is the 5-minute adjusted institutional (individual) buy–sell imbalance for a given stock. All three variables are adjusted by subtracting the equal-weighted average for the stocks comprising the Nasdaq 100 index for the corresponding 5-minute interval. For each stock, the institutional (individual) buy–sell imbalance is the difference between the institutional (individual) buy and sell volumes for that 5-minute interval scaled by the total number of outstanding shares, where the buy and sell volumes only include trades for greater than or equal to 500 and less than 10,000 (less than 10,000) shares. To avoid crossing day boundaries for lagged returns and buy–sell imbalances, the first half hour of each trading day is excluded from the analysis. To facilitate interpretation, all variables are standardized prior to estimation of the VAR. This table reports the cross-sectional averages of the coefficient estimates and the adjusted R^2s first. Second, the percentage of stocks with positive and negative coefficients that are significantly different from zero at the five percent confidence level are shown.

			Return						Inst. Imbal.						Ind. Imbal						
	α	β_0	β_1	β_2	β_3	β_4	β_5	β_6	λ_1	λ_2	λ_3	λ_4	λ_5	λ_6	γ_1	γ_2	γ_3	γ_4	γ_5	γ_6	Adj. R^2
Return	0.00		−0.01	−0.01	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.004
% pos. sig.	0.0		25.6	9.8	12.2	13.4	14.6	9.8	41.5	14.6	12.2	2.4	7.3	8.5	30.5	6.1	3.7	3.7	7.3	6.1	
% neg. sig.	0.0		46.3	42.7	25.6	17.1	4.9	7.3	1.2	9.8	6.1	3.7	4.9	2.4	9.8	9.8	8.5	3.7	7.3	7.3	
Inst. Imbal.	0.00	0.04	0.09	0.02	0.00	0.00	0.00	−0.01	0.16	0.08	0.06	0.05	0.05	0.04	0.01	0.01	0.00	0.00	0.00	−0.01	0.087
% pos. sig.	0.0	69.5	96.3	53.7	17.1	12.2	3.7	1.2	100.0	98.8	97.6	96.3	98.8	97.6	30.5	25.6	6.1	14.6	12.2	9.8	
% neg. sig.	0.0	9.8	0.0	12.2	15.9	15.9	8.5	22.0	0.0	1.2	0.0	1.2	0.0	0.0	37.8	17.1	19.5	14.6	18.3	18.3	
Ind. Imbal.	0.00	0.00	−0.10	−0.06	−0.04	−0.03	−0.02	−0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.23	0.10	0.07	0.06	0.06	0.06	0.164
% pos. sig.	0.0	36.6	0.0	1.2	1.2	1.2	1.2	0.0	23.2	9.8	23.2	18.3	19.5	17.1	100.0	100.0	97.6	96.3	98.8	100.0	
% neg. sig.	0.0	41.5	96.3	97.6	95.1	87.8	64.6	39.0	29.3	17.1	9.8	3.7	3.7	7.3	0.0	0.0	0.0	0.0	0.0	0.0	

to 500 and less than 10,000 shares. Panel A shows that medium-size institutional imbalances follow the previous day's return although not with the same magnitude as shown previously in Panel B of Table IV. A 1 standard deviation increase in the previous day's return leads to a 0.07 standard deviation increase in today's institutional imbalance and 23.2% of the firms have positive significant coefficients at the 5% level. Imbalances are related to past imbalances with only weak evidence of predictability in daily returns.

We next investigate the relation between afternoon institutional imbalances and the lagged returns. If a large institutional order is placed near the close of a trading day, then it is reasonable that the order may not be fully filled the same day. Alternatively, if the patterns we observe are not solely from institutional orders being filled across trading days but rather from institutional orders being placed in the same direction as the previous trading day's return, then we expect afternoon institutional imbalances to be related to the previous trading day's return.[22] Panel B examines regressions of afternoon institutional imbalances on the past 5 day's returns and institutional imbalances. If one assumes that spillovers in orders across days would likely be filled in the morning of the next trading day, then the results in Panel B suggest that our findings are not driven by large institutional orders taking a long time to be filled. A 1 standard deviation increase in the previous day's return is accompanied with a 0.12 standard deviation increase in today's institutional imbalance. The previous day's return is a significant predictor of this afternoon's imbalances in 31.7% of the firms at the 5% level. Afternoon imbalances are also related to the previous day's imbalances.

We also examine our results for the 10 most active Nasdaq 100 stocks according to May 2000 trading volume. If one thinks that the patterns of institutional trades following past stock returns are driven by orders moving prices and taking time to clear, then one should expect these patterns to be less severe in the 10 most active stocks as these stocks are extremely liquid. Panel C shows that a 1 standard deviation increase in yesterday's return leads to a 0.13 standard deviation increase in this afternoon's imbalances. While we cannot rule out all alternatives, our daily and intradaily evidence suggest that these patterns are in large part due to trading activity following returns.

VI. Price Reversals and the Relation to Longer Horizons

If buying (selling) activity by positive feedback traders pushes prices beyond fundamentals and/or triggers additional buying (selling) by other investors, then it has a destabilizing influence. However, while trend chasing and herding may move prices away from fundamentals, it may also move prices towards fundamentals if investors infer useful information from other traders (e.g., Bikhchandani et al. (1992), Froot et al. (1992), Hirshleifer et al. (1994), and Hong and Stein (1999)).

[22] It is important to note that our sample of Nasdaq 100 stocks is extremely liquid with the average (median) stock experiencing an average volume of 7,783,149 (3,874,913) shares traded per day over the sample period.

TableVII

A Closer Investigation of the Daily Relation between Institutional Imbalances and Lagged Returns

For each of the 82 stocks that is a member of the Nasdaq 100 for the whole sample period from May 1, 2000 to February 28, 2001, the following daily structural vector autoregressions (VARs) with five lags are estimated:

$$R_t = \alpha + \sum_{i=1}^{5} \beta_i R_{t-i} + \sum_{i=1}^{5} \lambda_i I_{t-i} + \delta_{t,R} \tag{A}$$

$$I_t = \alpha + \beta_0 R_t + \sum_{i=1}^{5} \beta_i R_{t-i} + \sum_{i=1}^{5} \lambda_i I_{t-i} + \delta_{t,I}, \tag{B}$$

where R_t is the daily adjusted return and I_t is the daily adjusted institutional buy–sell imbalance for a given stock. Both variables are adjusted by subtracting the equal-weighted average for the stocks comprising the Nasdaq 100 index for the corresponding day. For each stock, the institutional buy–sell imbalance is the difference between the institutional buy and sell volumes for that day scaled by the total number of outstanding shares, where the buy and sell volumes only include trades for greater than or equal to 500 and less than 10,000 shares. Results for the VAR are reported in Panel A. Next, for the same 82 stocks, the following regression is estimated:

$$I_t^* = \alpha + \sum_{i=1}^{5} \beta_i R_{t-i} + \sum_{i=1}^{5} \lambda_i I_{t-i} + \delta_{t,I}, \tag{C}$$

where I_t^* (I_t) is the daily adjusted institutional buy–sell imbalance from 12:00 p.m. to 4:00 p.m (for the whole day) for a given stock. For each stock, the institutional buy–sell imbalance is the difference between the institutional buy and sell volumes from 12:00 p.m. to 4:00 p.m (for the whole day) scaled by the total number of outstanding shares. Results for all 82 stocks are reported in Panel B. Panel C reports results for the 10 stocks with the highest average trading volume in May 2000. This table reports the cross-sectional averages of the coefficient estimates and adjusted R^2s first. Second, the percentage of stocks with positive and negative coefficients that are significantly different from 0 at the 5% confidence level (% pos. sig. and % neg. sig.) are shown. To facilitate interpretation, all variables are standardized prior to estimation of the regressions.

			Return					Inst. Imbal.					
	α	β_0	β_1	β_2	β_3	β_4	β_5	λ_1	λ_2	λ_3	λ_4	λ_5	Adj. R^2
Panel A													
Return	0.00		−0.06	−0.07	0.01	−0.02	−0.01	0.01	0.02	0.01	−0.01	0.01	0.016
% pos. sig.	0.0		2.4	1.2	2.4	1.2	3.7	12.2	7.3	6.1	2.4	2.4	
% neg. sig.	0.0		12.2	15.9	2.4	3.7	3.7	2.4	2.4	4.9	1.2	2.4	
Inst. Imbal.	0.00	0.11	0.07	−0.01	−0.04	−0.04	−0.02	0.18	0.04	0.02	0.02	0.02	0.117
% pos. sig.	0.0	54.9	23.2	1.2	0.0	2.4	2.4	62.2	7.3	1.2	11.0	6.1	
% neg. sig.	0.0	14.6	3.7	4.9	6.1	8.5	3.7	0.0	1.2	1.2	2.4	3.7	
Panel B													
Inst. Imbal.	0.00		0.12	−0.02	−0.04	−0.03	−0.01	0.14	0.05	0.02	0.02	0.02	0.071
% pos. sig.	0.0		31.7	6.1	0.0	0.0	3.7	39.0	12.2	4.9	3.7	6.1	
% neg. sig.	0.0		1.2	6.1	9.8	9.8	4.9	0.0	2.4	3.7	2.4	1.2	
Panel C													
Inst. Imbal.	−0.01		0.13	0.04	−0.02	−0.02	−0.03	0.15	0.01	0.01	0.05	0.07	0.082
% pos. sig.	0.0		30.0	20.0	0.0	0.0	10.0	40.0	20.0	0.0	10.0	10.0	
% neg. sig.	0.0		10.0	0.0	10.0	10.0	10.0	0.0	0.0	0.0	0.0	0.0	

Testing for deviations from fundamental value is a difficult task. One obvious testable implication of destabilization is that periods of excessive institutional buying or selling activity will be followed by stock price reversals (although the duration of the reversal may also be variable (DeLong et al. (1990b)).

We examine postformation excess returns for the 10 portfolios ranked by institutional buy–sell imbalances. In unreported results, we find that the day after portfolio formation, the portfolio with the largest sell imbalances experiences a small positive and insignificant return, while the largest buy imbalance portfolio experiences a small negative and significant return. The return differentials between the high and low institutional buy–sell imbalance portfolios are of the correct sign for a reversal on every day of the week but are insignificant. Interestingly, however, for the week following the ranking day there is a nearly monotonic ordering of cumulative abnormal returns. However, the weekly return difference between the high and low deciles of institutional imbalance is -0.67 but statistically insignificant.[23] Our results do not support reversals. However, a longer time frame is needed to draw clear inferences here.

VII. Conclusion

This paper provides interesting cross-sectional evidence on the relation between institutional and individual trading and a stock's past returns, trading persistence, and return predictability. We find economically and statistically strong evidence of trades following short-term past returns. On the day following extreme return performance, stocks in the top decile of firm performance are 23.9% more likely to be bought in net by institutions (and sold by individuals) than those in the bottom decile of return performance. In addition, there is a strong contemporaneous positive (negative) relation between institutional (individual) trading activity and daily stock returns that is primarily due to intradaily trades following past returns. This finding of daily and intradaily trades strongly following past returns and trading persistence is robust to a variety of different trade-size classifications and methodologies.

We find no evidence that trade imbalances predict return movements at the daily frequency, but intradaily institutional imbalances precede short-term price movements. However, this effect is economically small. Similarly, there is some evidence that institutional imbalances move prices, but this effect is small in comparison to the influence of past price movements on institutional and individual trading activity. As a cautionary note, the relatively small importance of price pressure in our sample of Nasdaq 100 stocks may not carry over to less liquid firms. While our results provide strong evidence at the cross-sectional level, it is important to note that our findings are not necessarily generalizable to the

[23] We also form a portfolio that is long in the two largest institutional buy imbalance portfolios and short in the two sell imbalance portfolios and find that the return on this difference portfolio is marginally insignificant (p-value $= 0.059$). We also rank on weekly institutional imbalances but find no evidence of differences in subsequent weekly stock returns between those with high and low institutional imbalances.

market as a whole. In a follow-up paper, we are examining the interaction between aggregate institutional and individual trading and market returns.

One potential explanation for the strong relation between changes in ownership and past returns is that institutional or individual investors observe news or price movements in a different manner and trade accordingly. Alternatively, when a market maker receives a large institutional order, the market maker may accumulate inventory to fill the order, thereby driving up prices. However, we do not find any evidence to indicate that the relation is induced by market maker activity. Similarly, on a daily basis we find that afternoon institutional imbalances strongly follow the previous day's returns, even for liquid securities, suggesting that the patterns we observe are not predominantly driven by splitting up large institutional orders. While there are likely multiple explanations for our findings, it appears that institutions view recent positive return movements or the news associated with such movements as a buy signal and individuals view positive returns as a selling opportunity. Even though the practice of institutions moving in response to stock returns could be destabilizing, we find little evidence that this action leads to reversals in stock prices (one form of destabilization).

A puzzling implication of our findings is why two groups of investors seem to interpret information related to past stock price movements so differently. We hope to see future research investigate the timing and motivation of this large amount of opposing trading activity more fully. Perhaps distinguishing between competing models of investor behavior as they relate to the interactions between investor groups can help in this pursuit.

Appendix

According to the Nasdaq's Economic Research department, all reporting parties are classified as institutional brokers, wirehouses, electronic communication networks (ECNs), regional firms, wholesalers, small firms, or regional exchanges. Based on conversations with Nasdaq and industry participants, we classify institutional brokers and wirehouses as primarily handling institutional order flow. Among the ECNs, Instinet attracts institutional clients while the other ECNs primarily handle order flow for dealers dealing directly with individual clients. Regional firms and wholesalers (e.g., Schwab and National Financial Services Corporation) are classified as primarily handling individual order flow. These relatively simplistic classifications ignore industry trends toward more diversified order flow. However, we show below that trade-size characteristics generally confirm the separation of institutional order flow from individual retail order flow.

Small firms and the two regional exchanges constitute about 18% of the total trades over the period and contain a mix of individual and institutional trading volume. With limited information on these firms, we classify each small firm and regional exchange as an institutional dealer if the third quartile of trade-size distribution is 1,000 shares or greater. We choose the 1,000-share cutoff because it is consistent with the third quartile of trade-size distribution for institutional brokers, wirehouses, and Instinet. The Chicago Stock Exchange is also classified as

Table AI
Distribution of Trade Size for Market Maker Categories

This table reports the percentage of total trades, the mean, the minimum (min.), the maximum (max.), and the 25th, 50th, 75th, 90th, 95th, and 99th percentiles of the distribution of the trade size for each market maker category for the Nasdaq 100 stocks. All market makers are classified as institutional brokers, wirehouses, electronic communication networks (ECNs), regional firms, wholesalers, small firms, and regional exchanges. Institutional brokers, wirehouses, and Instinet primarily handle institutional order flow. The other ECNs (excluding Instinet), regional firms, and wholesalers are classified as primarily handlers of individual order flow. Small firms and the two regional exchanges contain a mix of individual and institutional trading volume. Each small firm is classified as an institutional dealer (Small–Inst.) if the 75th percentile of trade size distribution is 1,000 shares or greater, and as an individual dealer (Small–Indiv.) if otherwise. The 1,000-share cutoff is chosen to be consistent with the trade size distribution of the other market makers classified as institutions. The Chicago Stock Exchange is also classified as primarily handling trades by individual investors using this algorithm.

				Percentile						
Institutions	Percent of Trades	Mean	Min.	25	50	75	90	95	99	Max.
Instit. Broker	8.12	1,650	100	100	500	1,000	2,500	5,000	25,000	4,965,000
Wirehouse	12.37	1,124	100	100	300	900	1,500	3,900	15,000	7,000,000
Instinet	1.18	795	100	200	500	1,000	1,400	2,400	6,000	639,450
Small–Inst.	4.93	1,190	100	100	400	1,000	2,000	4,000	15,000	2,609,146
Individuals										
ECN	25.46	369	100	100	200	500	900	1,000	2,000	999,900
Regional firm	3.45	768	100	100	200	600	1,000	2,100	10,000	4,000,000
Wholesaler	31.52	423	100	100	200	500	1,000	1,000	3,200	1,254,900
Small–Indiv.	9.60	507	100	100	200	500	1,000	1,200	4,200	1,400,000
Chicago Stock Ex.	3.38	438	100	100	200	400	910	1,000	3,000	7,000,000

primarily handling trades by individual investors using this algorithm.[24] Handlers of individual order flow (other ECNs, regional firms, and wholesalers) all have smaller than 600-share trades at the third quartile of the trade size distribution. Using this assignment mechanism, 66.1% of the trades handled by small firms are classified as individual trades.

We examine the accuracy of our individual/institution classifications for all groups by examining the distributions of trade size. Table AI shows various points of the distributions of trade size over the entire period. The distributions of trade size are generally considerably higher, particularly for the largest quartile, for the venues used for institutional trading. For instance, the median trade size for the market participants classified as primarily handling institutional trades ranges from 300 shares for wirehouses to 500 for institutional brokers and Instinet. All market participants identified as primarily handling trades for individuals have median trade sizes of 200 shares. The third quartile of the trade-size distribution is between 900 and 1,000 shares for those market participants classi-

[24] Cincinnati Stock Exchange is classified as a handler of institutional trading but handled only a few large trades over our sample period.

fied as dealing primarily with institutions, but varies from 400 to 600 shares for those classified as handling individual trades.

All trades are classified as to whether the market maker is trading on his own account (as a principal) or handling a trade for a customer (as an agent). We classify all agency trades based on whether the market maker primarily deals with institutions or individuals. All principal trades are simply regarded as market maker trading, irrespective of whether the market maker primarily deals with institutional or individual clients. In this way, both sides of each trade are classified as to whether it is due to trading by an institution, an individual, or a market maker. Although in our final data each trade is reported only once, some trades are routed multiple times. We check for consistency in assigning whether a market maker acted as a principal or an agent for each leg of the trade and do not classify trades that are inconsistently reported in each leg of the routing report. In addition, we do not classify a small fraction of crossed and risk-free principal trades.

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