

Investor Behavior over the Rise and Fall of Nasdaq

JOHN M. GRIFFIN, JEFFREY H. HARRIS, AND SELIM TOPALOGLU*

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* Griffin is visiting at Yale University and on faculty at the University of Texas at Austin, Harris is at University of Delaware and is a former Visiting Academic Fellow at Nasdaq, and Topaloglu is at Queen's University. Griffin can be reached at john.griffin@yale.edu. We are grateful for helpful comments and discussion from Eric Falkenstein, Ken French, Will Goetzmann, David Hirshleifer, Roger Ibbotson, Steve Jordan, Jason Karceski, Patrick Kelly, Stephen F. LeRoy, Federico Nardari, Spencer Martin, Bob Parrino, Avri Ravid, Jay Ritter, Geert Rouwenhorst, Laura Starks, René Stulz, Fabio Trojani, Kent Womack, and seminar participants at Arizona State University, Dartmouth College, The Ohio State University, University of Maryland, University of New South Wales, University of Texas, 2003 European Finance Association, and 2003 Western Finance Association.

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Abstract

The large theoretical literature about bubbles includes models where naïve individuals cause excessive price movements and smart money trades against (and potentially eliminates) a bubble or where sophisticated investors follow market prices and help drive a bubble. We examine these competing views by focusing on investor activity over the spectacular rise and fall of Nasdaq from September 1999 through 2001. We find that both institutional ownership levels and volume on Nasdaq were high. Institutions bought shares from individuals the day after market up-moves and institutions sold on net following market dips. These patterns are pervasive throughout the market run-up and subsequent crash period. This short-term institutional trend-chasing behavior does not appear to be mechanically induced by flows into and out of mutual funds. Our evidence supports the view that institutions contributed more than individuals to the Nasdaq rise and fall.

Optimal planning for individuals and organizations hinges critically on the level and implied future return of the aggregate stock market. Rapid swings in market prices can cause costly misallocations of resources. The market run-up in the 1990s was the greatest in U.S. history and the subsequent price correction has been the largest since the Great Depression.¹ During this unique period, we examine the interaction of investor groups on the Nasdaq market.

Bubbles in asset prices have been the subject of extensive debate. While numerous theoretical models examine the forces and assumptions necessary to generate price bubbles, relatively little empirical research has distinguished between these theories. Much of the theoretical bubble literature posits different roles for investor groups, including the interaction of sophisticated traders with less informed agents. The goal of this paper is to examine whether institutional and individual trading activity surrounding the rise and fall of the Nasdaq index is consistent with any of the various proposed views of stock price bubbles, abstracting away from whether the price levels were justifiable.

Some models of stock price bubbles posit that noise traders simply chase past prices (positive feedback trading) and lead prices away from fundamental values (DeLong et al. (1990a)). In support of this view, Ofek and Richardson (2003) demonstrate that internet stocks in 2000 had low levels of institutional ownership and fewer block trades than non-internet securities.

The traditional rational markets view (e.g., Friedman (1953), Fama (1965)) recognizes that agents may trade irrationally but contends that such trading does not substantially affect prices since sophisticated traders (arbitrageurs) quickly trade against these agents to eliminate deviations from “true” economic values. In this setting, irrational bubbles do not occur. However, if arbitrageurs face limited capital and are evaluated under a finite time horizon (as described by Shleifer and Vishny (1997)) then they may not trade against what they view as a clear deviation from the true economic value. In this view, arbitrageurs may not eliminate a bubble but they would also not actively participate in it.

¹ Shiller (2000, p. 6-9) documents that in real terms the 1992-2000 S&P price run-up is even larger than those in the 1920s and also shows that the price-to-earnings ratios in 2000 are much higher than in the entire history of U.S. stock prices.

Alternatively, DeLong et al. (1990b) and Abreu and Brunnermeier (2002, 2003) propose a world where smart money, or arbitrageurs, actually see the direction that uninformed investors are trading and move ahead of these investors, further driving stock price movements. In support of these theories, Brunnermeier and Nagel (2003) find compelling evidence that 53 hedge fund managers generally took larger positions in high price-to-sales stocks during the 1998-2000 Nasdaq run-up.² Shiller (2000) provides another reason why institutional capital may move with the market, noting that (p. 18), “Professional investors...are not immune from the effects of the popular investing culture that we observe in individual investors.”

Our main tool of analysis is a unique dataset that allows us to classify investors by type in Nasdaq 100 securities over the period from September 1, 1999 through December 31, 2001. We classify order flow as individual (retail) or institutional based on the brokerage house that handles the order. Although the individual/institutional investor brokerage house classification may not exactly fit the noise trader/arbitrageur distinction, it does fit the popular notion that individuals are less informed and that institutions are “smart money.”³

We first examine institutional trading and holdings of Nasdaq 100 stocks and find that during the dramatic market run-up from March 1999 to March 2000 institutions generally increased their positions in Nasdaq securities. In March 2000 institutions held over 50 percent of Nasdaq’s market capitalization, similar to levels of ownership in other securities. In addition, we find that institutions were responsible for more trading volume than individuals in the six-month period prior to the Nasdaq peak in March 2000.

We also examine the relation between short-term daily stock price movements and changes in ownership. If a group of investors had a propensity to sell when the market rose and buy when the market fell then it could be inferred that they tend to have a dampening effect on market movement. On a

² Nevertheless, they document that hedge funds own less than one-third of one percent of the high price-to-sales Nasdaq securities, suggesting that hedge fund activity seems unlikely to be the predominant driver of the market.

³ This idea is supported by recent empirical evidence from Chen, Jegadeesh and Wermers (2000) who show that stocks that mutual funds buy outperform those they sell, potentially at the expense of poor timing of trades by individuals (Odean (1999)). Coval, Hirshleifer, and Shumway (2002) find that there is a subset of individuals who do earn abnormal returns.

contemporaneous daily and lagged basis we find that individuals (and not institutions) play such a role. Large negative (positive) return days are accompanied by institutional selling (buying) and individual buying (selling). There is an even stronger relation on the next trading day. For example, on the day following a large negative Nasdaq return, institutions sell approximately \$508 million worth of shares on average and buy \$588 million following large positive return days. We investigate these relations using daily VAR regressions and find that a one standard deviation increase in today's Nasdaq market return is associated with a 0.48 standard deviation increase in tomorrow's net institutional buying activity.

We also examine the timing of institutional/individual trading in relation to the level of Nasdaq prices. It could be that, while institutions are generally trend chasers, they move against prices during the market run-up. We find this is not the case. Institutions buy stocks on the day following Nasdaq market increases and sell securities (to individuals) on the day following market decreases during the market run-up as well as during the crash, suggesting that sophisticated (institutional) investors actively contributed to the Nasdaq run-up and run-down.

One explanation for our findings is that the institutional investors are merely reacting to redemptions and purchases of mutual funds. Goetzmann and Massa (1999) find a strong contemporaneous relation between S&P index fund flows and the contemporaneous daily index returns and Edelen and Warner (2001) find evidence of mutual fund flows following returns. We examine the joint relation between daily institutional order imbalances, mutual fund flows, and returns in the VAR framework. We find that, while institutional imbalances are positively related to mutual fund flows, mutual fund flows cannot explain the strong contemporaneous or lagged relation between institutional imbalances and returns or the persistence throughout the rise and fall of the Nasdaq index.

To gain a clearer picture of the timing of daily trading we also examine intradaily trading behavior in five-minute windows. Individual (institutional) trading is strongly positively (negatively) associated with contemporaneous five-minute market moves. However, this activity quickly reverses with institutions following short-term market returns (or the information which induced the returns) and individuals trading to the contrary. Overall, we find that institutional traders (or smart money) do not

attempt to trade against market movements, but rather actively participate in both the run-up and run-down of Nasdaq 100 prices. Our evidence is most consistent with models where smart money follows past stock price movements leading to larger stock price bubbles than would exist in their absence.

The outline of our paper is as follows. Section I discusses the role that the interaction among traders plays in bubble theories. Section II describes the data. Section III examines the level of institutional ownership and the fraction of trading volume that can be assigned to institutions and individuals. Section IV details the overall daily trading behavior of institutional and individual investors in relation to daily price movements over the entire period and tests whether these relations have changed pre- and post-March 2000. We examine how capital inflows affect institutional behavior in Section V and the intraday trading behavior of individual and institutional investors in Section VI. We address robustness issues in Section VII and our conclusions follow.

I. Bubble Theories and Testable Implications

A. Price Bubbles and the Interaction between Investor Groups

What is a bubble? Kindleberger's (1978) book on bubbles merely defines it as "an upward price movement over an extended range that then implodes." When referring to the rapid increase and fall of the Nasdaq index, we use the term in this simple manner. Yet people also often associate bubbles with a de-coupling of market prices from the underlying fundamental values.⁴ Ofek and Richardson (2002) show compelling evidence that Internet stock price levels were too high to be justified by even exceptional levels of expected earnings growth. The purpose of our study is not to examine the relation between Nasdaq prices and fundamentals but to examine the connection between models that can generate bubbles (and those that argue they will not exist) and the trading behavior of investor groups.⁵

⁴ Hindsight benefits from knowing the price realization that actually occurred whereas in real time, investors face only uncertain future probabilities. For example, the famous 1634-37 Dutch Tulip mania is often cited as a psychologically driven bubble, yet Garber (1989) argues that tulip bulb price patterns may be consistent with fundamentals.

⁵ While our analysis centers on the literature on bubbles, many of our predictions are related to the literature on institutional herding. Institutional investors may trade together and with past price movements as a result of slowly

We focus on predictions about bubbles that call for the interaction between investor groups.⁶ The most basic conjecture about price bubbles is that the overzealous trading activity of irrational agents causes prices to diverge from fundamental value. The efficient markets response is that arbitrageurs quickly eliminate any pricing discrepancies. As described by Fama (1965), “If there are many sophisticated traders in the market, however, they may cause these ‘bubbles’ to burst before they have a chance to really get under way.” However, DeLong et al. (1990a) show that noise traders who follow past price movements create noise-trader risk — the risk that they may drive prices further away from fundamentals. Furthermore, Shleifer and Vishny (1997) show that, with delegated portfolio management and capital constraints, arbitrage is limited. Funds may lose money and experience capital outflows precisely when the mispricings on the securities they are arbitraging are the largest.

Thus, the above literature argues that price bubbles: a) will not exist, or b) exist and are driven by noise traders with sophisticated traders staying relatively neutral or taking bets against these agents. A more unconventional view of bubbles is that sophisticated traders actually help drive them. DeLong et al. (1990b) show that rational speculators may actually start price movements knowing that positive feedback traders will follow and purchase these securities at higher prices tomorrow. Likewise, in Abreu and Brunnermeier (2002, 2003) arbitrageurs know that the market is overvalued but maximize profits by riding the bubble. Because arbitrageurs face limited capital and short-sale constraints, they can only burst a bubble when a coordinated selling effort among arbitrageurs occurs. These models predict that sophisticated investors generally move in the same direction as the price bubbles. Similarly, agency

diffusing private information (Froot, Scharfstein, and Stein (1992), Hirshleifer, Subrahmanyam, and Titman (1994)) or to infer information from other traders (Bikhchandani, Hirshleifer, and Welch (1992)).

⁶ Most rational bubble models in simultaneous or sequential markets do not rest on investor heterogeneity. Santos and Woodford (1997) argue that conditions used to generate rational bubbles are special circumstances. However, LeRoy (2003) reviews these models and argues that the theoretical conditions which rule out rational bubble models are implausible. He argues that evidence of informed investors failing to move against prices is support of rational bubble models (see LeRoy, p. 16). Brunnermeier (2001) provides an evaluation of bubble models, focusing on asymmetric information. Summaries of related behavioral pricing issues are also provided in Shleifer (2000), Hirshleifer (2001) and De Bondt (2003). Empirical connections with bubbles are discussed in Shiller (2003).

problems (as described in Allen and Gale (2003)) can cause rational portfolio managers to take additional risk and move asset prices to excessive levels.⁷

B. Empirical Implications

In our empirical analysis we relate the behavior of institutional investors (more sophisticated) relative to individual (perhaps noise traders) to the above literature along several dimensions. First, we examine their overall level of activity as proxied for by holdings and trading volume. Second, we examine whether institutional or individual investors react differently in response to past market movements.⁸ We interpret changes in ownership in the same direction as short-term past price moves (trend chasing) as a behavior that likely leads to larger price swings than those that might occur in the absence of that investor group. Third, we also examine whether trading in response to contemporaneous and past market returns changes during the run-up and fall of Nasdaq.

We are not the first to examine the relation between institutional trading and past price movements. Grinblatt, Titman, and Wermers (1995) and Wermers (1999) find evidence that mutual funds chase past individual security stock returns at the quarterly horizon. At shorter frequencies, Odean (1998), Choe, Kho, and Stulz (1999), Barber and Odean (2002), and Griffin, Harris, and Topaloglu (2003) find that individual investors are often contrarians and more likely to sell (purchase) a stock if its price recently decreased (increased).⁹ These papers focus on the relation between cross-sectional firm performance and changes in ownership and do not examine market-wide relations.¹⁰ If institutions or individuals keep their net amount of investment fixed but reallocate investments between stocks, such as described in the model of Barberis and Shleifer (2003), one would see little relation between changes in ownership and aggregate stock market return performance.

⁷ Similarly, Allen, Morris and Postlewaite (1993) and Allen and Gale (1993) present models where bubbles arise due to asymmetric information and moral hazard.

⁸ We loosely refer to the Nasdaq 100 index as the market. Separating effects on Nasdaq versus a broader index would likely not be fruitful as the correlation between daily Nasdaq 100 and S&P 500 returns is 0.8364 over our sample period of September 1, 1999 to December 31, 2001.

⁹ Sias, Starks, and Titman (2000) and Cai, Kaul, and Zheng (2001) use quarterly data but also investigate short-term trend chasing and price impact of institutional investors.

¹⁰ For example, in Griffin, Harris, and Topaloglu (2003) all changes in ownership and returns are measured relative to Nasdaq averages. Ownership for a particular firm is measured relative to the average change in ownership for all Nasdaq firms and abnormal returns are in excess of the Nasdaq index.

Recent evidence by Shapira and Venezia (2003) finds that individual investors in Israel are market trend chasers and buy more than they sell following market up-moves and professional money managers are contrarian with respect to the Israeli market between 1994-1998.¹¹ However, in survey evidence Shiller (1999) documents that 56 (19) percent of U.S. individual investors thought that a three percent one-day drop would be followed by an increase (decrease) in prices in 1999—a large increase from 35 (34) percent in 1989. Given the common perception by individual investors that dips were buying opportunities in 1999, one might see net individual buying after downward price moves. We study the relation between leading, contemporaneous, and lagged market returns and institutional and individual trading activity over our September 1999 to December 2001 sample of Nasdaq 100 index stocks.

II. Data

The primary data set for this paper consists of aggregate trades and quotes in Nasdaq 100 stocks from September 1, 1999 to December 31, 2001. We use only the Nasdaq 100 stocks to avoid liquidity problems in less active securities and to make direct comparisons to the rise and fall of the index. The proprietary data we use is directly from Nasdaq clearing records and includes the date, time, ticker symbol, trade size and price of each transaction for each Nasdaq 100 security. The data also include additional identifying fields (related to the settlement process) about the parties involved in each trade.

These additional fields include three 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. 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.

¹¹ Dennis and Strickland (2002) examine the relation between institutional ownership levels and the cross-sectional volatility from 1988 to 1996. They find that stocks with higher levels of institutional ownership move more than other stocks in the 30 days when the market index moves up or down more than two percent. However, institutions prefer liquid stocks (Falkenstein (1996)) that are more likely to move more when the market moves and institutional holdings do not necessarily imply institutional activity. Boyer and Zheng (2002) document that mutual funds, foreigners, and pension funds move with the market on a quarterly basis from 1952-1996. Cohen (1999) finds that institutions buy shares from individuals during economic downturns also using quarterly ownership data.

This designation helps us avoid problematic trade classifications that commonly result from tick-test rules. With these three pieces of proprietary information, trading volume is assigned to brokerage houses that primarily deal with individual investors, to brokerage houses primarily handling institutional order flow, or to market makers. Although for ease of discussion we refer to the data as institutional and individual, a more accurate but cumbersome classification would be to denote the trades as those executed through brokerage houses primarily dealing with institutional or individual clients.

We first examine the relation among individual/institution classification and trade-size groups as reported in Table A1. The average individual-to-market maker trade is for 483 shares and institution-to-market maker trades average 1,972 shares. A note of caution is in order as the percent of volume by all parties is understated due to 9.43 percent of volume (8 percent of trades) that we are unable to classify because of discrepancies in the trade routing records.

We also use trade-size groups. Small trades are those for fewer than 500 shares; medium-size trades are from 500 to 10,000 shares; and trades for greater than 10,000 shares are classified as large trades (Barclay and Warner (1993)). Small, medium, and large trades constitute 66.16, 33.01, and 0.83 percent of all trades but 17.01, 54.44, and 28.55 percent of volume, respectively. While some papers use the large/small trade distinction as a proxy for institutional and individual trading, it is important to note that this procedure ignores a large proportion of medium-size trading, which Barclay and Warner show is most likely to contain information.

Figure 1 reports the percentage of the total volume in the small and large trade groups. Individual-to-individual and individual-to-market maker trades together account for 68.77 percent of volume in trades for less than 500 shares, whereas institutions trading with other institutions or market makers accounts for 10.23 percent of all small-size trade volume. Conversely, for large trades, individuals trading with market makers or other individuals account for 14.73 percent of trading volume. Total institutional trading accounts for 73.22 percent of trading volume. While the assignment of trading volume is sure to capture some individuals trading at institutional brokerage houses and vice versa, if one

accepts that large blocks are more likely to be originated by institutions and small trades by individuals, these findings strongly support our classification as a useful mechanism for assigning trading volume.¹²

To examine long-run trends in ownership levels and to compare trends across markets, we compute aggregate ownership from the 13F filings compiled on the Spectrum database. Spectrum classifies institutions into five groups: (1) banks, (2) insurance companies, (3) mutual funds, (4) investment advisors, and (5) other (including pension and endowment funds).¹³ 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, holdings from Spectrum should form a close but imperfect proxy for the level of quarterly holdings. Griffin, Harris, and Topaloglu (2003) find a strong relation between quarterly changes in ownership from Spectrum and the Nasdaq individual/institutional data. Furthermore, they find that Nasdaq institutional ownership changes are most strongly associated with mutual funds and the investment advisor categories.

III. Ownership levels and aggregate activity

To determine the role of institutional behavior over the long run, we examine three main questions: 1) Do institutions increase or decrease their holdings in Nasdaq securities over its rise and fall? 2) Is there a wide difference between institutional holdings on Nasdaq and the overall market? 3) Do institutions or individuals dominate trading activity in the Nasdaq 100?

We first examine the overall level of ownership on Nasdaq using quarterly Spectrum holdings from the beginning of the Nasdaq index in 1985 through 2001. We then compare equal and value-weighted ownership levels and ownership levels by institutional type to ownership levels in all CRSP

¹² Nevertheless, we also investigate our main findings using the additional filter that institutional trades must also be block trades and obtain similar results.

¹³ The other category also includes foundations, trusts, financial institutions, government, miscellaneous, and non-financial companies.

stocks and S&P 500 stocks. We also examine the fraction of volume classified as institutional or individual over the September 1999 to December 2001 period.

A. Ownership levels over time

Figure 2, Panel A plots value-weighted ownership levels along with the corresponding index return for the Nasdaq 100, the CRSP value-weighted, and the S&P 500 index. If a particular group of traders is responsible for the large price increases on Nasdaq relative to the S&P 500 then we might expect distinctly different ownership levels between the two indices. Aggregate institutional ownership reported on Spectrum increases throughout the period from late 1985 through the mid 1990s. It is important to note that some of this increase could be due to institutions and firms reaching thresholds where they are required to report their positions.¹⁴ Gompers and Metrick (2001) and Bennett, Sias, and Starks (2003), document these aggregate increases across all securities from 1980 to 1997.

By the end of 1995 institutions held approximately 58 percent of the Nasdaq 100 market capitalization. During the initial stages of the Nasdaq 100 run-up (from 1996 to March 1999), institutions generally decreased their positions in Nasdaq index stocks, although the shift in ownership was not smooth. However, when prices more than doubled during the final stages of the Nasdaq 100 run-up from March 1999 to March 2000, institutional ownership increased from 46 percent to 50.5 percent of the Nasdaq 100. Ofek and Richardson (2003) find that the mean (median) institutional holdings in internet stocks is 31.33 (25.92) percent in March 2000.¹⁵ Our findings show that institutions held a much larger fraction of Nasdaq 100 securities. Furthermore, during the Nasdaq collapse institutions actually slightly increased their aggregate holdings, consistent with increased hedge fund ownership in high growth stocks documented in Brunnermeier and Nagel (2003).

We also compare the ownership patterns to those from all CRSP securities and the S&P 500. At the inception of the Nasdaq 100 institutions held approximately the same percentage in Nasdaq stocks as

¹⁴ Firms with less than \$100 million under management are not required to report nor are firms required to report security positions below 10,000 shares or \$200,000. Obviously, more positions are reported following upward stock price moves and stock splits.

¹⁵ They argue that the combination of low institutional ownership and the difficulty of shorting shares can lead to mispricing.

they did in all CRSP stocks. By 1996, Nasdaq ownership increased to levels higher than the average CRSP and S&P 500 stock. However, institutions reduced their positions in Nasdaq 100 securities in both 1996 and 1997 so that by March 31, 1998 institutional ownership in the Nasdaq 100 was similar to that of all other firms covered by Spectrum. From March of 1998 to December 2001, Nasdaq ownership levels closely track all CRSP and S&P 500 securities.

We present equal-weighted levels of ownership across securities for the three indices in Figure 2, Panel B. Small stocks have substantially less institutional ownership. Panel B shows that the inferences made for Nasdaq 100 and S&P 500 securities are not driven by a few large cap stocks in the indices. On March 31, 2000 institutions held 58.17 of Nasdaq 100 shares on an equal-weighted basis, a number not far below the 61.10 percent held in the average S&P 500 security. Since we do not see large ownership changes in 2000 it suggests that a combination of weak institutional and individual demand are likely culprits for the burst.

Figure 3 details the ownership patterns of the five different institutional groups for Nasdaq 100 securities in Panel A and then compares those to S&P ownership levels in Panel B. As Figure 3 shows, mutual fund ownership has generally increased from below five percent in 1985 to over 15 percent in 2001. This trend is present for both S&P and Nasdaq 100 stocks.

Ownership by investment advisors increases from 1985 through 1993 but falls dramatically in Nasdaq stocks until March 1999. These advisors slightly increased their positions in Nasdaq stocks prior to and during the Nasdaq crash. Other institutional types saw less variation from 1985 through 2001. From March 1998 to December 2001 most institution types slightly increased their ownership in Nasdaq 100 equities except for a small decrease by banks. Particularly from 1998 to 2001 ownership trends in Nasdaq 100 and S&P 500 stocks were quite similar, indicating that institutions did not actively underweight positions in rising Nasdaq stocks.

B. Trading Volume

Institutions can own a large fraction of the Nasdaq market but if they trade infrequently they will likely have little impact on short-run pricing. We break down the proportion of individual trading volume

relative to institutional volume over the period from September 1999 through December 2001 in Figure 4.¹⁶ Interestingly, up until mid-March of 2000, institutional trading volume was generally larger than the proportion of trading volume due to individuals. Ofek and Richardson (2003) argue that internet stock volume, composed of few block trades with a large proportion of individual ownership, was due to individual investors. Prior to the market fall, this was not the case for Nasdaq 100 stocks.

After March 2000, institutions and individuals trade roughly equal share volumes, but in early 2001 the fraction of institutional trading volume gradually decreases. Over the entire period the shift is dramatic. During the first two months of the sample, institutional trading represents 53.3 percent of non-market maker volume. Yet by the last two months of the sample period institutions only account for 40.4 percent of volume. We also examine value-weighted proportions and find a similar (but not as dramatic) increase in individual volume in 2001.¹⁷ That institutions account for a majority of the trading volume and a large, growing fraction of holdings prior to the Nasdaq bubble's peak suggests that individuals were not solely responsible for the Nasdaq run-up.

IV. Daily trading behavior

What is the interaction between contemporaneous market returns and institutional and individual buying? Are institutions or individuals more likely to buy after high previous-day stock returns? We examine the relation between returns and ownership type over the whole period as well as whether the nature of the relations changed across the rise and fall of the market. We also briefly examine whether the relation is different for market up and down moves.

A. Whole Period Results

We calculate the trading imbalance for each stock as the difference between the buy and sell volumes each day scaled by the number of shares outstanding. We then examine equal- and value-weighted averages across stocks to obtain a relative measure of the magnitude of the institutional or

¹⁶ As shown in Table A1, 12.86 percent of volume is due to market makers and 9.43 percent is unassigned.

¹⁷ In unreported results we also examine both equal- and value-weighted turnover for the Nasdaq 100 and find dramatic turnover increases in late 2000 and 2001 but 2001 value-weighted turnover is similar to earlier years.

individual trading imbalance. Unless otherwise noted, we refer to this as the imbalance. Since for every buyer there must be a seller, in the absence of a market maker, net institutional buying activity would perfectly offset individual selling activity. However, given that we cannot assign 9.43 percent of trades and market makers do participate, the institutional and individual imbalances are close substitutes but not perfectly negatively correlated. While we focus on the daily institutional buy-sell imbalance measure, one could also interpret findings from the individual sell-buy imbalance perspective.

To examine the relation between institutional/individual activity and Nasdaq 100 returns, we divide all trading days into six categories, those with returns: less than negative two percent; in four increasing one percent intervals; and those with greater than two percent. Over our sample period, Nasdaq 100 returns are extremely volatile with 25.1 percent of days having returns greater than two percent and 27.2 percent of days having returns less than negative two percent. Table I reports the average returns, equal-weighted institutional imbalance, dollar value of the total imbalances, as well as the buy-sell volume as a fraction of total volume. We examine all figures on the day of the return move as well as the two days before and after.

Institutional trading activity exhibits a strong contemporaneous relation with market returns—days with the lowest returns have the largest institutional selling. However, there is an even stronger relation between returns and next-day institutional trading. For returns moves of less than negative two percent, the imbalance of -19.98 indicates that 0.01998 percent of total outstanding shares are sold by institutions, whereas for return moves of greater than two percent, 0.01775 of the typical Nasdaq 100 security is bought by institutions. However, institutions sell 0.03359 percent of shares on the next day for large negative market moves, and buy 0.03111 percent of shares on the day following large market up-moves. Differences in the net institutional buying for winners and losers are highly statistically and economically significant.

Using beginning of the day market values, we also estimate the dollar values of the net activity. The next panel shows that on days following market down-moves, institutions sell (and individuals approximately buy) slightly more than half-a-billion dollars of Nasdaq shares (-508.22 million) and

following market up-moves institutions buy 588.15 million dollars worth of securities. Two days following the return move there is little difference in the behavior of institutions and individuals.

We also examine institutional buy-sell volume scaled by total volume. These patterns show a weaker contemporaneous daily relation between institutional trading and stock prices but an even stronger relation on the following day. On the day following a large negative return move, -0.85 percent of the daily volume is institutional selling (to individuals). For large market up-moves, 1.59 percent of the following day's volume consists of net institutional buying. Since following past prices in a positive fashion can lead to larger price moves than in the absence of trend chasing, the evidence here does not support the notion that individuals were entirely responsible for excess price movements during the Nasdaq bubble.

Aggregate institutional trading imbalances are correlated with both prior day returns and imbalances. Therefore, it is not clear if imbalances are associated with previous day returns or whether this is merely an artifact of institutional trading being correlated across days. To investigate these inferences jointly and more rigorously, we estimate a VAR model for both equal- and value-weighted aggregate buy-sell imbalances and Nasdaq 100 index returns. We standardize both variables by their time-series mean and standard deviation for ease of interpretation and estimate the following system of structural VAR equations:

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

$$I_t = \alpha + \beta_0 R_t + \sum_{i=1}^5 \beta_i R_{t-i} + \sum_{i=1}^5 \lambda_i I_{t-i} + \delta_{t,I} \quad (2)$$

where R_t is the return on the Nasdaq 100 index on date t and I_t is the institutional buy-sell imbalance at time t . We estimate the system with five lags.¹⁸

¹⁸ The Akaike information criterion tests shows that five lags is the appropriate lag-length for the equal-weighted VARs and finds four lags for the value-weighted regressions. For consistency, we use five lags in all specifications. Rather than using a VAR, some previous literature such as Warther (1995) uses expected and unexpected flows from a first-pass estimation. However, the VAR approach has the advantage of simultaneously modeling the persistence of imbalances within the VAR (rather

Panel A of Table II displays results for equal-weighted market returns and equal-weighted aggregate institutional trading imbalances for a standard VAR without contemporaneous effects. In the imbalance equation, a one standard deviation increase in institutional imbalances is positively associated with the previous two days' institutional imbalances. Institutions systematically move in and out of Nasdaq 100 stocks in opposite direction over windows averaging three days.

The return equation shows that institutional imbalances have some ability to predict next-day returns. However, the predictability in returns is small compared to that in imbalances. The adjusted R^2 's for the return equation indicate that roughly only 2.2 percent of the variance of returns is explained by past returns and imbalances.

In Panel B, we use a structural VAR model where institutional imbalances depend on past imbalances and both contemporaneous and lagged returns. The contemporaneous return is included in the structural VAR to jointly estimate the contemporaneous relation between imbalances and returns. We are not assuming causality. A one standard deviation increase in returns is associated with a contemporaneous 0.36 standard deviation increase in daily institutional buying and a shock to the previous-day return leads to a 0.48 standard deviation increase in net institutional buying. After controlling for past imbalances, imbalances are even slightly more strongly associated with the previous day's return than the contemporaneous return. One standard deviation shocks to lagged two- and three-day returns are associated with a -0.09 and -0.13 standard deviation decrease in institutional net activity.

We also examine value-weighted Nasdaq returns and value-weighted institutional imbalances in Panel C of Table II. The value-weighted Nasdaq 100 is interesting to examine since it is a widely traded asset. Again, past returns are an important determinant of imbalances, with a coefficient of 0.45 on the contemporaneous return and a coefficient of 0.47 on the lagged return. Institutions (individuals) move into (out of) the market on the day of and following a market increase.

than from a first-pass regression) and avoiding the error-in-variables problem that arise from using estimated regressors as dependent variables in a second-stage regression.

B. Trading Behavior in Different Market Environments

The trend chasing behavior observed thus far suggests that institutions could be at least partially responsible for the Nasdaq bubble. Yet, the timing of their trading activity is important. In particular, if institutions primarily follow negative price moves during the run-up and correction phase of the bubble, then their trading behavior could take prices towards fundamental values quicker than in the absence of their trading. Conversely, if they engage in trend chasing during the run-up, then their behavior may lead to higher prices than would have occurred in their absence. We examine these issues by studying the institutional and individual trading behavior during the Nasdaq run-up, crash and subsequent periods separately.

We define the run-up as the period from September 1, 1999 (the beginning of our sample) to the peak of the Nasdaq 100 on March 27, 2000 and the crash period from March 28, 2000 to April 4, 2001. The more-stable period starts on April 5, 2001 and runs until the end of our sample on December 31, 2001. The more-stable period is picked from April 5, 2001 onwards because the market rebounded for five months before going below levels set on April 4, 2001.

Table III examines the relation between returns and contemporaneous daily imbalances as well as the imbalances on the two days before and two days after a return move during the three sub-periods. Table III shows that there is a relatively weak relation between returns and contemporaneous institutional imbalances in the run-up period. However, there appears to be a strong relation between returns and next-day institutional imbalances. For the largest negative return moves, institutions sell 0.02128 percent of the shares to individuals whereas for the most positive return moves institutions buy 0.02681 percent of the shares.

In the crash and more-stable periods, the relation between returns and the next day's institutional buying is even stronger. For return moves less than minus two percent, in the crash (more-stable) period institutions sell 0.0295 (0.0462) percent of the shares to individuals whereas for return moves greater than two percent institutions buy 0.03133 (0.03359) percent of the shares. In all three periods the institutional

trading in relation to returns is greater on the day after the return move than on the same day. No statistically significant patterns are observed after two days.

In unreported results we also examine estimates of the dollar values of trading relative to return moves. The three periods are not directly comparable because the market value of Nasdaq falls rapidly over the second sub-period but the three periods can be used as a gauge of the overall economic importance. Following large negative market moves, roughly 472 million dollars are sold in the run-up period, 582 in the crash period, and 390 in the more-stable period. The dollar value of purchases following market up-moves is even greater in each period. Overall, the sorting evidence suggests that institutions are strong trend chasers throughout the sample period.

We formally test whether the dynamics of institutional/individual trading has changed throughout the period using a VAR. Panel A of Table IV reports VAR results by sub-period. Consistent with our sorting results, the contemporaneous relation between institutional trading and returns is weakest in the market run-up period (with a 0.17 coefficient). However, the relation between returns and the next day's institutional imbalance is strong in this period (with a coefficient of 0.47). In the crash (more-stable) period the contemporaneous return relation is 0.34 (0.44). Similarly, a one standard deviation shock to returns leads to a 0.45 increase in the following day's institutional buying during the crash period and an increase of 0.52 in the more-stable period.

Institutional imbalances are negatively related to the prior two- and three-day returns in all three periods but the relation is only significant in the final sub-period. In the crash period, there is some weak evidence that institutional imbalances foreshadow next-day market return movements.

To judge the difference among periods, we estimate a single regression over the entire sample and interact dummy variables with returns and institutional imbalances for both the run-up and crash period. We interpret all variables relative to the more-stable period. In the imbalance equation, Panel B shows that institutions moved less with the market during the run-up period than in the more-stable period (coefficient of -0.25). This coefficient is also negative although insignificant during the crash period. We find no significant difference in trend chasing activity relative to the more-stable period. Overall,

institutional trend chasing is quite strong throughout the period. Rather than providing a stabilizing force for the market, institutions strongly followed past prices even during the market run-up period—a practice that enhances any potential price distortions.

One potential issue is whether there are asymmetries in the relation between both positive and negative return moves and institutional trading. In particular, it may be the case that institutional trading follows positive but not negative market moves or vice versa. In Table V we examine this with daily VAR regressions by sub-period where returns are interacted with a dummy variable (equal to one when returns are negative).¹⁹ Although the differences are not statistically significant, in the run-up period institutions did not move with market down moves as much as they did with up moves. In contrast, there is weak evidence that institutional selling was more rampant on market down days during the crash period. Such is not the case in the more stable period where institutions sold significantly less on market down days than they bought on market up days. During both the run-up and crash periods, institutions sold slightly more on the day following up-moves than they bought following down-moves. Overall, the evidence that institutions moved with the market on the day of and the day following market up-moves in the pre-crash period suggests that institutions helped drive Nasdaq's rise.

V. Institutional Activity and Mutual Fund Flows

One question raised by our analysis is whether the institutional activity seen in Nasdaq imbalances merely reflects institutional managers reacting to aggregate inflows and outflows from individuals in professionally managed funds. If individual investors sell stocks in their individual accounts following large up-moves and at the same time buy securities via mutual funds then the net market exposure of individual investors could be unchanged. Indeed, from February 1998 through June 1999, Edelen and Warner (2001) document a positive contemporaneous relation between daily mutual fund net flows and NYSE index returns and an even stronger positive relation between net flows and the

¹⁹ The coefficients on returns interacted with the dummy variables for negative return days can be interpreted as the incremental impact of returns on negative return days as compared to those day zero returns that are positive.

previous day's market return. Goetzmann and Massa (1999) examine flows in and out of several large S&P index funds and find a contemporaneous relation, but little lagged relation, between daily fund flows and returns. They argue that these inflows may be responsible for the large S&P index price increase.

We obtain aggregate net flows into U.S. mutual funds from TrimTabs. Both Edelen and Warner (2001) and Goetzmann, Rouwenhorst, and Ivkovich (2001) find that the accuracy and timing of the TrimTabs reporting is high, but TrimTabs covers just 15 to 20 percent of mutual fund assets. Because these flows only represent mutual funds and our imbalance data consists of all institutional brokerage houses, our examination of the market is somewhat incomplete. Investors are thought to be more active in redeeming and purchasing mutual funds compared to other types of institutional capital (i.e., managed accounts, pension or hedge funds). Indeed Griffin, Harris, and Topaloglu (2003) show that cross-sectional changes in mutual fund holdings have the strongest relation of all investor types to quarterly imbalances computed from similar Nasdaq data for individual securities.

Empirically, we estimate a VAR with returns, institutional imbalances and mutual fund flows together. The model consists of the following three equations:

$$R_t = \alpha + \sum_{i=1}^5 \beta_i R_{t-i} + \sum_{i=1}^5 \lambda_i I_{t-i} + \sum_{i=1}^5 \gamma_i F_{t-i} + \delta_{t,R} \quad (3)$$

$$I_t = \alpha + \beta_0 R_t + \sum_{i=1}^5 \beta_i R_{t-i} + \sum_{i=1}^5 \lambda_i I_{t-i} + \gamma_0 F_t + \sum_{i=1}^5 \gamma_i F_{t-i} + \delta_{t,I} \quad (4)$$

$$F_t = \alpha + \beta_0 R_t + \sum_{i=1}^5 \beta_i R_{t-i} + \sum_{i=1}^5 \lambda_i I_{t-i} + \sum_{i=1}^5 \gamma_i F_{t-i} + \delta_{t,I} \quad (5)$$

where F_t is the mutual fund flows scaled by the previous month's aggregate S&P market capitalization. Returns and imbalances are defined as above. We include contemporaneous flows in the imbalance equation to test whether there still exists a positive contemporaneous (and lagged) relation between imbalances and past returns after controlling for contemporaneous flows.

Because flows are value-weighted, Table VI presents the results of the value-weighted VAR model. To see whether our institutional imbalance measure captures individual investors trading through

institutional channels, we examine the relation between contemporaneous or lagged fund flows and our imbalance measure. The relation between returns and imbalances remain relatively unchanged but several other results emerge.

First, fund flows are marginally contemporaneously correlated with our institutional imbalance measure (p-value of 0.15). Lagged flows, however, have little significant relation with institutional imbalances. Second, the magnitude and significance of the return and imbalance coefficients remain largely unchanged even after including contemporaneous and lagged mutual fund flows in the imbalance equation. A one standard deviation increase in returns is still associated with a contemporaneous 0.45 standard deviation increase in daily institutional buying, identical to the coefficient found without controlling for fund flows in Panel C of Table II. Similar results hold for previous-day returns (coefficient of 0.42 vs. 0.47 in Panel C of Table II). Past returns remain important determinants of institutional imbalances even after controlling for mutual fund flows. Return lags 2 to 5 are negative and half significantly so, presenting some evidence that institutions are somewhat contrarian at longer lags.

Third, the importance of the previous day's returns for explaining flows is strikingly similar to that found in Edelen and Warner (2001). Mutual fund flows are negatively related to past one- and two-day flows but significantly positively correlated at three- to five-day horizons. In addition, there is little evidence that mutual fund flows have any relation to future Nasdaq 100 returns. In unreported results, we demean the flow variables by day-of-the-week indicators but found little change in the VAR coefficients.²⁰ We also examine whether these relations change across the three sub-periods. Overall our main findings are similar—controlling for mutual fund flows does not substantially reduce the strong relation between imbalances and contemporaneous or previous-day returns in any of the three sub-periods.

Although the individual VAR coefficients are informative, they only measure the static lead-lag relationships among institutional imbalances, mutual fund flows and returns. The joint impact of past

²⁰ Mutual fund flows are much greater on Fridays and somewhat larger on Mondays and Tuesdays but exhibit no clear day-of-the-month patterns.

shocks is more important for determining the dynamic behavior of the system. Through the use of impulse response functions we trace out the cumulative impact of an innovation in institutional imbalances, mutual fund flows, and returns on subsequent imbalances, flows, and returns over time. Using equations (3) through (5) without the contemporaneous variables, we examine the cumulative impact for ten days with two standard deviation confidence intervals.

Figure 5 shows that returns have a strong impact on institutional imbalances at lag one but the effect reverses and goes to zero in the subsequent periods. This reversal, consistent with the negative relation between imbalances and returns at lags 2 through 5 shown in Table VI, indicates that the short-term increase in institutional buying in response to the previous day's stock return is counteracted by institutional selling. In contrast, shocks to returns lead to an increase in mutual fund inflows, yet only part of the flow increase is transitory. Even at lag ten, a one standard deviation increase in returns leads to a 0.42 percent increase in mutual fund flows.

There are few short-term dynamic effects of mutual fund flows on institutional imbalances and insignificantly positive effects at longer horizons. As expected, there is no relation between institutional activity and future mutual fund flows. The VAR system shows no impact of mutual fund flows on returns but institutional imbalances seem to have a small but significant impact on returns. Overall, these results reinforce the conclusion that mutual fund flows do not have a large effect on imbalances even though both imbalances and mutual fund flows are strongly related to past Nasdaq 100 returns. Interestingly, while a shock to returns has a lasting effect on mutual fund flows, the positive relation between returns and institutional imbalances is transitory.

VI. Intradaily Investor Trading

Our previous analysis shows a strong contemporaneous positive relation between daily returns and institutional imbalances. However, it is unclear what is occurring within the day. If individuals act as noise traders using extraneous information or past prices then one might expect to see that institutions incorporate news into prices with individuals following these price movements. In contrast, theoretical

models such as Abreu and Brunnermeier (2002) call for the smart money to watch the direction of trading by the naïve investors and then follow suit.

To examine the intraday relation, we divide each trading day into 78 five-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 midpoint returns at five-minute intervals. We lag the bid-ask midpoints by two seconds before computing the returns since internal Nasdaq analysis indicates that trades are on average reported two seconds later than quotes. We define buy-sell imbalances as the difference between the buy and sell volumes for each five-minute interval scaled by the total number of outstanding shares. Equal-weighted aggregate institutional imbalances and returns are constructed by averaging across all 100 Nasdaq stocks for each of the five-minute intervals. Because market makers take positions throughout the day, intradaily institutional and individual imbalances are not essentially offsetting so we examine both institutional and individual imbalances. We estimate standardized intradaily VARs with six lags (30-minutes) for returns and institutional and individual buy-sell imbalances during the Nasdaq run-up, crash, and more-stable periods. To avoid crossing day boundaries for lagged variables, we exclude the first half hour of each trading day.

Table VII shows a strong negative relation between contemporaneous institutional buy-sell imbalances and returns and a strong and economically large relation between individual imbalances and contemporaneous market returns. A one standard deviation increase in return is contemporaneously associated with a 0.45 standard deviation decrease in net institutional buying and a 0.74 standard deviation increase in individual buying. This evidence is inconsistent with models such as DeLong et al. (1990b) where institutions move prices and individuals follow.

However, the relation reverses quickly with institutional imbalances positively related to past return moves and individual trading negatively related to the previous 20-minute returns. Institutional net buying is negatively related to the past five-minute institutional imbalance but positively related to all other institutional imbalances. Individual imbalances have an economically small negative relation to institutional trading over the previous 30-minute period and an economically larger positive relation to

past individual trading over the preceding 20-minute window. In general, even after controlling for past returns, there is persistence in the trade executions of both institutional and individual brokerage houses.

If one group trades on news faster than another group then one might expect the trading of that particular group to lead prices. Examining the return equation in the run-up period shows that there is little evidence of either institutional or individual imbalances leading the market.

We also examine the crash and more-stable period. In both there is an economically large contemporaneous negative relation between returns and institutional net buying and a positive relation between returns and individual buying. Both periods also show institutions buying and individuals selling following positive return moves. In general, individuals trade either with news or for other reasons and move the market. Institutions seem to follow the market, or alternatively, are not able to effectively mask their trading intent and suffer price impact accordingly. This behavior of institutions chasing past prices during all stages of the bubble potentially exacerbates stock price movements.

VII. Robustness Issues

A. Timing of Trades

Our results all show strong evidence of institutional trades being executed in the same direction as the previous day's market moves. Such activity could be due to institutions making decisions to trade after the market moves or due to institutional orders moving the market and then orders being executed. Market wide price pressure by institutions would predict that the contemporaneous effect should be much stronger than the lagged effect—we observe the opposite. Nevertheless, we examine this relation by using sorting results similar to those in Table I except that we also require institutions to move in the opposite direction of the market on day zero. Interestingly, for days where the market drops by more than two percent and institutions are net buyers, institutions are still strong net sellers on the following day. Similarly, institutions are strong net buyers following days where the market goes up accompanied by institutional net selling.

This evidence again suggests inventory rebalancing is an incomplete explanation and that institutions are making active decisions to trade in response to market returns or the information associated with those market moves. One possible explanation why institutions might follow market moves (deemed probable by some leading practitioners) is that peer benchmarking leads managers to shift from cash into equities when the market rises, hedging the risk of relative underperformance.²¹

B. Trade Classification

Since our method of identifying trades may capture some individuals who trade at institutional brokerage houses, we replicate our key results using the more stringent classification that trades executed through an institutional brokerage house must also be for amounts greater than 10,000 shares. The findings in Table VIII are comparable to those in Panel B of Table II. They show a slightly weaker contemporaneous relation but a nearly identical relation between imbalances and past returns. Results in Tables IV and VI are also re-examined and show that our main findings are robust to the method of trade classification.

VIII. Conclusion

This paper examines the trading behavior of institutional and individual investors surrounding the rise and fall of Nasdaq. We find that institutions held a large fraction of the Nasdaq market capitalization and were also responsible for more trading volume than individuals during the market run-up. On the day of and the day following a large positive return, institutions buy. Conversely, individuals sell when the market rises and buy the day after the market dips. Overall, a one standard deviation increase in

²¹ Mechanical constraints might also impose restrictions on managers. However, the most probable constraints seem to actually lead to an opposite effect from the behavior we observe. Suppose a manager thinks the market is overvalued and would like to maintain a 50 percent weighting. Due to restrictions imposed in the fund's prospectus must maintain at least 80 percent of capital in equities and hence is currently at the lower 80 percent allocation limit. A market increase would increase the manager's equity allocation above 80 percent and hence a bearish manager could now sell equities. In contrast, if a manager is judging themselves relative to other managers who are more heavily weighted in equities than the market up-move might cause the manager who is underweighted in the market to move more money into equities out of fear of being left behind the pack. Nevertheless, it is interesting to note that this decision is an active one on the part of the manager and not induced by a (legal) constraint on holdings.

yesterday's market return is followed by an economically large 0.48 standard deviation increase in today's net institutional buying.

This pattern of strong institutional daily trend chasing behavior is present throughout the Nasdaq run-up and collapse. In addition these patterns are symmetric with respect to both positive and negative returns. We examine whether the patterns reflect the behavior of institutional investors or if institutions (like mutual funds) merely react to individual investor demand via their funds. Although we find that institutional activity is related to daily mutual fund flows, these flows explain only a small proportion of short-term institutional activity and cannot explain the strong daily contemporaneous and lagged relation between institutional imbalances and returns.

Furthermore, we find an extremely strong positive relation between intradaily individual investor trading and stock returns in the same five-minute interval. However, institutional trades soon follow recent price changes and subsequent individual trades move against the past prices. This activity is pervasive during the Nasdaq run-up, crash, and more-stable periods.

Overall our results do not support models where individuals move market-wide prices and institutions (smart money) either passively stand by or actively move against noise traders. Our evidence is most consistent with models where institutions, at least over short one-day intervals, follow recent market moves—a practice which may exacerbate price trends. Future research should examine the underlying motivations behind the complex interactions between individual and institutional traders.

Appendix

Based on internal conversations within Nasdaq, institutional brokers, wirehouses (e.g., Salomon Smith Barney and Morgan Stanley) and Instinet are classified as primarily handling institutional order flow. Other ECNs (excluding Instinet), regional firms and wholesalers (e.g., Schwab and National Financial Services Corporation) are classified as primarily handling individual order flow. Small firms and the two regional exchanges constitute about 18 percent of the total trades over the period and contain a mix of individual and institutional trading volume. These brokerage houses are assigned as primarily institutional or individual trading houses based on their overall distribution of trading volume over the period. Small firm and regional exchanges are classified as an institutional dealer if the third quartile of trade-size distribution is 1,000 shares or greater. The 1,000-share cutoff is consistent with the third quartile of trade-size distribution for institutional brokers, wirehouses, and Instinet whereas handlers of individual order flow (other ECNs, regional firms and wholesalers) have trade sizes smaller than 600 shares at the third quartile of the trade size distribution. Further analysis of the data is available in Griffin, Harris, and Topaloglu (2003).

We note that 9.43 percent of volume cannot be assigned to either an institution or individual brokerage because of inconsistencies in the trade routing process. Because a disproportionate number of these unclassified trades are sell trades, we typically observe slightly more buy than sell trades in the individual (and possibly in the institutional) categories. Since the proportion of unclassified trades is small relative to the total daily imbalances it seems unlikely to bear much impact on our daily regression results. However, because the buy trade bias affects cumulative ownership levels we do not cumulate ownership by investment type.

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Table I
Various Characteristics for Return Groups

Each day from September 3, 1999 to December 27, 2001 is assigned to one of six groups based on the equal-weighted average return on the stocks comprising the Nasdaq 100 index. This table reports the equal-weighted average return, equal-weighted institutional buy-sell imbalance, institutional net buying and equal-weighted institutional net volume for the five trading days centered around the ranking day. For each stock, institutional buy-sell imbalance (expressed in 1/1000 of a percent) is the difference between the institutional buy and sell volumes for that day scaled by the total number of outstanding shares. Institutional net volume is the difference between the institutional buy and sell volumes scaled by the total number of shares traded on a given day. Returns and institutional net volume are expressed in percent per day. Institutional net buying, expressed in million dollars, is the difference between the total value bought and sold by institutions. ^a and ^b indicate significance at the one and five percent level.

	EW Return					
	N	-2	-1	0	1	2
<i>R</i> <-2	158	0.06	-0.17	-3.96 ^a	-0.11	0.42
-2<= <i>R</i> <-1	55	0.56	-0.11	-1.46 ^a	0.31	0.45
-1<= <i>R</i> <0	68	0.60	0.53	-0.46 ^a	0.20	0.59
0<= <i>R</i> <1	87	0.49	0.47	0.42 ^a	0.17	-0.13
1<= <i>R</i> <2	67	-0.08	0.12	1.46 ^a	-0.01	-0.28
<i>R</i> >=2	146	-0.67 ^b	-0.21	4.29 ^a	-0.06	-0.57 ^b
<i>Diff.</i>		-0.73	-0.04	8.25 ^a	0.05	-0.99 ^b

	EW Institutional Imbalance					
	N	-2	-1	0	1	2
<i>R</i> <-2	158	-2.20	-6.39	-19.98 ^a	-33.59 ^a	-4.15
-2<= <i>R</i> <-1	55	-4.38	-7.53	-11.86	-14.56 ^b	1.93
-1<= <i>R</i> <0	68	5.85	12.29	-1.80	2.39	-0.78
0<= <i>R</i> <1	87	4.66	6.20	2.33	-0.20	1.21
1<= <i>R</i> <2	67	-6.58	-1.13	7.74	11.83 ^a	-8.36
<i>R</i> >=2	146	-2.45	-3.42	17.75 ^a	31.11 ^a	2.66
<i>Diff.</i>		-0.25	2.97	37.73 ^a	64.70 ^a	6.81

	Institutional Net Buying					
	N	-2	-1	0	1	2
<i>R</i> <-2	158	-36.99	-71.37	-401.27 ^a	-508.22 ^a	-38.44
-2<= <i>R</i> <-1	55	90.72	-71.72	-140.31	-340.91 ^b	48.63
-1<= <i>R</i> <0	68	34.03	270.98 ^b	-46.41	18.63	66.33
0<= <i>R</i> <1	87	141.82	148.05	110.49	62.37	14.67
1<= <i>R</i> <2	67	65.74	151.36	283.71 ^a	250.79 ^a	-94.28
<i>R</i> >=2	146	-45.16	-104.77	386.74 ^a	588.15 ^a	95.55
<i>Diff.</i>		-8.17	-33.40	788.01 ^a	1096.37 ^a	133.99

	EW Institutional Net Volume					
	N	-2	-1	0	1	2
<i>R</i> <-2	158	0.25	0.17	-0.14	-0.85 ^a	0.10
-2<= <i>R</i> <-1	55	0.22	-0.01	0.06	-0.15	0.51
-1<= <i>R</i> <0	68	0.53 ^b	0.94 ^a	0.39	0.53 ^b	0.53 ^b
0<= <i>R</i> <1	87	0.59 ^a	0.45 ^b	0.50 ^b	0.27	0.40
1<= <i>R</i> <2	67	0.45	0.65 ^b	0.85 ^a	0.86 ^a	0.09
<i>R</i> >=2	146	0.28	0.23	0.68 ^a	1.59 ^a	0.58 ^a
<i>Diff.</i>		0.03	0.06	0.82 ^a	2.44 ^a	0.48 ^b

Table II

Daily VAR Estimates of Nasdaq 100 Returns and Institutional Buy-Sell Imbalances

This table presents the coefficient estimates, p-values and adjusted R²s from the daily vector autoregression (VAR) with 5 lags and the following structural VAR:

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

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

where R_t is the average daily return and I_t is the daily average institutional buy-sell imbalance for the stocks comprising the Nasdaq 100 index. For each stock, 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. Panels A and B report the results for equal-weighted averages and Panel C presents the results for value-weighted averages. To facilitate interpretation, both variables are standardized prior to estimation of the VAR. p-values are in parentheses.

Panel A		<i>Return</i>						<i>Inst. Imbal.</i>					Adj. R²
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	
<i>Return</i>	0.00 (0.99)		-0.05 (0.24)	-0.20 (0.00)	0.06 (0.26)	0.08 (0.15)	-0.07 (0.22)	0.14 (0.01)	-0.01 (0.88)	-0.07 (0.23)	0.03 (0.59)	0.04 (0.42)	0.022
<i>Inst. Imbal.</i>	0.00 (1.00)	0.46 (0.00)	-0.16 (0.00)	-0.11 (0.01)	-0.04 (0.42)	-0.09 (0.03)	0.26 (0.00)	0.12 (0.01)	-0.03 (0.56)	0.09 (0.07)	0.11 (0.00)		0.384
Panel B		<i>Return</i>						<i>Inst. Imbal.</i>					Adj. R²
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	
<i>Return</i>	0.00 (0.99)		-0.05 (0.24)	-0.20 (0.00)	0.06 (0.26)	0.08 (0.15)	-0.07 (0.22)	0.14 (0.01)	-0.01 (0.88)	-0.07 (0.23)	0.03 (0.59)	0.04 (0.42)	0.022
<i>Inst. Imbal.</i>	0.00 (1.00)	0.36 (0.00)	0.48 (0.00)	-0.09 (0.02)	-0.13 (0.00)	-0.06 (0.11)	-0.07 (0.07)	0.21 (0.00)	0.12 (0.00)	0.00 (0.96)	0.08 (0.08)	0.10 (0.00)	0.507
Panel C		<i>Return</i>						<i>Inst. Imbal.</i>					Adj. R²
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	
<i>Return</i>	0.00 (0.99)		-0.10 (0.04)	-0.20 (0.00)	-0.02 (0.66)	0.06 (0.27)	-0.07 (0.23)	0.11 (0.06)	0.10 (0.11)	-0.12 (0.04)	0.03 (0.58)	0.06 (0.20)	0.019
<i>Inst. Imbal.</i>	0.00 (1.00)	0.45 (0.00)	0.47 (0.00)	-0.09 (0.03)	-0.12 (0.00)	-0.12 (0.00)	-0.05 (0.18)	0.14 (0.00)	0.15 (0.00)	0.01 (0.88)	0.08 (0.06)	0.03 (0.43)	0.513

Table III
Institutional Imbalances for Return Groups for Subperiods

Each day from September 3, 1999 to December 27, 2001 is assigned to one of six groups based on the equal-weighted average return on the stocks comprising the Nasdaq 100 index. This table reports the equal-weighted average institutional buy-sell imbalance and institutional net buying for the five trading days centered around the ranking day for each subperiod. The period from September 1, 1999 to March 27, 2000 comprises the run-up period. March 28, 2000 to April 4, 2001 is the crash period. The more-stable period starts on April 5, 2001 and ends on December 31, 2001. For each stock, institutional buy-sell imbalance (expressed in 1/1000 of a percent) is the difference between the institutional buy and sell volumes for that day scaled by the total number of outstanding shares.

Run-up						
	N	-2	-1	0	1	2
$R < -2$	21	11.27 ^b	3.40	5.78	-21.28 ^a	9.01
$-2 \leq R < -1$	9	1.02	30.01 ^a	7.42	3.52	7.80
$-1 \leq R < 0$	24	7.03	13.50	4.07	14.25 ^b	15.88 ^b
$0 \leq R < 1$	30	12.76 ^b	13.12 ^b	2.03	-0.39	3.81
$1 \leq R < 2$	26	19.26 ^b	14.22 ^b	19.76 ^a	20.61 ^a	-1.51
$R \geq 2$	32	3.03	-2.19	15.27 ^b	26.81 ^a	13.57 ^b
<i>Diff.</i>		-8.24	-5.59	9.49	48.09 ^a	4.56
Crash						
	N	-2	-1	0	1	2
$R < -2$	88	-0.74	-5.13	-21.51 ^a	-29.50 ^a	-2.90
$-2 \leq R < -1$	27	-2.44	-18.44	-10.15	-12.29	11.81
$-1 \leq R < 0$	24	5.89	26.16 ^b	10.93	9.60	2.34
$0 \leq R < 1$	33	12.92	9.61	15.75 ^b	8.55	11.05
$1 \leq R < 2$	22	-13.48	14.41	15.24 ^b	14.57	-21.38 ^b
$R \geq 2$	64	-1.31	-6.96	13.42 ^b	31.33 ^a	1.47
<i>Diff.</i>		-0.57	-1.83	34.93 ^a	60.83 ^a	4.37
More-stable						
	N	-2	-1	0	1	2
$R < -2$	49	-10.58	-12.84	-28.29 ^a	-46.20 ^a	-12.05
$-2 \leq R < -1$	19	-9.70	-9.81	-23.41 ^b	-26.34 ^b	-14.87
$-1 \leq R < 0$	20	4.40	-5.80	-24.12	-20.50 ^b	-24.51 ^b
$0 \leq R < 1$	24	-16.82	-7.12	-15.73	-12.01	-15.58
$1 \leq R < 2$	19	-33.97 ^a	-40.12 ^a	-17.38 ^b	-3.35	-2.65
$R \geq 2$	50	-7.41	0.32	24.89 ^a	33.59 ^a	-2.80
<i>Diff.</i>		3.17	13.16	53.18 ^a	79.79 ^a	9.25

^a indicates significance at 1 percent. ^b indicates significance at 5 percent.

Table IV

Daily VAR Estimates of Nasdaq 100 Returns and Institutional Imbalances for Subperiods

Panel A presents the coefficient estimates, p-values and adjusted R²s from the following daily structural vector autoregression (VAR) with 5 lags for each subperiod:

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

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

where R_t is the daily equal-weighted average return and I_t is the daily equal-weighted average institutional buy-sell imbalance for the stocks comprising the Nasdaq 100 index. For each stock, 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. Panel B presents the results for a VAR where returns and institutional imbalances are interacted with indicator variables for the run-up and crash periods and included as exogenous variables. The period from September 1, 1999 to March 27, 2000 comprises the run-up period. March 28, 2000 to April 4, 2001 is the crash period. The more-stable period starts on April 5, 2001 and ends on December 31, 2001. To facilitate interpretation, all variables are standardized prior to estimation of the VAR. p-values are in parentheses.

Panel A

Run-up													
	<i>Return</i>							<i>Inst. Imbal.</i>					<i>Adj. R²</i>
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	
<i>Return</i>	0.18 (0.01)		-0.08 (0.34)	-0.26 (0.01)	0.01 (0.91)	0.04 (0.72)	0.12 (0.24)	0.01 (0.95)	-0.04 (0.64)	0.04 (0.66)	-0.17 (0.09)	0.04 (0.63)	0.028
<i>Inst. Imbal.</i>	0.09 (0.16)	0.17 (0.04)	0.47 (0.00)	-0.01 (0.90)	-0.14 (0.14)	-0.07 (0.44)	0.03 (0.73)	0.19 (0.03)	0.11 (0.20)	-0.02 (0.78)	-0.03 (0.75)	0.08 (0.29)	0.248
Crash													
	<i>Return</i>							<i>Inst. Imbal.</i>					<i>Adj. R²</i>
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	
<i>Return</i>	-0.16 (0.03)		-0.15 (0.04)	-0.27 (0.00)	-0.05 (0.59)	0.05 (0.53)	-0.16 (0.05)	0.19 (0.04)	0.11 (0.28)	-0.15 (0.14)	0.16 (0.10)	0.10 (0.18)	0.045
<i>Inst. Imbal.</i>	0.05 (0.30)	0.34 (0.00)	0.45 (0.00)	-0.07 (0.21)	-0.10 (0.09)	-0.07 (0.21)	-0.03 (0.60)	0.18 (0.01)	0.10 (0.14)	-0.01 (0.83)	0.09 (0.16)	0.09 (0.09)	0.496
More-stable													
	<i>Return</i>							<i>Inst. Imbal.</i>					<i>Adj. R²</i>
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	
<i>Return</i>	0.03 (0.70)		0.05 (0.55)	-0.14 (0.18)	0.18 (0.10)	0.06 (0.56)	-0.01 (0.94)	0.12 (0.27)	-0.05 (0.67)	-0.09 (0.40)	0.03 (0.76)	-0.01 (0.92)	-0.017
<i>Inst. Imbal.</i>	-0.11 (0.07)	0.44 (0.00)	0.52 (0.00)	-0.13 (0.09)	-0.17 (0.02)	0.03 (0.65)	-0.12 (0.10)	0.20 (0.01)	0.18 (0.02)	-0.04 (0.62)	0.03 (0.74)	0.14 (0.01)	0.588

Panel B

	Run-up Dummy × Return				Crash Dummy × Return				Run-up Dummy × Inst. Imbal.			Crash Dummy × Inst. Imbal.			Return				Inst. Imbal.			Adj. R ²	
	int.	0	-1	-2	-3	0	-1	-2	-3	-1	-2	-3	-1	-2	-3	0	-1	-2	-3	-1	-2	-3	
<i>Return</i>	-0.02 (0.61)	-0.11 (0.48)	-0.10 (0.57)	-0.14 (0.43)	-0.22 (0.03)	-0.16 (0.19)	-0.20 (0.10)	-0.04 (0.82)	0.04 (0.84)	0.13 (0.35)	0.12 (0.38)	0.10 (0.46)	0.03 (0.73)	0.07 (0.38)	-0.12 (0.21)	0.17 (0.07)	0.09 (0.38)	-0.06 (0.54)	-0.04 (0.59)	0.016			
<i>Inst. Imbal.</i>	0.01 (0.72)	-0.25 (0.01)	-0.01 (0.92)	0.21 (0.09)	0.10 (0.44)	-0.11 (0.09)	-0.06 (0.45)	0.10 (0.27)	0.13 (0.14)	-0.02 (0.84)	-0.10 (0.40)	-0.05 (0.59)	-0.03 (0.77)	-0.14 (0.15)	-0.04 (0.57)	0.45 (0.00)	0.50 (0.00)	-0.19 (0.01)	-0.23 (0.00)	0.24 (0.00)	0.23 (0.00)	0.02 (0.71)	0.498

Table V
Asymmetries

This table presents the coefficient estimates, p-values and adjusted R²s from the daily structural vector autoregression (VAR) with 3 lags for each subperiod. The endogenous variables are the daily equal-weighted average return and the daily equal-weighted average institutional buy-sell imbalance for the stocks comprising the Nasdaq 100 index. For each stock, 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. Returns are interacted with indicator variables for negative returns and included as exogenous variables for the institutional buy-sell imbalance. The period from September 1, 1999 to March 27, 2000 comprise the run-up period. March 28, 2000 to April 4, 2001 is the crash period. The more-stable period starts on April 5, 2001 and ends on December 31, 2001. p-values are in parentheses.

Run-up													
		Neg. Ret. Dummy × Return				Return				Inst. Imbal.			Adj. R²
	int.	0	-1	-2	-3	0	-1	-2	-3	-1	-2	-3	
<i>Return</i>	0.58 (0.01)					0	-0.09 (0.32)	-0.24 (0.01)	0.04 (0.66)	0.00 (0.85)	-0.01 (0.16)	0.01 (0.44)	0.046
<i>Inst. Imbal.</i>	-1.82 (0.70)	-3.75 (0.20)	4.84 (0.09)	2.40 (0.39)	0.78 (0.79)	3.52 (0.03)	3.35 (0.04)	-0.70 (0.65)	-1.97 (0.20)	0.21 (0.02)	0.13 (0.14)	-0.01 (0.86)	0.268
Crash													
		Neg. Ret. Dummy × Return				Return				Inst. Imbal.			Adj. R²
	int.	0	-1	-2	-3	0	-1	-2	-3	-1	-2	-3	
<i>Return</i>	-0.13 (0.61)					0	-0.16 (0.03)	-0.30 (0.00)	-0.09 (0.24)	0.02 (0.04)	0.02 (0.06)	-0.01 (0.40)	0.040
<i>Inst. Imbal.</i>	-0.47 (0.91)	2.68 (0.08)	1.95 (0.20)	-0.47 (0.76)	-0.25 (0.87)	2.30 (0.01)	3.60 (0.00)	-0.86 (0.34)	-0.95 (0.28)	0.23 (0.00)	0.11 (0.11)	-0.02 (0.65)	0.467
More-stable													
		Neg. Ret. Dummy × Return				Return				Inst. Imbal.			Adj. R²
	int.	0	-1	-2	-3	0	-1	-2	-3	-1	-2	-3	
<i>Return</i>	0.22 (0.57)					0	0.09 (0.27)	-0.13 (0.19)	0.13 (0.19)	0.01 (0.56)	0.00 (0.90)	0.00 (0.86)	-0.003
<i>Inst. Imbal.</i>	-19.37 (0.01)	-4.40 (0.02)	-0.28 (0.89)	1.47 (0.45)	-1.25 (0.52)	5.44 (0.00)	5.31 (0.00)	-2.16 (0.06)	-1.62 (0.16)	0.23 (0.00)	0.21 (0.01)	0.00 (0.99)	0.519

Table VI

Daily VAR Estimates of Nasdaq 100 Returns, Institutional Imbalances and Mutual Fund Flows

This table presents the coefficient estimates, p-values and adjusted R²s from the following daily structural vector autoregression (VAR) with 5 lags:

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

$$I_t = \alpha + \beta_0 R_t + \sum_{i=1}^5 \beta_i R_{t-i} + \sum_{i=1}^5 \lambda_i I_{t-i} + \gamma_0 F_t + \sum_{i=1}^5 \gamma_i F_{t-i} + \delta_{t,I} \quad (\text{B})$$

$$F_t = \alpha + \beta_0 R_t + \sum_{i=1}^5 \beta_i R_{t-i} + \sum_{i=1}^5 \lambda_i I_{t-i} + \sum_{i=1}^5 \gamma_i F_{t-i} + \delta_{t,F} \quad (\text{C})$$

where R_t is the daily value-weighted Nasdaq 100 return, I_t is the daily value-weighted average institutional buy-sell imbalance for the stocks comprising the Nasdaq 100 index and F_t is the mutual fund flows scaled by the aggregate S&P market capitalization. For each stock, 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, all variables are standardized prior to estimation of the VAR. p-values are in parentheses.

	<i>Return</i>						<i>Inst. Imbal.</i>					<i>Mut. flow</i>					<i>Adj. R²</i>		
	α	β_0	β_1	β_2	β_3	β_4	β_5	λ_1	λ_2	λ_3	λ_4	λ_5	γ_0	γ_1	γ_2	γ_3	γ_4	γ_5	
<i>Return</i>	0.00 (0.99)		-0.10 (0.05)	-0.17 (0.02)	0.06 (0.40)	-0.06 (0.43)	-0.01 (0.85)	0.12 (0.04)	0.09 (0.14)	-0.15 (0.01)	0.05 (0.38)	0.08 (0.15)		-0.05 (0.41)	-0.13 (0.04)	0.13 (0.04)	-0.07 (0.31)	-0.03 (0.54)	0.031
<i>Inst. Imbal.</i>	0.00 (1.00)	0.45 (0.00)	0.42 (0.00)	-0.09 (0.09)	-0.09 (0.07)	-0.16 (0.00)	-0.13 (0.01)	0.14 (0.00)	0.15 (0.00)	-0.01 (0.89)	0.07 (0.09)	0.05 (0.23)	0.07 (0.15)	0.03 (0.56)	-0.02 (0.69)	0.06 (0.18)	0.11 (0.01)	0.03 (0.44)	0.517
<i>Mut. flow</i>	0.00 (0.98)	0.03 (0.26)	0.75 (0.00)	-0.07 (0.13)	-0.07 (0.11)	-0.08 (0.09)	-0.04 (0.45)	-0.10 (0.01)	-0.04 (0.33)	0.01 (0.77)	0.07 (0.10)	-0.03 (0.47)	-0.14 (0.00)	-0.03 (0.50)	0.09 (0.03)	0.12 (0.00)	0.11 (0.00)		0.593

Table VII

Intradaily VAR Estimates of Nasdaq 100 Returns and Institutional and Individual Buy-Sell Imbalances

This table presents the coefficient estimates, p-values and adjusted R²s from the following intradaily vector autoregression (VAR) with 6 lags for each subperiod:

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

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

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

where R_t is the five-minute equal-weighted Nasdaq 100 return and I_t (J_t) is the five-minute equal-weighted average institutional (individual) buy-sell imbalance. This measure is the mean of the institutional (individual) buy-sell imbalances for the stocks comprising the Nasdaq 100 index. For each stock, buy-sell imbalance is the difference between the institutional (individual) buy and sell volumes for that five-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. The period from September 1, 1999 to March 27, 2000 comprises the run-up period. March 28, 2000 to April 4, 2001 is the crash period. More-stable period starts on April 5, 2001 and ends on December 31, 2001. To facilitate interpretation, all three variables are standardized prior to estimation of the VAR.

	Run-up																				Adj. R ²
	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	
Return	0.00 (0.41)		0.26 (0.00)	0.02 (0.04)	-0.03 (0.01)	-0.02 (0.08)	0.00 (0.89)	0.00 (0.88)	0.01 (0.26)	0.00 (0.67)	-0.01 (0.02)	-0.01 (0.36)	0.01 (0.40)	0.00 (0.83)	0.00 (0.68)	-0.02 (0.00)	0.00 (0.55)	0.01 (0.09)	0.01 (0.11)	0.00 (0.82)	0.064
Inst. Imbal.	0.05 (0.00)	-0.45 (0.00)	0.05 (0.02)	0.15 (0.00)	0.12 (0.00)	0.03 (0.14)	0.05 (0.01)	0.05 (0.01)	-0.18 (0.00)	0.04 (0.00)	0.08 (0.00)	0.07 (0.00)	0.06 (0.00)	0.03 (0.00)	-0.14 (0.00)	-0.07 (0.00)	-0.02 (0.11)	0.00 (0.72)	0.01 (0.24)	-0.02 (0.08)	0.123
Ind. Imbal.	-0.04 (0.00)	0.74 (0.00)	-0.12 (0.00)	-0.30 (0.00)	-0.09 (0.00)	-0.11 (0.00)	0.00 (0.84)	0.01 (0.46)	-0.03 (0.00)	-0.03 (0.00)	-0.02 (0.00)	-0.02 (0.06)	-0.02 (0.02)	-0.02 (0.00)	0.11 (0.00)	0.33 (0.00)	0.01 (0.20)	0.11 (0.00)	0.00 (0.71)	-0.05 (0.00)	0.335

Crash

	<i>Return</i>								<i>Inst. Imbal.</i>						<i>Ind. Imbal.</i>						<i>Adj. R²</i>
	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	
<i>Return</i>	-0.01		0.21	-0.05	-0.01	-0.01	0.00	0.00	-0.01	-0.03	-0.01	0.00	0.02	0.01	-0.05	-0.04	0.00	0.02	0.00	0.03	0.036
	(0.28)		(0.00)	(0.00)	(0.49)	(0.49)	(0.77)	(0.93)	(0.24)	(0.01)	(0.62)	(0.72)	(0.10)	(0.33)	(0.00)	(0.01)	(0.93)	(0.15)	(0.90)	(0.07)	
<i>Inst. Imbal.</i>	0.00	-0.30	0.28	0.11	0.06	0.02	0.03	0.01	0.18	0.13	0.07	0.06	0.05	0.05	-0.17	-0.01	-0.01	0.01	-0.01	-0.02	0.330
	(0.48)	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)	(0.00)	(0.16)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.25)	(0.14)	(0.40)	(0.21)	(0.12)	
<i>Ind. Imbal.</i>	-0.02	0.48	-0.19	-0.09	-0.06	-0.03	-0.03	-0.03	-0.04	-0.01	-0.01	-0.01	-0.01	-0.01	0.31	0.12	0.07	0.04	0.03	0.06	0.490
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.03)	(0.11)	(0.13)	(0.22)	(0.09)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	

More-stable

	<i>Return</i>								<i>Inst. Imbal.</i>						<i>Ind. Imbal.</i>						<i>Adj. R²</i>
	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	
<i>Return</i>	0.01		0.10	-0.05	0.03	0.00	-0.02	0.01	0.00	0.00	0.01	0.04	0.00	0.01	-0.01	0.02	-0.02	0.01	0.01	-0.01	0.010
	(0.24)		(0.00)	(0.00)	(0.01)	(0.82)	(0.11)	(0.28)	(0.95)	(1.00)	(0.31)	(0.00)	(0.88)	(0.21)	(0.41)	(0.18)	(0.12)	(0.47)	(0.31)	(0.60)	
<i>Inst. Imbal.</i>	-0.01	-0.25	0.28	0.13	0.04	0.01	0.01	0.01	0.23	0.14	0.10	0.06	0.06	0.03	-0.10	-0.03	0.01	0.01	0.00	-0.03	0.313
	(0.10)	(0.00)	(0.00)	(0.00)	(0.00)	(0.40)	(0.15)	(0.25)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.23)	(0.58)	(0.87)	(0.00)	
<i>Ind. Imbal.</i>	0.05	0.62	-0.22	-0.08	-0.04	-0.02	-0.01	-0.01	-0.07	-0.02	-0.02	-0.01	0.00	0.00	0.30	0.10	0.05	0.03	0.03	0.04	0.472
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)	(0.32)	(0.26)	(0.00)	(0.07)	(0.07)	(0.36)	(0.79)	(0.88)	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)	(0.00)	

Table VIII
Institutional Block Trades

This table presents the coefficient estimates, p-values and adjusted R²s from the following daily structural vector autoregression (VAR) with 5 lags:

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

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

where R_t is the daily equal-weighted average return and I_t is the daily equal-weighted average institutional buy-sell imbalance for the stocks comprising the Nasdaq 100 index. For each stock, 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 10,000 shares. To facilitate interpretation, both variables are standardized prior to estimation of the VAR. p-values are in parentheses.

	<i>Return</i>							<i>Inst. Imbal.</i>					<i>Adj. R²</i>
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	
<i>Return</i>	0.00 (0.99)		-0.04 (0.42)	-0.18 (0.00)	0.07 (0.15)	0.09 (0.10)	-0.07 (0.19)	0.12 (0.03)	-0.03 (0.62)	-0.08 (0.15)	0.03 (0.59)	0.05 (0.29)	0.023
<i>Inst. Imbal.</i>	0.00 (0.99)	0.28 (0.00)	0.49 (0.00)	-0.09 (0.02)	-0.08 (0.06)	-0.04 (0.32)	-0.05 (0.20)	0.23 (0.00)	0.05 (0.23)	-0.02 (0.63)	0.08 (0.07)	0.05 (0.16)	0.432

Figure 1
Distribution of Volume by Trade Size

This figure plots the percentage of volume that can be explained by each trade assignment over the September 1, 1999 to December 31, 2001 period for small and large trades. The market maker (dealer) on each side of each trade is trading for his/her own account (MM) or is simply acting as an agent and handling a trade for a customer. All agency trades are classified into institutional (Inst.) or individual (Ind.) 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 non-classified group. Trades for less than 500 shares are labeled as small trades, and trades for greater than 10,000 shares are classified as large trades.

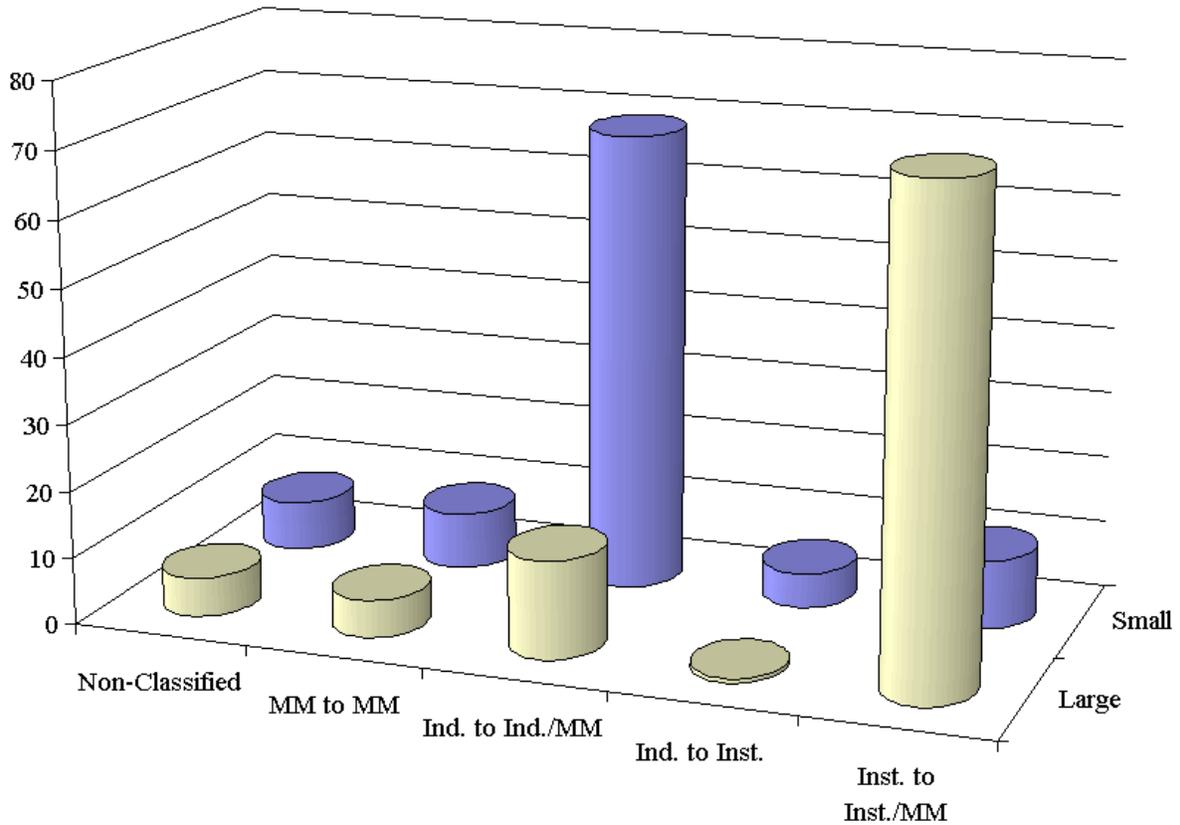
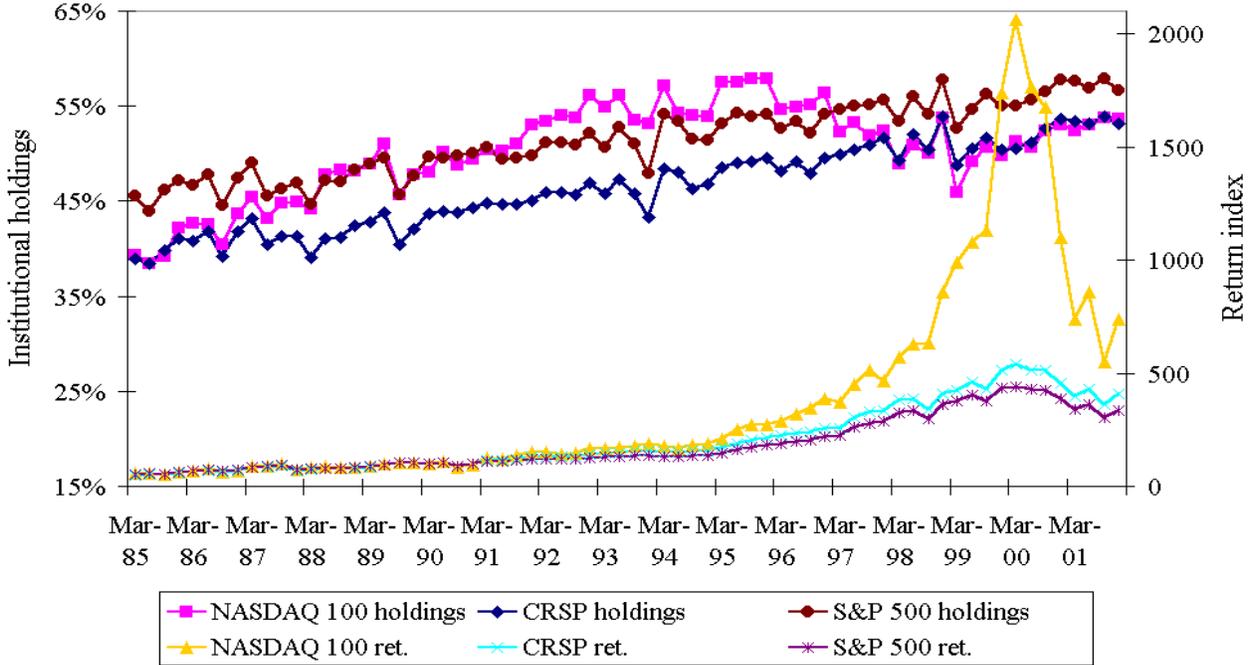


Figure 2
Spectrum Ownership Levels

This figure plots the levels of Nasdaq 100, CRSP value-weighted, and S&P 500 indices, and average institutional holdings as a percentage of shares outstanding for Nasdaq 100, CRSP, and S&P 500 from 1985 to 2001. Panel A reports value-weighted averages. Equal-weighted averages are in Panel B.

Panel A



Panel B

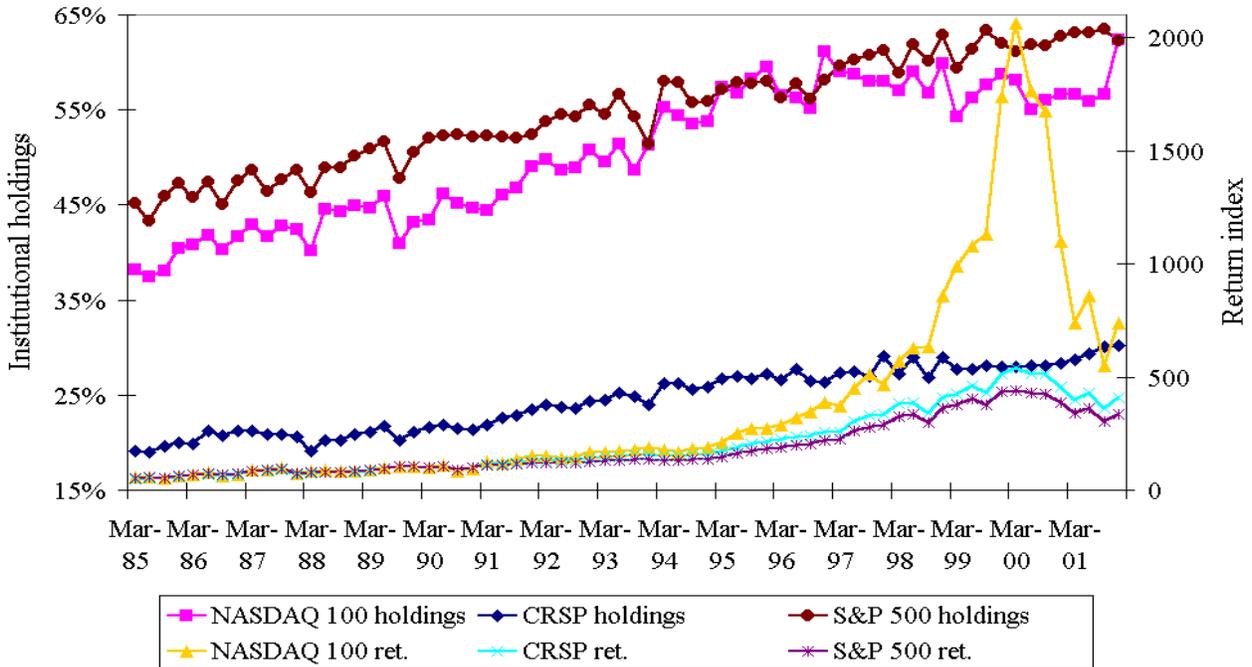
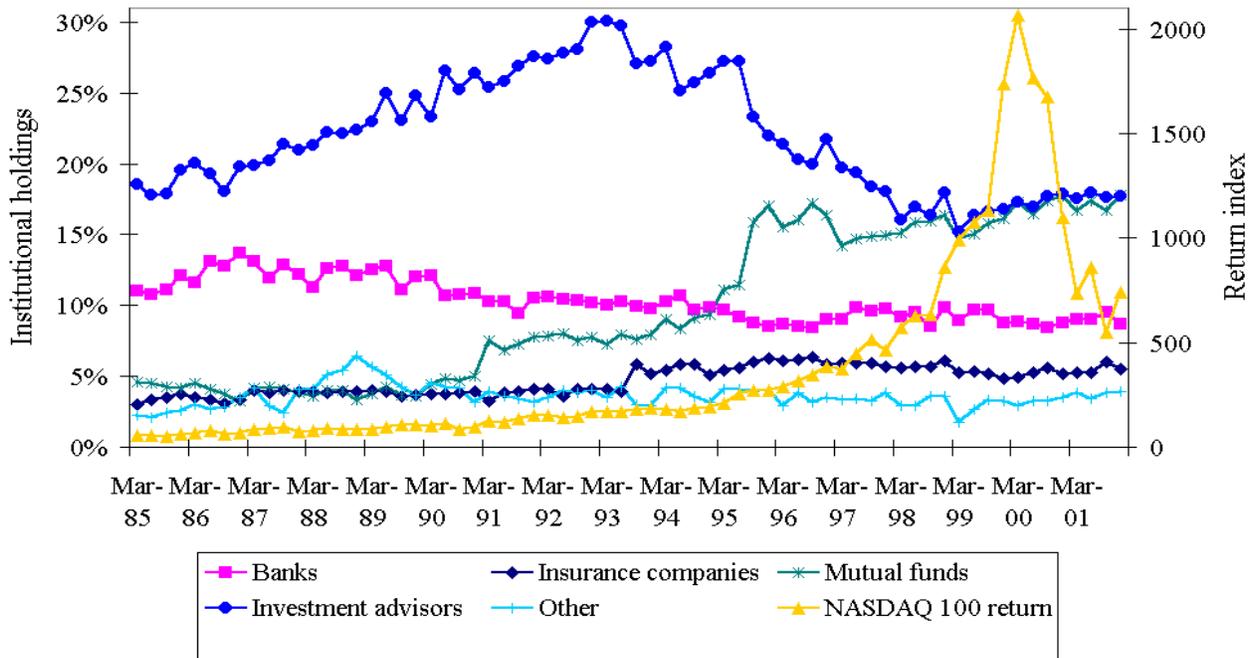


Figure 3
Ownership by Type of Institution

This figure plots the levels of the Nasdaq 100 and S&P 500 indices, and value-weighted average institutional holdings as a percentage of shares outstanding for each institution type from 1985 to 2001. Panel A reports the values for Nasdaq 100. S&P 500 results are in Panel B.

Panel A



Panel B

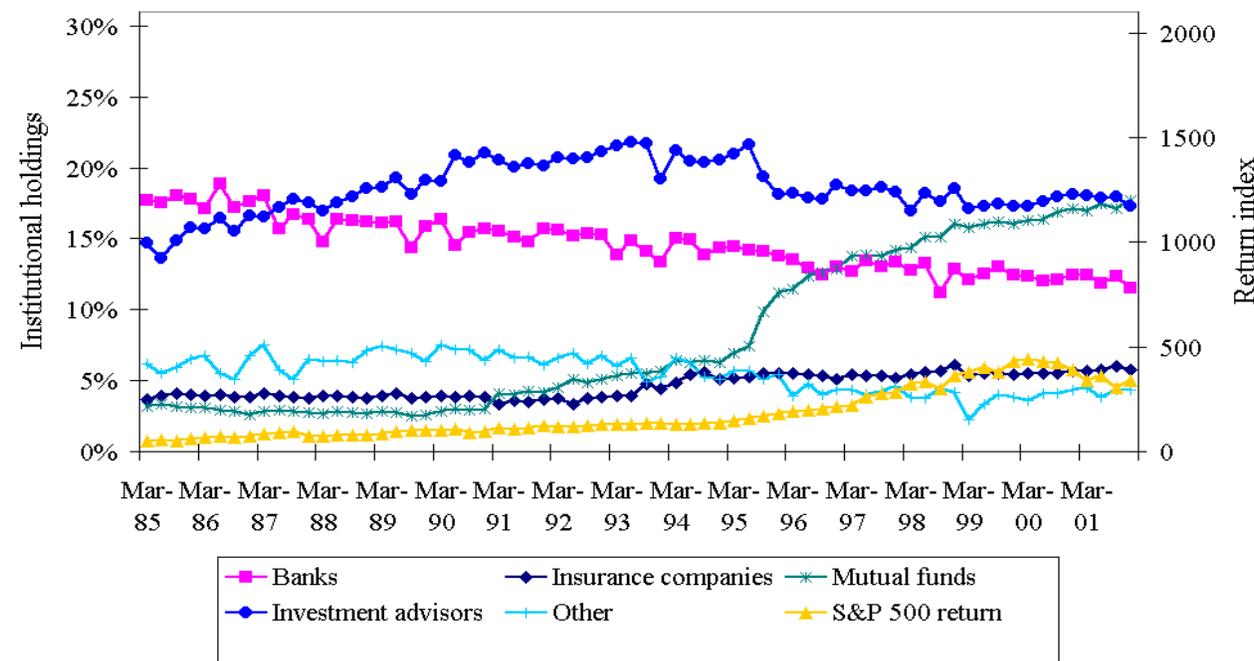


Figure 4

Ratio of Institutional to Individual Volume

This figure plots the level of the Nasdaq 100 index and institutional trading volume to individual trading volume ratio for the stocks comprising the Nasdaq 100 index over the September 1, 1999 to December 31, 2001 period.

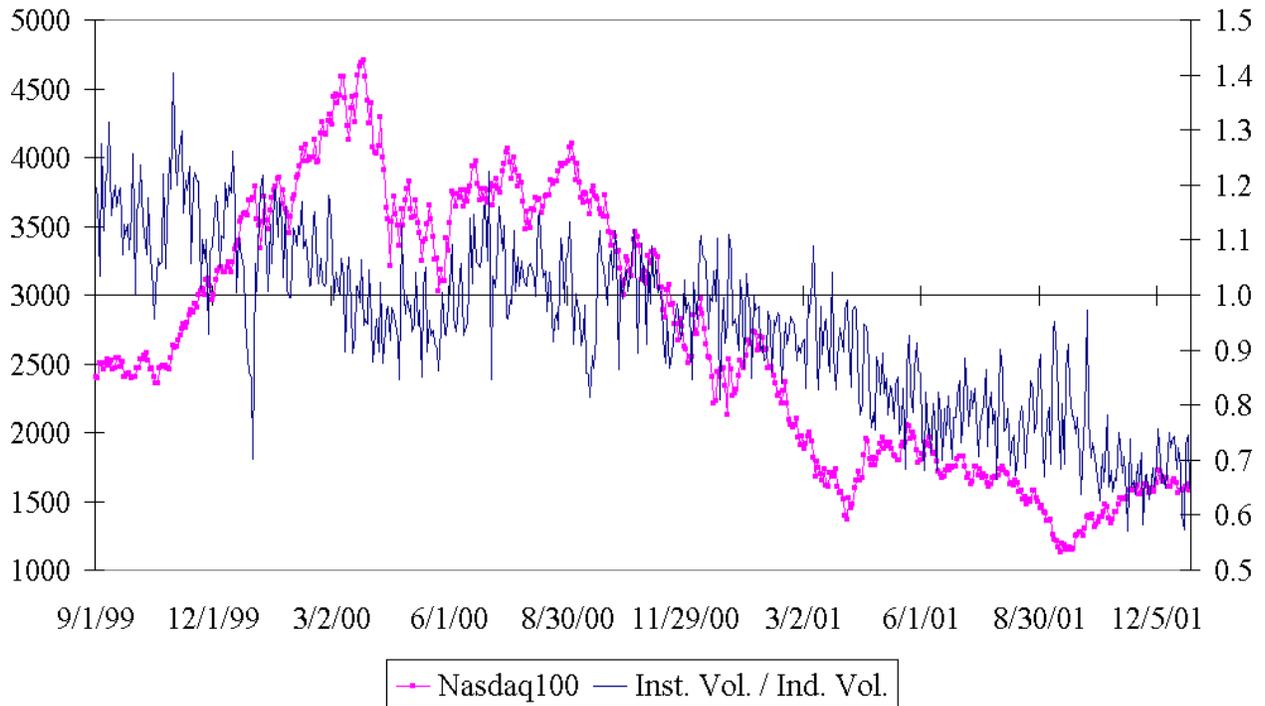


Figure 5 Impulse Response Graphs

This figure plots the accumulated impulse response functions describing the response of institutional imbalances, mutual fund flows and returns to shocks in each variable. Results are based on the daily vector autoregression (VAR) with five lags. The variables are the daily value-weighted average institutional buy-sell imbalance for the stocks comprising the Nasdaq 100 index, the mutual fund flows scaled by the aggregate S&P market capitalization and the daily value-weighted Nasdaq 100 return. For each stock, 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. All variables are standardized prior to estimation of the VAR. For each impulse response function we also report the two-standard-deviation confidence intervals. The time scale on the horizontal axis is expressed in days.

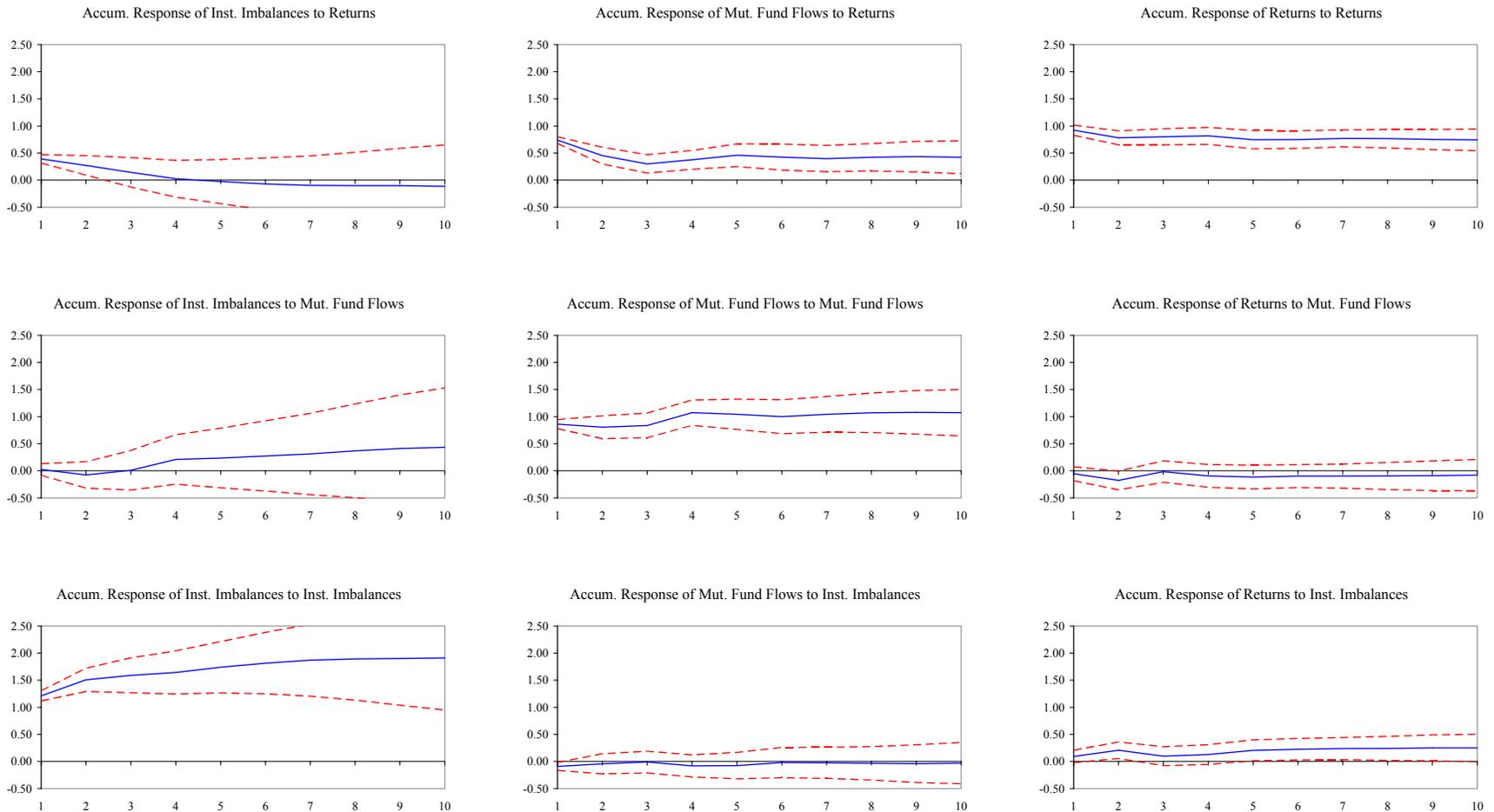


Table A1**Distribution of Trades According to the Investor Type**

Panel A reports the number of trades (in 1,000s), the average trade size, the percent of trades and the percent of volume that can be explained by each trade assignment for the Nasdaq 100 stocks over the September 1, 1999 to December 31, 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 non-classified 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.	Non- Classified	Total
Panel A								
	<i>All</i>							
<i>No. of trades</i>	72,805	265,457	144,444	33,432	76,436	2,742	51,781	647,095
<i>Avg. trade size</i>	793	483	336	541	1,972	1,156	818	694
<i>% of trades</i>	11.25	41.02	22.32	5.17	11.81	0.42	8.00	100.00
<i>% of volume</i>	12.86	28.57	10.82	4.03	33.58	0.71	9.43	100.00
Panel B								
	<i>Small</i>							
<i>No. of trades</i>	38,629	187,961	110,826	20,646	40,725	1,175	28,129	428,091
<i>Avg. trade size</i>	167	171	183	190	186	197	202	178
<i>% of trades</i>	5.97	29.05	17.13	3.19	6.29	0.18	4.35	66.16
<i>% of volume</i>	1.43	7.17	4.52	0.87	1.69	0.05	1.26	17.01
	<i>Medium</i>							
<i>No. of trades</i>	33,720	76,687	33,596	12,738	31,989	1,536	23,340	213,606
<i>Avg. trade size</i>	1,309	1,011	831	1,052	1,560	1,536	1,251	1,144
<i>% of trades</i>	5.21	11.85	5.19	1.97	4.94	0.24	3.61	33.01
<i>% of volume</i>	9.83	17.27	6.22	2.99	11.12	0.53	6.50	54.44
	<i>Large</i>							
<i>No. of trades</i>	455	809	22	48	3,722	31	311	5,398
<i>Avg. trade size</i>	15,816	22,901	16,004	16,051	25,061	18,396	24,067	23,745
<i>% of trades</i>	0.07	0.13	0.00	0.01	0.58	0.01	0.05	0.83
<i>% of volume</i>	1.60	4.13	0.08	0.17	20.77	0.13	1.67	28.55