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Qiang CHENG
Singapore Management University, qcheng@smu.edu.sg

Xia CHEN
Singapore Management University, xchen@smu.edu.sg

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Xia Chen
xia.chen@sauder.ubc.ca
604-822-8528

Qiang Cheng
qiang.cheng@sauder.ubc.ca
604-827-5156

Sauder School of Business
University of British Columbia
2053 Main Mall, Vancouver, BC
Canada, V6T 1Z2

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Institutional Holdings and Analysts' Stock Recommendations

Abstract

Prior studies document that institutional investors outperform the market. We investigate whether this superior performance is partly derived from institutional investors' use of sell-side analysts' stock recommendations. First, we find that the quarterly change in institutional ownership is positively correlated with consensus recommendations. After controlling for other determinants of institutional holdings, the quarterly change in institutional ownership is on average 0.90% higher for firms with favorable recommendations than for those with unfavorable recommendations. Second, using large trades to proxy for institutional trading, we find that there are more buyer-initiated than seller-initiated large trades around favorable recommendations and vice versa for unfavorable recommendations. Lastly, we find that the change in institutional ownership that is explained by stock recommendations is associated with positive abnormal returns in the future, about 4.2% per year. Overall, these results indicate that institutional investors trade upon stock recommendations and such trading contributes to their superior performance.

Key Words: Financial analysts, institutional trading, stock recommendations.

JEL Classification: G11, G14, G2, M4.

1. Introduction

Institutional investors are regarded as sophisticated investors in the capital markets. Prior research has studied the trading behavior of institutional investors and documented their superior performance relative to benchmarks. However, there is no evidence on whether or not this performance is partly derived from sell-side analysts' stock recommendations. In this paper, we fill the gap by investigating whether institutional investors trade upon analysts' stock recommendations, and if so, whether such trading contributes to their superior performance.

Whether institutional investors have the ability to identify mispriced stocks and outperform the market has been widely studied in the literature. Prior studies have documented a positive association between changes in institutional ownership and contemporaneous stock returns (Lakonishock et al. [1992]; Wermers [1999]; Nofsinger and Sias [1999]). This association is consistent with the superior performance of institutional investors and/or momentum trading by institutional investors. Recent studies (e.g., Gompers and Metrick [2001]; Sias et al. [2001]) find that institutional trading leads *subsequent* stock price changes, that is, stocks purchased (sold) by institutional investors outperform (underperform) benchmarks.

While prior studies examine various sources of this superior performance, an omission is sell-side financial analysts' stock recommendations.[1] Prior research (e.g., Womack [1996]; Barber et al. [2001]) finds that favorable (unfavorable) recommendations are associated with positive (negative) abnormal returns. Institutional investors have timely access to stock recommendations through soft-dollar arrangements – arrangements under which institutional investors exchange additional commissions for research, either directly from brokerage houses or indirectly from research intermediaries such as First Call. Given the investment value of recommendations and institutional investors' timely access to them, we expect institutional investors to trade upon stock recommendations: to increase holdings of firms with favorable

[1] For example, Wermers (1999) studies whether institutional investors' herding contributes to their superior performance, and Chen et al. (2000) examine whether momentum trading explains institutional investors' superior performance.

recommendations and to decrease holdings of firms with unfavorable recommendations.

We test this prediction using two complementary sets of analyses: quarterly and intraday. In the quarterly analysis, we examine the quarterly change in institutional ownership for firms with different types of consensus recommendations. In the intraday analysis, we examine the abnormal order imbalance (i.e., buyer-initiated minus seller-initiated) of large trades (proxy for institutional trading) around the release of recommendations. The two analyses complement each other in the sense that the quarterly analysis yields estimates of the quantitative impact of recommendations, while the intraday analysis provides cleaner tests by focusing on short trading intervals surrounding recommendations without confounding events. Consistent results from the two analyses can strengthen our inferences.

The empirical evidence is consistent with our prediction. In the quarterly analysis, we find that, relative to firms without recommendations, the quarterly change in institutional ownership is on average 0.51% for firms with favorable recommendations and -0.39% for firms with unfavorable recommendations, after controlling for other determinants of institutional holdings.[2] Both are significantly different from the change in institutional ownership for firms with neutral recommendations, which is insignificantly different from zero.

The impact of recommendations on institutional trading is economically significant as well. Along with stock returns, stock recommendations are among the most important determinants of institutional trading. The 0.90% difference in institutional trading between firms with favorable versus unfavorable recommendations is about one-fourth of the inter-quartile range of the quarterly change in institutional ownership. In terms of dollar value, institutional investors increase their holdings of firms with favorable recommendations by approximately $12 billion in a quarter relative to firms with unfavorable recommendations, based on our sample distribution of market value and stock recommendations.

[2] As discussed later, the comparisons are between firms *within* a quarter and thus are not affected by the increasing trend of institutional ownership over time.

An alternative explanation for our findings is that analysts issue favorable (unfavorable) recommendations for a firm after observing that institutional investors buy (sell) shares of the firm. To investigate the validity of this argument, we examine the association between stock recommendations and future institutional trading. If stock recommendations induce institutional investors to trade, institutional investors might reverse their investments after stock prices have fully reflected information in these recommendations. This is indeed the case: stock recommendations are *negatively* correlated with changes in institutional holdings in the future. In contrast, we do not expect this negative association under the alternative explanation. Therefore, our evidence is unlikely to be driven by analysts learning from institutional trading.

In the intraday analysis, we find that there are more buyer-initiated than seller-initiated large trades around "Strong Buy" and more seller-initiated than buyer-initiated large trades around "Hold," "Sell," or "Strong Sell." The abnormal order imbalance is also significantly different between "Strong Buy" ("Hold/Sell/Strong Sell") and "Buy" in the predicted directions in the trading day around recommendations. The results are robust to controlling for other determinants of institutional trading and are similar if we focus on medium trades, which some researchers argue is a better proxy for institutional trading (Barclay et al. [1993]; Chakravarty [2001]).

Lastly, we directly investigate whether institutional trading in response to stock recommendations partly explains institutional investors' superior performance. We find that institutional trading that is explained by stock recommendations is positively correlated with future stock returns, after controlling for other determinants of institutional trading and risk factors. Forming portfolios based on this measure, we find that firms in the top decile outperform those in the bottom decile by 1.05% in the next quarter, an annualized return of 4.20%. This is consistent with recommendations contributing to institutional investors' superior performance.

This study contributes to the literature in several ways. First, it presents systematic evidence that institutional investors trade in response to stock recommendations and that such

trading contributes to institutional investors outperforming individual investors. We also find that stock recommendations are among the most important factors that explain institutional investors' trading and performance, suggesting that future research on institutional trading should consider the impact of stock recommendations.

Second, this paper contributes to our understanding of the market for analyst research. While prior studies have examined the properties of analyst research, there is little systematic evidence on who uses that research or how analyst research becomes incorporated into market prices. Our results suggest that information in stock recommendations is incorporated into stock prices, at least partially, through institutional trading.

Lastly, our evidence has implications for the effect of Regulation Fair Disclosure (FD). An underlying premise of Regulation FD is that when managers selectively disclose information to financial analysts, some investors can use the information in their trading, while others cannot. Consistent with this premise, we find that institutional investors trade using analyst recommendations and thus are more likely to benefit from the information disclosed by managers than individual investors.[3] Hence, if successfully enforced, Regulation FD could reduce institutional investors' information advantage over individual investors.

The remainder of this paper is organized as follows. Section 2 develops our hypothesis and explains the research design. Section 3 discusses data and control variables for the quarterly analysis. Section 4 presents the quarterly analysis and Section 5 presents the intraday analysis. Section 6 examines the link between stock recommendations and institutional investors' superior performance. Section 7 presents conclusions.

2. Hypothesis Development and Research Design

A robust finding in the institutional trading literature is the positive correlation between

[3] This is consistent with the survey evidence presented in Boni and Womack (2002), who find that what institutional investors value the most is the information financial analysts obtain from firm management.

changes in institutional ownership and stock returns over the same period. Recent studies find that this correlation is partly due to institutional investors' superior performance relative to the market. For example, using a covariance decomposition method, Sias et al. (2001) conclude that the correlation is driven by information revelation of institutional trading. That is, institutional investors are better informed than individual investors and hence institutional trading leads price changes. Their finding is confirmed by the intraday evidence presented in Chan and Lakonishok (1993) and Chakravarty (2001).

Many studies document that institutional trading leads stock returns. For example, Gompers and Metrick (2001) find that the level of institutional ownership in a stock can help to forecast its future return. Nofsinger and Sias (1999) find that firms with the largest increases in institutional ownership outperform firms with the largest decreases in institutional ownership by 5.43% in the following year. Chen et al. (2000) find that the stocks fund managers buy outperform those they sell by 2% per year after controlling for various characteristics. Confirming these results from a different perspective, Odean (1999) finds that stocks purchased by individual investors consistently *underperform* the stocks they sell.

Prior research has examined various sources of institutional investors' superior performance, including herding (Wermers [1999]) and momentum trading strategies (Chen et al. [2000]). However, one factor that has not been studied is sell-side analysts' stock recommendations. Because stock recommendations have investment value and institutional investors have timely access to them, recommendations can be a potential driver of institutional investors' superior performance.

The investment value of stock recommendations has been well documented in the literature. For example, Womack (1996) analyzes 1,573 recommendations in 1989-1991 and finds that the average three-day abnormal returns are 3.0% for upgrades and -4.7% for downgrades. He also documents a post-recommendation drift, 2.4% for upgrades and -9.1% for downgrades. These findings are confirmed by later studies with more recent and larger recommendation

samples, such as Juergens (1999) and Barber et al. (2001). Furthermore, the price movements do not reverse in the future, suggesting that recommendations contain valuable information.

Institutional investors have timely access to sell-side analysts through soft-dollar arrangements, a mechanism through which institutional investors exchange commissions for research from brokerage houses.[4] Soft-dollar arrangements are prevalent and costly to institutional investors. Based on a survey conducted by Greenwich Associates in 1996, the SEC (1998) reports that almost all institutional investors use soft-dollar arrangements to obtain research and that trade commissions involving soft-dollar arrangements comprise 27% of the total trade commissions. Conrad et al. (2001) find that the incremental execution costs under soft-dollar arrangements are substantial: about 0.29% (0.24%) of the transaction value for buy (sell) orders.

Institutional investors are willing to bear this cost only if the benefits of receiving timely research exceed such costs (Grossman and Stiglitz [1980]). Since favorable (unfavorable) recommendations are associated with positive (negative) abnormal returns, we hypothesize as follows:

H_1: Institutional investors increase holdings of firms with favorable recommendations and decrease holdings of firms with unfavorable recommendations.

To test this hypothesis, we conduct two sets of analyses: quarterly and intraday. In the quarterly analysis, we examine whether the quarterly change in institutional ownership is positively associated with consensus stock recommendations. We take special care to address concerns that the association might be driven by (a) other investment signals or (b) analysts learning from institutional trading. To address (a), we control for a comprehensive set of investment signals that might affect institutional holdings, including institutional preferences,

[4] Blume (1993) and SEC (1998) describe the history of soft-dollar arrangements. Soft-dollar arrangements developed in the 1950s, when trade commission rates were fixed above the competitive level and brokers competed for orders by offering additional services, including research. Congress abolished fixed commission rates in 1975, but legitimized soft-dollar arrangements via the "safe harbor" provisions.

momentum trading, herding, and value/glamour trading. To address (b), we investigate the association between stock recommendations and future changes in institutional ownership. In the intraday analysis, we examine abnormal trade imbalances in the three days surrounding stock recommendations. Intraday analysis is conducted on a subset of recommendations without confounding events and examines trades in half-hour intervals around the release of recommendations. We expect to find more buyer-initiated institutional trades around favorable recommendations and more seller-initiated institutional trades around unfavorable recommendations.

We use these two sets of complementary analyses to strengthen our inferences. The quarterly analysis is an indirect test but it can provide quantitative estimates of the impact of recommendations on institutional holdings and help assess the economic significance of this impact. On the other hand, the intraday analysis is less likely to be subject to the two confounding effects mentioned above, and it provides cleaner and more direct tests of our hypothesis. However, the economic significance is more difficult to assess based on the intraday analysis.

If institutional investors trade upon stock recommendations as hypothesized, such trading might help explain their above-average performance. We directly test this by examining the association between institutional trading attributed to recommendations and future abnormal returns. A positive association, after controlling for other drivers of institutional performance, indicates that institutional investors' superior performance is partly derived from their use of recommendations.

3. Data and Control Variables for Quarterly Analysis

This section describes data and variables used in the quarterly analysis. The data used in the intraday analysis will be discussed in Section 5.

3.1 Data

The sample period, limited by the time span of our stock recommendation dataset, is from

the first quarter of 1994 to the second quarter of 1999. We include all firm-quarters with data on changes in institutional holdings. We also require the availability of financial and stock return data from Compustat and CRSP to calculate control variables (to be described later). The final sample includes 67,230 firm-quarters.

3.1.1 Institutional Holdings

Institutional holding data were obtained from CDA/Spectrum. The SEC requires all institutional investors with equity security assets of $100 million or more to use Form 13F to report their holdings quarterly. For each firm-quarter, institutional ownership is calculated as the proportion of the firm's outstanding shares held by all reporting institutional investors as at the end of the quarter.[5, 6] We use quarterly change in institutional ownership to proxy for net institutional trading in the quarter.

Panel A of Table 1 presents descriptive statistics for institutional holdings and trading.[7] The average institutional ownership is 41%. The average quarterly change in institutional ownership is 0.23%, suggesting an upward trend. This overall trend does not affect our empirical analyses since we compare changes in institutional ownership of firms with different recommendations (favorable, neutral, unfavorable, no recommendations) within a quarter.

[Insert Table 1 Here]

3.1.2 Stock Recommendations

Stock recommendations were obtained from First Call. First Call collects stock

[5] About 94% of institutional investors file 13F in a timely fashion and report the quarter-ends as the filing dates. For late-filing institutional investors, CDA/Spectrum adjusts their reported holdings for stock splits/dividends that occur between the quarter-ends and the filing dates. We noticed occasional mismatches between the reported holdings and the shares outstanding at the filing dates for both on-time-filing and late-filing institutional investors, when stock splits/dividends happen after and close to the quarter-ends. These mismatches result in measurement errors in institutional ownership. Our inferences remain unchanged if we exclude firm-quarters with stock splits/dividends over the next year.

[6] We exclude holdings of institutional investors who do not report holdings in any firm in the previous or the following quarter. Infrequent reporting might indicate inconsistent reporting practices, introducing noise to the institutional ownership variable. Less than 1% of the firm-quarters are excluded as a result of this restriction.

[7] To minimize the influence of extreme values, we winsorize institutional holdings and trading at the 1st and 99th percentiles. Our inspection of the data suggests that most of the extreme values result from reporting errors. We also winsorize control variables. The results without winsorizing are qualitatively similar.

recommendations from a majority of U.S. and international brokerage houses and classifies them into five categories: "Strong Buy," "Buy," "Hold," "Sell," and "Strong Sell." In total, there are 151,848 stock recommendations over the sample period for firms in our sample.

We re-examine the effect of recommendations on stock returns because it underlies our hypothesis and our sample is significantly different from the samples in the prior studies.[8] It is necessary that stock recommendations predict stock returns if recommendations are to have any effect on institutional holdings, assuming that institutional investors are profit maximizing. Using a research methodology similar to that in prior research, Appendix A reports the mean abnormal returns in the three-day window around stock recommendations ([-1,+1]) and in the six months afterwards for our sample of recommendations.

Two main points emerge from Appendix A. First, in the three-day window, "Strong Buy" is associated with significantly positive abnormal returns (1.18%) and "Hold," "Sell," and "Strong Sell" are associated with significantly negative abnormal returns (-1.54%, -1.07%, and -1.46%, respectively). While "Buy" is associated with significantly positive abnormal returns, the magnitude, 0.12%, is small, suggesting that "Buy" is perceived as close to neutral recommendations. In the six months afterwards, stock recommendations are generally associated with abnormal returns of the same signs as in the three-day window. These returns become insignificant starting the second month, except for "Sell" and "Strong Sell" whose abnormal returns display a longer drift.[9] Second, "Sell" and "Strong Sell" comprise only 3.8% of the

[8] The sample in Womack (1996), 1,573 recommendations in the period 1989-1991 from First Call, is much smaller than ours; Barber et al. (2001) obtain recommendations from Zacks, which has less accurate recommendation dates than First Call and omits recommendations from some large brokerage houses, such as Merrill Lynch and Goldman Sachs.

[9] The abnormal returns after the first six months (not reported) are insignificant, suggesting that stock recommendations are not associated with future return reversals and are thus not self-fulfilling prophecies.

recommendations and have similar returns as "Hold." Therefore, in the subsequent analyses, we combine "Hold," "Sell," and "Strong Sell" together as unfavorable recommendations.[10]

To measure the consensus recommendation for a firm-quarter, we first denote "Strong Buy," "Buy," "Hold/Sell/Strong Sell" as 5, 4, and 3 and then take the average of recommendations issued in the firm-quarter.[11] As reported in Panel B of Table 1, consensus recommendations (*REC*) are available for 44,675 firm-quarters, roughly two-thirds of the sample. The mean of consensus recommendations is close to 4 (equivalent to "Buy").[12] For the quarterly analysis, we construct three indicator variables, *D_SBuy, D_Buy,* and *D_Sell,* to represent favorable, neutral, and unfavorable recommendations, respectively. *D_SBuy* is 1 if *REC* falls into the top 33% in the current quarter; *D_Buy* is 1 if *REC* falls into the middle 33%; and *D_Sell* is 1 if *REC* falls into the bottom 34%.

3.2 Control Variables

One concern with analyzing the contemporaneous relation between institutional trading and recommendations is that other investment signals might affect both measures. To address this concern, we control for a comprehensive set of factors that might affect institutional holdings and stock recommendations. Relying on prior research, we identify 12 factors and organize them into four groups:

Institutional preferences (5 factors). Bennett et al. (2003) summarize four stock characteristics that affect institutional preferences as measured by nine proxies: risk (beta, return volatility, and firm-specific risk), investment constraints (firm size, firm age, and dividend yield),

[10] This characterization is also consistent with practitioners' perception: "the 'Hold' category – that's Wall Street code for 'Sell' (Benson and Bryan-Low [2002])," in particular with institutional investors' perception (Boni and Womack [2002]).

[11] Unlike the consensus recommendation measure provided by First Call, our consensus recommendation does not include stale recommendations. When calculating consensus recommendations, First Call uses the outstanding recommendations of all the analysts; some of the recommendations may have been issued a long time ago and are no longer relevant to institutional investors' trading decisions. In contrast, we only include the recommendations issued in the current quarter.

[12] Having a "Buy" recommendation on average is consistent with prior evidence that analysts' stock recommendations are upward biased. Appendix A indicates that "Buy" is interpreted as a neutral recommendation by the capital market: it is not associated with economically significant positive abnormal returns.

liquidity (share price and share turnover), and return momentum (past stock returns). We include changes in five of the nine variables (beta, return volatility, firm-specific risk, dividend yield, and share turnover) as control variables. We do not include change in firm age because it is constant. Changes in firm size (proxied by market value of equity) and share price are essentially stock returns, which are separately discussed below, along with past returns, as momentum factors.

Momentum trading (3 factors). Recent empirical work finds that both institutional investors and financial analysts prefer stocks with positive momentum (Grinblatt et al. [1995]; Jegadeesh et al. [2004]). We include contemporaneous and lagged quarterly stock returns to control for return momentum (i.e., returns in quarter t and quarter t-1) and contemporaneous earnings forecast revisions to control for earnings momentum.

Herding (1 factor). Herding refers to institutional investors following past trading patterns. Sias (2004) finds evidence consistent with such herding. Since institutional trading is informative of future stock returns (Chen et al. [2002]), analysts can extract information from institutional trading. We include the change in institutional ownership in the previous quarter to control for herding and analysts learning from institutional trades.

Value/Glamour trading (3 factors). Prior research suggests that institutional investors prefer firms with certain value/glamour characteristics and analysts are more likely to issue favorable recommendations for glamour stocks than for value stocks (Jegadeesh et al. [2004]). Accordingly, we control for current earnings-to-price ratio (EP), book-to-price ratio (BP), and sales growth. (Firm-quarters with negative EP or BP are excluded from the analyses.)

The measurement of control variables follows that of prior research and is summarized in Panel C of Table 1. Panel C also reports descriptive statistics for these variables. On average, changes in beta, return volatility, firm-specific risk, dividend yield, and share turnover are close to zero. The mean quarterly market-adjusted return is 0.17%. The average earnings forecast revision (deflated by stock price) is -0.01, although both the 1st and 3rd quartiles are 0.00. EP averages 0.02, BP averages 0.59, and sales on average grow 20% annually.

Panel D of Table 1 presents the Pearson correlations between changes in institutional ownership, consensus recommendations, and control variables. The correlation between changes in institutional ownership and consensus recommendations is 0.13 and significantly positive, consistent with institutional ownership increasing with stock recommendations. Both changes in institutional ownership and consensus recommendations are generally correlated with control variables in the same directions, confirming the importance of controlling for these factors. It appears that institutional investors increase holdings of, and analysts issue more favorable recommendations for, firms with low risk, high liquidity, return momentum, earnings momentum, glamour characteristics, or strong institutional demand in the past. Also note that some correlations between control variables are quite high, such as that between change in return volatility and change in firm-specific risk (0.89). This may result in multicollinearity and is addressed in the next section.

4. Quarterly Analysis

In this section, we first report the main analysis of the association between the change in institutional ownership and the consensus recommendation. We then report the analysis that addresses the potential endogeneity of analysts learning from institutional trading. Lastly, we examine the robustness of the results by conducting various sensitivity tests and additional analyses (by institution type, firm size, and institution's trading decision). For each test, we estimate quarterly regressions and report the average coefficients across quarters and the accompanying p-values based on time-series standard errors (Fama and MacBeth [1973]). This approach controls for potential cross-sectional correlations in error terms. To facilitate comparisons across explanatory variables, we standardize the control variables – subtracting the sample mean and dividing by the sample standard deviation within the quarter. Therefore, the coefficient on a control variable captures the change in institutional trading associated with one standard deviation's change in the control variable.

4.1 Main Analysis

To test our hypothesis, we regress the change in institutional ownership on the three recommendation indicators and the control variables:

$$\begin{aligned}\Delta Inst = {} & \beta_0 + \beta_{1,a} D\_SBuy + \beta_{1,b} D\_Buy + \beta_{1,c} D\_Sell \\ & + \beta_2 \Delta Beta + \beta_3 \Delta Stdev + \beta_4 \Delta Risk + \beta_5 \Delta Dividend\_yield + \beta_6 \Delta Liquidity \\ & + \beta_7 Ret + \beta_8 Lag(Ret) + \beta_9 Forecast\_revision + \beta_{10} Lag(\Delta Inst) \\ & + \beta_{11} EP + \beta_{12} BP + \beta_{13} Sales\_growth + \varepsilon\end{aligned} \quad (1)$$

Firm subscript *i* and quarter subscript *t* are omitted for simplicity. $\beta_{1,a}$ ($\beta_{1,b}$, $\beta_{1,c}$) captures the impact of a favorable (neutral, unfavorable) recommendation on the change in a firm's institutional ownership in a quarter. Our hypothesis predicts $\beta_{1,a}$ to be positive and $\beta_{1,c}$ to be negative. We do not have a prediction for the sign of $\beta_{1,b}$ as it is unclear how institutional investors should react to "Buy" recommendations, which are arguably neutral signals and associated with only small positive abnormal returns. However, we expect $\beta_{1,a} > \beta_{1,b} > \beta_{1,c}$.

The regression results are presented in Table 2. Panel A, Column (1) reports the regression results when control variables are not included. Consistent with our hypothesis, the coefficient on *D_SBuy* is significantly positive (0.0100, p=0.001) and that on *D_Sell* is significantly negative (-0.0063, p=0.001). (Throughout the paper, p-values are one-sided for coefficients with directional predictions and two-sided otherwise.) These coefficients correspond to an incremental quarterly change in institutional ownership of 1.00% and -0.63%, compared with firms without recommendations. The coefficient on *D_Buy* is also significantly positive (0.0018, p=0.068), but its magnitude is only one-fifth of that on *D_SBuy*. The formal tests reported in Panel B indicate that the differences in coefficients between *D_SBuy* and *D_Buy*, between *D_Sell* and *D_Buy*, and between *D_SBuy* and *D_Sell* are significant in the predicted directions at the 0.001 level. That is, relative to firms with neutral recommendations, firms with favorable (unfavorable) recommendations are associated with increased (decreased) institutional ownership.

[Insert Table 2 Here]

Columns (2), (3), and (4) report the regression results after including control variables. Because change in return volatility and change in firm-specific risk are highly correlated (the Pearson correlation coefficient is 0.89, as reported in Panel D of Table 1), we include them separately in Columns (2) and (3). To ensure that the change in risk is fully controlled, we include both of them in Column (4). Because the results are similar across the three specifications, we focus our discussions on the full model (Column (4)) here and only report the full model results for subsequent tests.[13] The coefficients on favorable and unfavorable recommendation indicators, although smaller in magnitude than those in Column (1), are highly significant in predicted directions: 0.0051 for *D_SBuy* and -0.0039 for *D_Sell*. [14] The coefficient on *D_Buy* is no longer significantly different from zero. Panel B shows that as expected, *D_SBuy* - *D_Buy*, *D_Sell* - *D_Buy*, and *D_SBuy* - *D_Sell* are significantly positive, negative, and positive, respectively.[15]

The impact of stock recommendations is economically significant as well. Relative to a firm with unfavorable recommendations, a firm with favorable recommendations attracts an additional 0.90% of institutional ownership (0.0051-[-0.0039]) in a quarter. Given the total market value of around $4 trillion for firms with stock recommendations (quarterly average in our sample) and the proportion of firms with favorable and unfavorable recommendations (one third each in our sample), our finding implies an additional increase in institutional investment of about $12 billion (4,000×0.90%×1/3) in a quarter for firms with favorable recommendations relative to those with unfavorable recommendations.

The results for control variables are consistent with prior studies. Institutional investors increase holdings of firms with lower return volatility, higher dividend yield, higher return, more earnings momentum, stronger prior institutional demand, lower EP, lower BP, or higher growth.

[13] The condition index is lower than 10 for all regressions. Thus, multicollinearity is not a concern (Belsley et al. [1980]).
[14] The results are consistent over time: *D_SBuy* is positive and *D_Sell* is negative for all of the 22 quarters in our sample.
[15] To simplify the discussion here and later, we use *D_SBuy* - *D_Buy*, *D_Sell* - *D_Buy*, and *D_SBuy* - *D_Sell* to indicate the difference in coefficients between *D_SBuy* and *D_Buy*, between *D_Sell* and *D_Buy*, and between *D_SBuy* and *D_Sell*, respectively.

Comparing the coefficients on these control variables with those on the recommendation variables indicates that the impact of stock recommendations is comparable to that of the most important determinants of institutional trading; a one-standard-deviation increase in contemporaneous stock returns, lagged stock returns, change in return volatility is associated with quarterly changes in institutional ownership of 1.07%, 0.52%, -0.33%, respectively.

4.2 Are the Results Driven by Analysts Learning from Institutional Trading?

The positive contemporaneous association between institutional trading and recommendations is also consistent with analysts issuing recommendations in response to institutional trading. That is, analysts issue favorable (unfavorable) recommendations for a firm after they observe institutional investors purchasing (selling) shares of the firm. To differentiate our hypothesis from this alternative explanation, we investigate the relation between recommendations and future institutional trading. If institutional investors adjust their holdings in response to stock recommendations and such adjustments make institutional investors' holdings deviate from the optimal position (e.g., from the perspective of risk diversification), institutional investors may reverse their investments after stock prices have fully reflected information in recommendations. Since stock recommendations are not associated with abnormal stock returns after about six months, as shown in Womack (1996) and Appendix A of this paper, institutional investors who trade on the basis of recommendations are expected to unwind the position to revert to their prior portfolio allocations. That is, our hypothesis implies a *negative* association between current recommendations and future institutional trading. In contrast, we do not expect this negative association under the alternative explanation.

To examine the association between recommendations and future institutional trading, we add consensus recommendations in the past eight quarters to the right-hand side of regression (1). To simplify result presentations, we use one consensus recommendation variable rather than three recommendation indicators (the inferences are the same if we use indicators). The regression is as follows:

$$\begin{aligned}\Delta Inst = {} & \beta_0 + \beta_{1,0} REC_{i,t} + \beta_{1,1} REC_{i,t-1} + \beta_{1,2} REC_{i,t-2} + \beta_{1,3} REC_{i,t-3} + \beta_{1,4} REC_{i,t-4} \\ & + \beta_{1,5} REC_{i,t-5} + \beta_{1,6} REC_{i,t-6} + \beta_{1,7} REC_{i,t-7} + \beta_{1,8} REC_{i,t-8} \\ & + \beta_2 \Delta Beta + \beta_3 \Delta Stdev + \beta_4 \Delta Risk + \beta_5 \Delta Dividend\_yield + \beta_6 \Delta Liquidity \\ & + \beta_7 Ret + \beta_8 Lag(Ret) + \beta_9 Forecast\_revision + \beta_{10} Lag(\Delta Inst) \\ & + \beta_{11} EP + \beta_{12} BP + \beta_{13} Sales\_growth + \varepsilon\end{aligned} \tag{2}$$

Firm subscript *i* and quarter subscript *t* are omitted from all the variables (except recommendation variables) for simplicity. Because it is unclear when institutional investors reverse their trading, we include lagged recommendations up to eight quarters to capture any potential reversal. Although we do not have directional predictions for the sign of each particular lagged recommendation, we expect the sum of their coefficients to be negative.

Table 3 reports the regression results. Due to the requirements of additional recommendations, the sample is reduced to 11,371 firm-quarters covering the period from the first quarter of 1996 to the second quarter of 1999. The coefficient on current recommendation (0.0056) is significantly positive, as before. The recommendation coefficients are insignificant for lags one and two, significantly negative for lags three to six (-0.0014, -0.0020, -0.0012, and -0.0010, respectively), and insignificant again for lags seven and eight. The sum of the coefficients on all the lagged recommendations is significantly negative (p=0.001), as expected, and the sum of the coefficients on current and lagged recommendations is insignificantly different from zero. These results suggest that institutional investors completely unwind their positions within one and a half years after recommendations. Such evidence is inconsistent with the alternative explanation.[16]

[Insert Table 3 Here]

4.3 Sensitivity Tests

To investigate whether our finding is robust, we conduct a series of sensitivity tests, namely adding additional control variables, adopting an alternative research design, and using alternative

[16] We also use an instrumental variables approach to explicitly control for the endogeneity of issuing stock recommendations. We use the lagged recommendation as the instrumental variable and obtain similar results as in Section 4.1.

measures. We also report results that condition on institution type, firm size, and institution's trading decision. Because institutional investors' responses to investment signals may vary across settings, consistent results for stock recommendations in different settings will suggest that the results for recommendations are not driven by other investment signals.

Additional controls. (1) Because changes in stock characteristics might measure unexpected changes with noise, we add contemporaneous levels of beta, return volatility, firm-specific risk, dividend yield, and share turnover to regressions. (2) Institutional investors could respond to investment signals in the previous quarter if they do not learn about these signals in a timely fashion. Accordingly, we control for the lags of all the control variables. (3) We add market value, firm age, and stock price at the end of the current quarter to control for potential changes in institutional investors' preferences over time. (4) We add earnings surprises (announced in the current quarter) to proxy for earnings momentum, analysts' forecasts of long-term growth rate (announced in the current quarter) to proxy for growth, and accruals and capital expenditures (summed over the previous four quarters, deflated by total assets) to proxy for accounting fundamentals. (5) Lastly, we add squares of all the control variables to control for potential nonlinearity of the association between institutional trading and control variables. In all these tests, the results for stock recommendations (not tabulated) remain similar to the main analysis: the difference in coefficients between *D_SBuy* (*D_Sell*) and *D_Buy* is significant at the 0.001 level and ranges between 0.0044 and 0.0051 (between -0.0045 and -0.0038).

Alternative research design – the matched-pairs approach. Within each quarter, we match a *D_SBuy* firm with a *D_Sell* firm that has similar values for the control variables. We then compare the average change in institutional ownership of the *D_SBuy* group with that of the matched *D_Sell* group: the difference is 0.0069 and significant at the 0.001 level. Since there are twelve dimensions to match on, this approach reduces the sample size by more than 90%. Accordingly, we do not use this approach in our main analysis.

Alternative measures. We use an alternative measure of institutional trading – changes in

the number of institutional investors investing in the firm (Chen et al. [2002]) – and find similar results. We also use recommendation changes (i.e., upgrades, reiterations, and downgrades) instead of recommendation levels. The results are similar: institutions increase holdings of firms with upgrades and decrease holdings of firms with downgrades.

Analysis by institution type

CDA/Spectrum classifies institutional investors into five types: banks, insurance companies, investment companies (e.g., mutual funds), investment advisors (including most large brokerage houses), and other institutional investors (e.g., pension funds, university endowments). If all the types have timely access to stock recommendations, their trading should all vary with recommendations.

Panel A of Table 4 reports the regression results from equation (1) for each institution type. For simplicity, we only report the differences across recommendations (i.e., *D_SBuy* - *D_Buy*, *D_Sell* - *D_Buy*, *D_SBuy* - *D_Sell*). The results indicate that *D_SBuy* - *D_Buy* is significantly positive, *D_Sell* - *D_Buy* is significantly negative, and *D_SBuy* - *D_Sell* is significantly positive for each type of institutional investor, consistent with all types of institutional investors trading upon stock recommendations.

[Insert Table 4 Here]

Analysis by firm size

We split the sample into five groups based on the market value quintiles of all CRSP firms at the end of each quarter. Because institutional investors tend to invest more in large firms, there are fewer observations in the three groups of smaller firms. To increase the power of tests, we combine these three groups into one small-firm group of 24,688 firm-quarters. The medium- and large-firm groups have 17,272 and 25,270 firm-quarters, respectively.

Panel B of Table 4 presents the differences in coefficients across recommendations. The differences are significant in the predicted directions for all the three groups, suggesting that the results hold for firms of different sizes.

Analysis by institution's trading decision

Changes in institutional ownership arise from three trading decisions: (1) entry of new institutional investors, (2) exit of old institutional investors, and (3) adjustment of existing holdings. Prior research finds that the effect of information differs across these decisions. In particular, Chan and Lakonishok (1993) find that institutional investors' exit decisions are more likely to be driven by liquidity considerations than by information. To examine whether recommendations affect these decisions similarly, we decompose the change in institutional ownership into three components: entry, exit, and adjustment of existing holdings and then analyze them separately. To be consistent, the lagged change in institutional ownership on the right-hand side of regression (1) is decomposed similarly.

The results, as reported in Panel C of Table 4, suggest that consensus recommendations significantly affect entry and adjustment in the predicted directions. The impact of recommendations on exit is less significant: while *D_SBuy - D_Buy* is significantly positive (p=0.057), *D_Sell - D_Buy* is insignificant (p=0.198). This evidence is consistent with Chan and Lakonishok's finding that exit decisions are less likely to be driven by information.

To summarize, these additional analyses suggest that the positive association between quarterly changes in institutional ownership and stock recommendations holds across different settings. Since certain investment signals affect institutional trading differently in different contexts, these consistent results further suggest that the association is not driven by other investment signals.[17]

4.4 Summary of the Quarterly Analysis

The quarterly analysis indicates that institutional investors increase their holdings of a firm upon favorable recommendations and decrease their holdings of a firm upon unfavorable

[17] For example, untabulated results suggest that while banks, insurance companies, investment companies, and investment advisors follow a momentum strategy, other institutional investors follow a contrarian strategy; institutional investors follow a momentum strategy when they enter a firm but not when they adjust existing holdings.

recommendations. This inference is robust to other factors affecting institutional holdings and holds across different contexts. Further analyses indicate that institutional investors gradually reverse their trading after stock prices have incorporated information in stock recommendations. This result suggests that our finding is not driven by analysts learning from institutional trading.

5. Intraday Analysis

In the intraday analysis, we use large trades to proxy for institutional trading, as is common in the microstructure literature, and we test whether there are more buyer-initiated than seller-initiated large trades around favorable recommendations and more seller-initiated than buyer-initiated large trades around unfavorable recommendations. We proxy favorable recommendations with "Strong Buy" and unfavorable recommendations with "Hold/Sell/Strong Sell." We do not have predictions for "Buy," which are shown to be close to neutral recommendations.

5.1 Data

To reduce data processing, we focus on stock recommendations issued in 1997 and 1998. We impose various filters to ensure that the time stamps are accurate and there are no confounding events such as dividends or earnings announcements. Appendix B describes the sample selection process in detail. The final sample includes 4,322 recommendations for 1,597 firms.

These recommendations are representative of the full sample analyzed in Section 4 except that "Buy" appears to be more favorable in this intraday sample than in the full sample. As reported in Appendix A, the average three-day abnormal return associated with "Buy" in the full sample is 0.12%, but it is 0.35% in the intraday sample, almost three times as large. The abnormal returns associated with "Strong Buy" or "Hold/Sell/Strong Sell" are similar between the intraday sample and the full sample. The distribution of recommendations across categories in the intraday sample, 36% "Strong Buy," 30% "Buy," 34% "Hold/Sell/Strong Sell," is similar to the full

sample. There is no concentration of recommendations in specific months. Slightly more recommendations are disclosed in the morning than later in the day (about 54% of the recommendations are in the period 9:30 A.M. – 12:00 P.M.)

The classification of large trades is based on a modified trade-value-based classification method, as in Lee (1992).[18] We first obtain the average trading price of a firm during the sample period and then determine the largest number of round lot shares with a trade value (based on the average trading price) less than or equal to $10,000. Trades above this cutoff are classified as large trades. In our sample, 58% of trades are classified as large trades, over 95% of which have trade value greater than $10,000. We choose this threshold based on the 2000 NYSE Shareownership Report and the 1998 Survey of Consumer Finances (the median household stock portfolio size was $28,000 in 1998). Two other thresholds ($20,000 and $30,000) are used in sensitivity tests and yield similar results. We also use a classification method allowing medium trades, which may be a better proxy for informed institutional trading. Barclay et al. (1993) find that medium trades have a disproportionate impact on stock prices, and Chakravarty (2001) finds that medium trades by institutional investors move prices. Thus, we classify trades into small (less than 500 shares), medium (500 to 10,000 shares), and large (more than 10,000 shares). The results for medium trades are similar to those reported below.

We use the Lee and Ready (1991) algorithm to infer trade direction. If the trading price is lower (higher) than the midpoint of the quote, the trade is classified as seller-initiated (buyer-initiated). The current quote is used if it is at least 5 seconds old. If not, the latest quote at least 5 seconds before the trade is used. The median age of quotes used is 24 seconds. The Lee and Ready algorithm uses the tick method to classify trades with a trading price at the midpoint of the quote. However, Odders-White (2000) finds that its accuracy is low and suggests that future research eliminate midpoint trades. We follow her suggestion and do not classify these trades. In

[18] While classifying trades based on the number of shares alone ignores differences in stock prices across firms, classifying trades based on trade value alone is sensitive to small price movements and thus problematic to implement, given the discrete trade size (in round lots of 100 shares).

our sample, 45% of trades are classified as buyer-initiated, 39% are classified as seller-initiated, and 16% are not classified.

The estimation of abnormal order imbalance follows Lee (1992). First, we compute a frequency-based direction measure for each half-hour interval in the three trading days surrounding a recommendation (-13 to +25 half-hour intervals, that is, from one day prior to two days after) by subtracting the number of seller-initiated large trades from the number of buyer-initiated large trades. The difference is then scaled by the total number of large trades for the firm during the sample period to allow for aggregation across firms. That is, the frequency-based direction measure for large trades ($FDir_{it}$) is calculated as:[19]

$$FDir_{it} = \frac{FBuy_{it} - FSell_{it}}{TRD_i} \times 100 ,$$

where $FBuy_{it}$ and $FSell_{it}$ represent the number of buyer-initiated and seller-initiated large trades for firm *i* in the half-hour interval *t*, respectively, and TRD_i represents the total number of large trades for firm *i* during the sample period (i.e., during 1997 and 1998).

Second, to estimate abnormal order imbalance, we compare the direction measure around recommendations with its empirical distribution based on a control sample of non-event periods (excluding [-2, +2] days around any dividend, stock split, earnings announcements, or stock recommendations). The empirical distribution of $FDir_{ik}$, including sample mean ($\overline{FDir_{ik}}$) and median ($MFDir_{ik}$), is estimated separately for each combination of firm *i* and half-hour interval *k* of a trading day (*k*=1, ..., 13). This way, we control for trading pattern differences across firms and across trading time. The abnormal order imbalance (AD) for large trades in each half-hour interval within the event window is then calculated as:

$$AD_{ir} = FDir_{ir} - \overline{FDir_{ik}} ,$$

[19] Replacing the number of trades with the number of shares traded yields a share-based direction measure. Analyses based on the share-based direction measure yield similar results.

where r is the r^{th} half-hour interval relative to the event: -13, ..., +25 and k is the half-hour interval in a trading day (1, ..., 13) that corresponds to the r^{th} half-hour interval.

5.2 Univariate Analysis of Large Trade Behavior around Stock Recommendations

In this section, we report large trade behavior around "Strong Buy," "Buy," and "Hold/Sell/Strong Sell." Specifically, we estimate the mean abnormal order imbalance (MAD) for large trades in each half-hour interval around a particular type of recommendations and test whether it is significantly different from zero. MAD is calculated as:

$$MAD_r = \frac{1}{m_r} \sum_{i=1}^{m_r} (FDir_{ir} - \overline{FDir_{ik}}) ,$$

where m_r is the number of recommendations for which there was at least one large trade in the event period r.

To test whether the mean abnormal order imbalance is significantly different from zero, we adopt a modified version of the Patell and Wolfson (1984) variance test (Normal approximation of a generalized form of the Binomial test). This test compares the actual measure in the event window with the corresponding empirical distribution in non-event periods:

$$YMed_r = \frac{VM_r - 0.5 - \sum_i PM_{ik}}{\sqrt{\sum_i PM_{ik}(1 - PM_{ik})}} ,$$

where:

VM_r = the actual number of observations (in the rth half-hour interval around a recommendation) that exceed the corresponding distribution's median value;
0.5 = a correction for continuity;
PM_{ik} = the probability that a random draw from the distribution exceeds the sample median; because the direction measure is discrete and multiple observations could take the median value, PM_{ik} is not necessarily 0.5 and is estimated from the empirical distribution of $FDir_{ik}$.
i, k, r = as defined above.

This statistic follows the standard normal distribution. Significance tests based on the top quartile instead of the median are similar and are not reported for the sake of brevity.

Figure 1 plots the mean abnormal order imbalance of large trades around "Strong Buy." Almost all the order imbalances are positive – there are more buyer-initiated than seller-initiated large trades. The order imbalance in the half-hour interval when the recommendation is disclosed and those in the thirteen intervals afterwards (except interval eight) are significant at the 0.10 level or better. These results are consistent with institutional investors buying stocks with favorable recommendations. Interestingly, there are more buyer-initiated than seller-initiated large trades even before the recommendation is disclosed, mainly in intervals -10 to -1. Corporate announcements triggering the recommendation are unlikely to drive this result because we only include recommendations without confounding events (such as earnings announcements, dividend/stock split announcements, or other recommendations). Instead, the evidence is consistent with anecdotal evidence that brokers generally disclose recommendations to their own clients earlier than to First Call (Juergens [1999]; Michaely and Womack [2002]).[20]

[Insert Figure 1 Here]

Figure 2 plots the mean abnormal order imbalance of large trades around "Buy." There are more buyer-initiated than seller-initiated large trades in many half-hour intervals, especially in intervals 2 to 12. Compared with Figure 1 ("Strong Buy"), the buying imbalance seems to be less prevalent, especially for intervals immediately around the recommendation. We formally test the difference between "Strong Buy" and "Buy" in the next section.

[Insert Figure 2 Here]

Figure 3 plots the mean abnormal order imbalance of large trades around "Hold/Sell/Strong Sell." In the half-hour interval when the recommendation is disclosed and in the three intervals afterwards, there are more seller-initiated than buyer-initiated large trades, significant at the 0.01 level or better for all but interval one. The selling imbalance lasts until about 25 intervals after the

[20] For example, according to *The Washington Post* (April 2 2000, H1), "Merrill Lynch's Internet analyst, Henry Blodget, spent an afternoon updating major clients before issuing a research report on Amazon." Michaely and Womack (2002) suggest that this is a common practice. Irvine et al. (2004) also find evidence consistent with this practice in the context of recommendation initiations.

recommendation, although there are also three intervals with buying imbalances in that period. These results are consistent with institutional investors selling stocks with unfavorable recommendations. Similar to the large trade behavior around "Strong Buy," the selling imbalance begins as early as 11 intervals before unfavorable recommendations, consistent with brokers disclosing recommendations to their own clients earlier than to First Call.

[Insert Figure 3 Here]

In summary, the abnormal order imbalance for large trades is significantly positive around "Strong Buy" and significantly negative around "Hold/Sell/Strong Sell." These results are consistent with our hypothesis. We also find some evidence of positive abnormal order imbalances around "Buy," consistent with the abnormal return result that "Buy" in the intraday sample is more favorable than in the full sample, as discussed in Section 5.1.

5.3 Regression Results

In this section, we investigate (1) whether our intraday results hold after controlling for other determinants of institutional trading and (2) whether there are significant differences in abnormal order imbalances across recommendations. To this end, we regress the abnormal order imbalance (AD) in the intervals around the recommendation on recommendation indicators and control variables:

$$\begin{aligned} AD = {} & \beta_{1,a} D\_SBuy + \beta_{1,b} D\_Buy + \beta_{1,c} D\_Sell \\ & + \beta_2 \Delta Beta + \beta_3 \Delta Stdev + \beta_4 \Delta Risk + \beta_5 \Delta Dividend\_yield + \beta_6 \Delta Liquidity \\ & + \beta_7 Ret + \beta_8 Lag(Ret) + \beta_9 Forecast\_revision + \beta_{10} Lag(\Delta Inst) \\ & + \beta_{11} EP + \beta_{12} BP + \beta_{13} Sales\_growth + \varepsilon \end{aligned}, \quad (3)$$

where *D_SBuy* (*D_Buy*, *D_Sell*) is 1 if the recommendation is "Strong Buy" ("Buy," "Hold/Sell/Strong Sell") and 0 otherwise. Control variables are the same as those used in the quarterly analysis and are measured in the quarter before the recommendation. As in the quarterly analysis, the control variables are standardized – demeaned and deflated by the sample standard deviation to facilitate result interpretation.

Coefficient $\beta_{1,a}$ ($\beta_{1,b}$, $\beta_{1,c}$) in regression (3) captures the average abnormal order imbalance in a half-hour interval around "Strong Buy" ("Buy," "Hold/Sell/Strong Sell"). Comparing $\beta_{1,a}$ ($\beta_{1,c}$) with $\beta_{1,b}$ indicates whether "Strong Buy" ("Hold/Sell/Strong Sell") is associated with higher (lower) buy order imbalances than "Buy." Because the abnormal trading is concentrated in the two trading days around the recommendation, as shown in the figures, we focus the regression analyses on the trading day before and after the recommendation (half-hour intervals [-13, -1], [0, +12]) and the trading day centered on the recommendation (half-hour intervals [-6, +6]).[21]

Panel A of Table 5 reports the regression results when the control variables are not included. Consistent with our hypothesis, "Strong Buy" is associated with significantly positive abnormal order imbalances in each trading day. "Buy" is also associated with significantly positive abnormal order imbalances. Also consistent with our hypothesis, "Hold/Sell/Strong Sell" is associated with significantly negative abnormal order imbalances.

[Insert Table 5 Here]

The bottom of Panel A reports the differences in order imbalances between recommendations. The abnormal order imbalance associated with "Strong Buy" is generally higher than that associated with "Buy." The difference is significant in the trading day right after the recommendation (p=0.082) and in the trading day centered on the recommendation (p=0.036). The abnormal order imbalance in each of the three trading days around "Hold/Sell/Strong Sell," as predicted, is significantly lower than that around "Buy" or "Strong Buy."

Panel B reports the regression results with controls. The results for recommendation indicators and the comparisons across recommendations are similar to, although slightly weaker than, those reported in Panel A. With respect to control variables, most do not have significant coefficients in the predicted directions.

In summary, the intraday analysis indicates that institutional investors reallocate their assets

[21] To be consistent with Figures 1 to 3, the dependent variable is the abnormal trading imbalance in half-hour intervals. The inferences are similar if we use the cumulated abnormal order imbalance across intervals as the dependent variable.

in response to analysts' stock recommendations. Institutional investors buy stocks of firms with favorable recommendations and sell stocks of firms with unfavorable recommendations. This result holds after controlling for other characteristics that may affect institutional trading.

6. Stock Recommendations and Institutional Investors' Superior Performance

The previous two sections establish that institutional investors trade upon stock recommendations. In this section, we investigate whether such trading helps explain institutional investors' superior performance documented in prior studies. To do this, we first examine the correlation between institutional trading (i.e., the quarterly change in institutional ownership) and future abnormal stock returns as in Gompers and Metrick (2001) and Nofsinger and Sias (1999). A positive correlation is consistent with institutional investors outperforming the market.[22] Specifically, we use the following regression to establish the superior performance of institutional trades:

$$Ret_{i,t+1} = \gamma_0 + \gamma_1 \Delta Inst + \gamma_2 MV + \gamma_3 BP + \xi \qquad (4a)$$

$Ret_{i,t+1}$ is the market-adjusted abnormal returns for firm i in quarter $t+1$ and $\Delta Inst$ is the change in institutional ownership for firm i in quarter t.[23] Market value (MV) and the book-to-price ratio (BP) are included to control for the size and book-to-market effects. Firm subscript i and quarter subscript t are omitted from the independent variables for simplicity.

To investigate whether stock recommendations contribute to institutional investors' superior performance, we decompose the change in institutional ownership ($\Delta Inst$) into four components:

[22] This design likely underestimates the superior performance of institutional investors. If the information (e.g., stock recommendations) upon which institutional investors trade is revealed in the current quarter, institutional investors' superior performance will be partly reflected in the positive correlation between institutional trading and contemporaneous stock returns (Sias et al. [2001]). However, the contemporaneous correlation is confounded by institutional investors' momentum trading.

[23] We choose to examine the abnormal returns in the next quarter because we believe that the results are the strongest in the period right after institutional trading. Results based on a longer horizon, such as six months or one year, are qualitatively similar but weaker.

(i) $\Delta Inst_{REC}$ – recommendation component,
(ii) $\Delta Inst_{Momentum}$ – momentum component,
(iii) $\Delta Inst_{Herding}$ – herding component, and
(iv) $\Delta Inst_{Other}$ – other component.

Each component is the change in institutional ownership that is explained by the corresponding variables in equation (1): (i) stock recommendations, (ii) past and contemporaneous stock returns, (iii) past change in institutional ownership, and (iv) other variables. To avoid using future information in the decomposition, we use a roll-over approach: for quarter *t*, we use all the data up to quarter *t* to estimate equation (1), and use the coefficient estimates and the explanatory variables in quarter *t* to calculate the four components.[24]

We then replace the total change in institutional ownership in equation (4a) with its four components to detect the correlation of each component with future abnormal stock returns:

$$Ret_{i,t+1} = \gamma_0 + \gamma_{1,a}\Delta Inst_{REC} + \gamma_{1,b}\Delta Inst_{Momentum} + \gamma_{1,c}\Delta Inst_{Herding} + \gamma_{1,d}\Delta Inst_{Other} + \gamma_2 MV + \gamma_3 BP + \xi \quad (4b)$$

The coefficient on each component captures the contribution of the corresponding variables to institutional investors' superior performance. Since we predict that recommendations contribute to institutional investors' superior performance, γ_{1a} is predicted to be positive. Prior research has demonstrated that both momentum trading and herding contribute to the ability of institutional investors to beat benchmarks, thus γ_{1b} and γ_{1c} are also expected to be positive. We do not have a directional prediction for the coefficient on $\Delta Inst_{Other}$, since this component reflects institutional trading due to a number of considerations, such as trading for liquidity reasons.[25]

Table 6 reports the results, Column (1) for regression (4a) and Column (1) for (4b). To facilitate comparisons between explanatory variables and to be consistent with prior research, we use the decile rank of each explanatory variable, which is then scaled to lie between zero and one. Thus, the coefficient captures the difference in future stock returns between firms in the top decile

[24] To ensure the accuracy of coefficient estimates, we use at least five quarters' data in estimating equation (1). Accordingly, the sample used for regressions (4a) and (4b) starts from the first quarter of 1995.
[25] Prior research finds that trading motivated by liquidity reasons yields under-performance. For example, Alexander et al. (2004) find that stocks bought (sold) by institutional investors for liquidity reasons under- (over-) perform the market by 1.65% (4.20%) in the following year.

of the corresponding explanatory variable and those in the bottom decile. As reported in Column (1), firms with the largest change in institutional holdings outperform firms with the smallest change in institutional holdings by 0.68% in the next quarter, an annualized return of 2.72%. This result is consistent with prior research (e.g., Nofsinger and Sias [1999]).

Column (2) indicates that, as expected, the change in institutional ownership explained by stock recommendations is positively correlated with future stock returns. Firms with the largest change outperform those with the lowest change by 1.05% in the next quarter, an annualized return of 4.20%. This is consistent with stock recommendations contributing to institutional investors' superior performance. The contribution of recommendations is lower than that of momentum trading (2.49% per quarter) but higher than that of herding (0.45% per quarter). In contrast, the coefficient on the other component is negative, suggesting that other factors, such as liquidity considerations, can lead to institutional investors' under-performance.

Overall, the analyses indicate that the positive correlation between institutional trading and future stock returns partly derives from institutional investors' use of stock recommendations. Like momentum trading and herding, recommendations are an important driver of institutional investors' superior performance.

7. Conclusions

We investigate whether institutional investors trade using analysts' stock recommendations, and if so, whether such trading contributes to their superior performance. Since stock recommendations contain valuable information and institutional investors have timely access to these recommendations under soft-dollar arrangements, we expect institutions to change their holdings to profit from the recommendations. The empirical results are consistent with this prediction. First, using quarterly institutional holding data, we find that institutional investors increase (decrease) holdings of firms with (un)favorable recommendations. After controlling for a comprehensive set of factors that affect institutional holdings, the quarterly change in institutional

ownership is 0.90% higher for firms with favorable versus unfavorable recommendations. This finding is robust to a series of sensitivity tests. Furthermore, we find a negative relation between stock recommendations and future institutional trading, consistent with institutional investors reversing their trading after stock prices have incorporated information in recommendations. This result suggests that our finding is not driven by analysts learning from institutional trading.

Second, using intraday data and large trades to proxy for institutional trading, we find that institutions initiate more buys than sells around favorable recommendations, and more sells than buys around unfavorable recommendations. Lastly, we find a positive correlation between the institutional trading that is explained by stock recommendations and future stock returns, suggesting that stock recommendations contribute to institutional investors' superior performance. The use of stock recommendations contributes an annualized abnormal return of 4.2%.

Overall, we provide evidence consistent with institutional investors profiting from analysts' recommendations, furthering our understanding of how institutional investors outperform individual investors. Our evidence also indicates that sell-side analysts' recommendations are an important factor that explains institutional trading and performance. Lastly, our findings further our understanding of the market for analyst research and the price discovery process around stock recommendations.

APPENDIX A
Abnormal Stock Returns Associated with Stock Recommendations

The sample includes 151,848 stock recommendations issued from the first quarter of 1994 to the second quarter of 1999. For each type of recommendations, we first calculate the average size-adjusted return for each quarter and then report its mean across quarters and the accompanying time-series p-values (based on two-sided tests) in parentheses. The size-adjusted stock return in the three-day window around each recommendation ([-1,+1]) is calculated as:

$$\prod_{d=-1}^{+1}(1+r_d^i)-\prod_{d=-1}^{+1}(1+r_d^{size}),$$

where d is the trading day relative to the recommendation day (for which d=0), r_d^i is the raw return of firm i on day d, and r_d^{size} is the return of the corresponding CRSP size decile on day d. Size-adjusted returns in the months after the three-day window are calculated similarly. Abnormal returns calculated in other ways (market-adjusted, size and book-to-market adjusted, size and industry adjusted) are qualitatively similar.

Stock Recommendations	N	Three-day Event [-1,+1]	1st Month after Event	2nd Month after Event	3rd Month after Event	4th Month after Event	5th Month after Event	6th Month after Event
"Strong Buy"	45,777	1.18%	0.66%	0.11%	0.00%	0.01%	-0.09%	0.00%
		(0.001)	(0.009)	(0.542)	(0.984)	(0.961)	(0.615)	(0.984)
"Buy"	45,871	0.12%	0.15%	-0.02%	0.00%	0.22%	-0.10%	0.00%
		(0.015)	(0.389)	(0.913)	(0.992)	(0.221)	(0.427)	(0.984)
"Hold"	54,493	-1.54%	-0.27%	-0.20%	-0.13%	0.10%	-0.17%	-0.11%
		(0.001)	(0.143)	(0.315)	(0.504)	(0.588)	(0.275)	(0.529)
"Sell"	3,701	-1.07%	-0.76%	-0.25%	-0.34%	0.06%	-0.55%	-0.78%
		(0.001)	(0.031)	(0.643)	(0.275)	(0.890)	(0.081)	(0.035)
"Strong Sell"	2,006	-1.46%	-0.51%	-0.60%	-0.90%	-0.66%	-0.56%	-0.76%
		(0.001)	(0.288)	(0.204)	(0.061)	(0.176)	(0.053)	(0.110)

APPENDIX B
Sample Selection Process for the Intraday Analysis

Restrictions	Number of Recommendations Left
All recommendations in the period 1997 – 1998 [a]	92,118
Recommendations are disclosed during trading hours [b]	50,616
First Call discloses recommendations in the same half-hour interval as they are received from analysts [c]	15,103
No confounding recommendations – if five-day event windows ([-2, +2]) of two recommendations for one firm overlap, both are deleted [d]	12,915
No confounding events – recommendations should be at least 5 days away from any earnings, dividend, or stock split announcements [d]	10,029
Recommendations are for NYSE firms covered by TAQ dataset	4,729
Trade and quote data are available to estimate the direction measures [e]	4,322

[a] To reduce data processing, we focus on recommendations issued in 1997 and 1998.
[b] Only recommendations disclosed during trading hours (9:30 A.M. to 4:00 P.M. of a trading day) are included since the intraday analysis focuses on the intraday information dissemination process.
[c] This restriction seeks to ensure that the recommendation time stamp accurately captures the time when institutional investors learn about the recommendation.
[d] These restrictions are imposed to reduce the influence of confounding recommendations and events.
[e] Trade/quote data satisfying the following criteria are deleted:

- Trades/quotes stamped outside trading hours (9:30 A.M. to 4:00 P.M.);
- Negative trades or quotes (Christie and Schultz [1994]);
- Trades with condition codes other than regular trade and quotes with condition codes other than regular quote;
- The first trade after the opening (with an opening trade condition code or without a preceding BBO eligible quote) – a call market is used for the opening trade;
- Extremely large block trades (more than 3.276 million shares, as defined in Lee [1992]);
- Trades with prices more than $5 away from the midpoint of the best displayed quote – possible data errors or stocks with extremely high prices (Blume and Goldstein [1997]);
- Quotes that are originated in markets other than the exchange where the stock is listed, that is, only NYSE issued BBO-eligible quotes are used in the analysis (Christie and Schultz [1994]);
- All locked or cross-quoted quotes (i.e., bid price ≥ ask price) – they are not sustainable (Christie and Schultz [1994]);
- The quote price differs from the prior quote price by more than 50%, or the spread exceeds 20% of the midpoint of the quote ($2) when the midpoint is equal to or more than (less than) $10 – possible data errors (Blume and Goldstein [1997]);
- Trades/quotes for firms with a sample average trading price outside the range [$1, $500] (Bhattacharya [2001]).

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TABLE 1 Descriptive Statistics and Pearson Correlations

The sample includes 67,230 firm-quarters from the first quarter of 1994 to the second quarter of 1999. All the descriptive statistics are averages across the 22 quarters. Subscript *i* represents firm *i* and subscript *t* represents quarter *t*.

Panel A: Institutional Holdings and Trading

$Inst_{i,t}$ = institutional ownership at the end of quarter *t* for firm *i*.

$\Delta Inst_{i,t}$ = change in institutional ownership from the beginning to the end of quarter *t* for firm *i*.

Variable	Mean	Standard Deviation	1st Quartile	Median	3rd Quartile
$Inst_{i,t}$	41.48%	23.05%	21.90%	40.78%	59.90%
$\Delta Inst_{i,t}$	0.23%	4.28%	-1.24%	0.13%	1.65%

Panel B: Consensus Stock Recommendations

$REC_{i,t}$ = consensus stock recommendations, calculated as the mean of stock recommendations issued in quarter *t* for firm *i*, with 5 standing for "Strong Buy," 4 for "Buy," and 3 for "Hold," "Sell," or "Strong Sell." $REC_{i,t}$ is available for 44,675 firm-quarters.

$D\_SBuy_{i,t}$ = 1 if $REC_{i,t}$ falls into the top 33% in quarter *t* and 0 otherwise.

$D\_Buy_{i,t}$ = 1 if $REC_{i,t}$ falls into the middle 33% in quarter *t* and 0 otherwise.

$D\_Sell_{i,t}$ = 1 if $REC_{i,t}$ falls into the bottom 34% in quarter *t* and 0 otherwise.

Variable	Mean	Standard Deviation	1st Quartile	Median	3rd Quartile
$REC_{i,t}$	3.82	0.69	3	4	4

TABLE 1 (Continued)

Panel C: Control Variables

Institutional preferences

$\Delta Beta_{i,t}$, $\Delta Stdev_{i,t}$, $\Delta Risk_{i,t}$, $\Delta Dividend\_yield_{i,t}$, and $\Delta Liquidity_{i,t}$ are changes in the corresponding variables from quarter *t-1* to quarter *t*.

$Beta_{i,t}$ = the sum of the coefficients in a regression of firm *i*'s monthly return on the contemporaneous and previous month' CRSP value-weighted index over the 60 months prior to the end of quarter *t*.

$Stdev_{i,t}$ = the standard deviation of firm *i*'s daily return in quarter *t*.

$Risk_{i,t}$ = the average monthly estimate of firm-specific risk in quarter *t*, with the monthly estimate generated as the squared difference between daily firm returns and associated daily industry returns summed each month.

$Dividend\_yield_{i,t}$ = the average annual dividend yield over the 12 months prior to the end of quarter *t*.

$Liquidity_{i,t}$ = the average of the ratio of daily trading volume, divided by two if firm *i* is traded on NASDAQ, to number of shares outstanding in quarter *t*.

Momentum trading

$Ret_{i,t}$ = market-adjusted stock return in quarter *t*.

$Lag(Ret)_{i,t}$ = market-adjusted stock return in quarter *t-1*.

$Forecast\_revision_{i,t}$ = the latest consensus EPS forecast in quarter *t* for the next fiscal year, minus the latest consensus EPS forecast prior to quarter *t* for the same fiscal year, then divided by the stock price at the end of quarter *t*.

Herding

$Lag(\Delta Inst)_{i,t}$ = change in institutional ownership from the beginning to the end of quarter *t-1*.

Value/Glamour trading

For $EP_{i,t}$, $BP_{i,t}$, and $Sales\_growth_{i,t}$, the previous fiscal quarter refers to the most recent fiscal quarter whose quarter end falls before the beginning of calendar quarter *t*, such that its financial information is available during calendar quarter *t*.

$EP_{i,t}$ = the sum of income before extraordinary items of the previous four fiscal quarters divided by market value at the end of quarter *t*.

$BP_{i,t}$ = book value of common equity of the previous fiscal quarter divided by market value at the end of quarter *t*.

$Sales\_growth_{i,t}$ = the sum of sales of the previous four fiscal quarters divided by the sum of sales of the previous five to eight fiscal quarters, minus one.

Variable	Mean	Standard Deviation	1st Quartile	Median	3rd Quartile
Institutional preferences					
$\Delta Beta_{i,t}$	-0.02	0.31	-0.17	-0.02	0.13
$\Delta Stdev_{i,t}$	0.05%	1.05%	-0.42%	0.02%	0.47%
$\Delta Risk_{i,t}$	0.00	0.03	0.00	0.00	0.00
$\Delta Dividend\_yield_{i,t}$	0.00%	0.22%	-0.02%	0.00%	0.02%
$\Delta Liquidity_{i,t}$	0.00%	0.21%	-0.06%	0.00%	0.06%
Momentum trading					
$Ret_{i,t}$	0.17%	20.84%	-11.74%	-1.15%	10.18%
$Lag(Ret)_{i,t}$	0.08%	20.32%	-11.60%	-1.11%	10.04%
$Forecast\_revision_{i,t}$	-0.01	0.03	0.00	0.00	0.00
Herding					
$Lag(\Delta Inst)_{i,t}$	0.40%	4.24%	-1.12%	0.19%	1.74%
Value/Glamour trading					
$EP_{i,t}$	0.02	0.17	0.02	0.05	0.07
$BP_{i,t}$	0.59	0.51	0.30	0.49	0.73
$Sales\_growth_{i,t}$	0.20	0.38	0.03	0.12	0.28

TABLE 1 (Continued)

Panel D: Pearson Correlations

All the correlations are based on 67,230 firm-quarters, except those between *REC* and other variables which are based on the 44,675 firm-quarters with recommendation data. We first estimate the correlations for each quarter and then present the time-series averages of the 22 quarterly correlations. The significance level is based on the associated time-series standard deviations (Fama and MacBeth 1973). All correlations are significant at the 0.10 level or better based on two-sided tests, except those with "#". See panels A, B, and C for variable measurement. Firm subscript *i* and quarter subscript *t* are omitted for simplicity.

	ΔInst	*REC*	*ΔBeta*	*ΔStdev*	*ΔRisk*	*ΔDividend_yield*	*ΔLiquidity*	*Ret*	*Lag(Ret)*	*Forecast_revision*	*Lag(ΔInst)*	*EP*	*BP*
REC	0.13												
ΔBeta	0.05	0.02#											
ΔStdev	-0.10	-0.04	0.05										
ΔRisk	-0.09	-0.04	0.04	0.89									
ΔDividend_yield	-0.01	-0.01#	-0.01#	0.01#	0.00#								
ΔLiquidity	0.01#	0.01	0.05	0.39	0.33	0.00#							
Ret	0.27	0.13	0.16#	-0.04	-0.05	-0.05	0.14						
Lag(Ret)	0.17	0.10	0.01#	-0.12	-0.12	-0.07	0.05	0.02#					
Forecast_revision	0.14	0.14	0.03#	-0.10	-0.11	-0.01	0.03	0.23	0.24				
Lag(ΔInst)	0.10	0.11	-0.01#	0.07	0.05	-0.01	0.08	0.00#	0.30	0.11			
EP	0.04	0.05	0.00#	-0.07	-0.10	0.04	0.01#	0.08	0.11	0.27	0.04		
BP	-0.13	-0.16	-0.01#	0.06	0.08	0.03	-0.03	-0.23	-0.20	-0.25	-0.11	-0.17	
Sales_growth	0.04	0.16	-0.02#	0.01#	0.00#	0.01#	-0.01#	-0.01#	0.04	0.05	0.08	0.04	-0.15

TABLE 2 Regressions of Changes in Institutional Ownership on Consensus Stock Recommendations and Control Variables

This table reports results from the following regression:

$$\begin{aligned}\Delta Inst = {} & \beta_0 + \beta_{1,a} D\_SBuy + \beta_{1,b} D\_Buy + \beta_{1,c} D\_Sell \\ & + \beta_2 \Delta Beta + \beta_3 \Delta Stdev + \beta_4 \Delta Risk + \beta_5 \Delta Dividend\_yield + \beta_6 \Delta Liquidity \\ & + \beta_7 Ret + \beta_8 Lag(Ret) + \beta_9 Forecast\_revision + \beta_{10} Lag(\Delta Inst) \\ & + \beta_{11} EP + \beta_{12} BP + \beta_{13} Sales\_growth + \varepsilon\end{aligned} \quad (1)$$

Firm subscript *i* and quarter subscript *t* are omitted for simplicity. The sample includes 67,230 firm-quarters from the first quarter of 1994 to the second quarter of 1999. See Table 1 for variable measurement. To facilitate comparisons, all the control variables are standardized – demeaned and then deflated by the standard deviation within the quarter. Panel A (B) reports the average coefficients (differences in coefficients) from quarterly regressions and the associated time-series p-values in parentheses (Fama and MacBeth 1973). The p-values are based on one-sided tests for variables with directional predictions and on two-sided tests otherwise.

Panel A: Regression Results

	Predicted signs	(1)	(2)	(3)	(4)
Intercept	?	0.0011	0.0019	0.0019	0.0019
		(0.196)	(0.026)	(0.022)	(0.024)
Recommendation indicators					
D_SBuy	+	0.0100	0.0052	0.0051	0.0051
		(0.001)	(0.001)	(0.001)	(0.001)
D_Buy	*	0.0018	0.0004	0.0003	0.0004
		(0.068)	(0.625)	(0.712)	(0.665)
D_Sell	–	-0.0063	-0.0039	-0.0040	-0.0039
		(0.001)	(0.001)	(0.001)	(0.001)
Control variables					
ΔBeta	–		0.0005	0.0004	0.0005
			(0.890)	(0.859)	(0.891)
ΔStdev	–		-0.0029		-0.0033
			(0.001)		(0.001)
ΔRisk	–			-0.0024	0.0004
				(0.001)	(0.720)
ΔDividend_yield	+		0.0006	0.0006	0.0006
			(0.001)	(0.001)	(0.001)
ΔLiquidity	+		-0.0007	-0.0010	-0.0006
			(0.864)	(0.961)	(0.853)
Ret	+		0.0106	0.0107	0.0107
			(0.001)	(0.001)	(0.001)
Lag(Ret)	+		0.0053	0.0054	0.0052
			(0.001)	(0.001)	(0.001)
Forecast_revision	+		0.0013	0.0013	0.0012
			(0.001)	(0.001)	(0.001)
Lag(ΔInst)	+		0.0026	0.0025	0.0026
			(0.001)	(0.001)	(0.001)
EP	–		-0.0008	-0.0009	-0.0009
			(0.002)	(0.002)	(0.002)
BP	–		-0.0010	-0.0009	-0.0009
			(0.010)	(0.014)	(0.012)
Sales_growth	+		0.0010	0.0010	0.0010
			(0.001)	(0.001)	(0.001)
Average Adj. R^2		0.018	0.127	0.127	0.128

TABLE 2 (Continued)

Panel B: Comparisons across Recommendations

	Predicted signs	(1)	(2)	(3)	(4)
D_SBuy −D_Buy	+	0.0081	0.0048	0.0048	0.0047
		(0.001)	(0.001)	(0.001)	(0.001)
D_Sell −D_Buy	–	-0.0082	-0.0043	-0.0043	-0.0043
		(0.001)	(0.001)	(0.001)	(0.001)
D_ SBuy −D_ Sell	+	0.0163	0.0091	0.0091	0.0090
		(0.001)	(0.001)	(0.001)	(0.001)

* The coefficient on *D_Buy* is expected to be less than that on *D_SBuy* and greater than that on *D_Sell*.

TABLE 3 Regressions of Changes in Institutional Ownership on Current and Lagged Consensus Stock Recommendations and Control Variables

This table reports results from the following regression:

$$\begin{aligned}\Delta Inst = {} & \beta_0 + \beta_{1,0} REC_{i,t} + \beta_{1,1} REC_{i,t-1} + \beta_{1,2} REC_{i,t-2} + \beta_{1,3} REC_{i,t-3} + \beta_{1,4} REC_{i,t-4} \\ & + \beta_{1,5} REC_{i,t-5} + \beta_{1,6} REC_{i,t-6} + \beta_{1,7} REC_{i,t-7} + \beta_{1,8} REC_{i,t-8} \\ & + \beta_2 \Delta Beta + \beta_3 \Delta Stdev + \beta_4 \Delta Risk + \beta_5 \Delta Dividend\_yield + \beta_6 \Delta Liquidity \\ & + \beta_7 Ret + \beta_8 Lag(Ret) + \beta_9 Forecast\_revision + \beta_{10} Lag(\Delta Inst) \\ & + \beta_{11} EP + \beta_{12} BP + \beta_{13} Sales\_growth + \varepsilon \end{aligned} \quad (2)$$

Firm subscript *i* and quarter subscript *t* are omitted from all the variables (except recommendation variables) for simplicity. The sample includes 11,371 firm-quarters with required recommendation data from the first quarter of 1996 to the second quarter of 1999. $REC_{i,t-s}$ is the consensus recommendation in quarter *t-s* for firm *i*. See Table 1 for definitions of other variables. To facilitate comparisons, all the control variables are standardized – demeaned and then deflated by the standard deviation within the quarter. The table reports the average coefficients (or sum of coefficients) from quarterly regressions and the associated time-series p-values in parentheses (Fama and MacBeth 1973). The p-values are based on one-sided tests for variables with directional predictions and on two-sided tests otherwise.

	Predicted signs			Predicted signs	
Intercept	?	0.0026	Control variables		
		(0.631)			
			$\Delta Beta$	–	0.0010
Consensus recommendations					(0.824)
$REC_{i,t}$	+	0.0056	$\Delta Stdev$	–	-0.0012
		(0.001)			(0.128)
$REC_{i,t-1}$	*	0.0002	$\Delta Risk$	–	-0.0021
		(0.821)			(0.042)
$REC_{i,t-2}$	*	-0.0002	$\Delta Dividend\_yield$	+	0.0016
		(0.727)			(0.001)
$REC_{i,t-3}$	*	-0.0014	$\Delta Liquidity$	+	-0.0016
		(0.027)			(0.971)
$REC_{i,t-4}$	*	-0.0020	*Ret*	+	0.0145
		(0.026)			(0.001)
$REC_{i,t-5}$	*	-0.0012	*Lag(Ret)*	+	0.0055
		(0.061)			(0.001)
$REC_{i,t-6}$	*	-0.0010	*Forecast_revision*	+	0.0030
		(0.099)			(0.001)
$REC_{i,t-7}$	*	-0.0000	*Lag(ΔInst)*	+	0.0027
		(0.944)			(0.003)
$REC_{i,t-8}$	*	0.0002	*EP*	–	-0.0011
		(0.785)			(0.020)
			BP	–	0.0010
Sum of coefficients on recommendation variables					(0.894)
$REC_{i,t-1} + ... + REC_{i,t-8}$	–	-0.0054	*Sales_growth*	+	0.0007
		(0.001)			(0.128)
$REC_{i,t} + ... + REC_{i,t-8}$	?	0.0002			
		(0.998)	Average Adj. R^2		0.197

* While we do not have directional predictions for individual lagged recommendations, we expect the sum of their coefficients to be negative.

TABLE 4 Additional Analyses by Institution Type, Firm Size, and Institution's Trading Decision

This table reports results from three additional analyses. The full sample includes 67,230 firm-quarters from the first quarter of 1994 to the second quarter of 1999. See Table 1 for variable measurement. To facilitate comparisons, all control variables are standardized – demeaned and then deflated by the standard deviation within the quarter. The regressions are run quarterly. For each analysis, we report the average differences in coefficients across recommendations and the associated time-series p-values in parentheses (Fama and MacBeth 1973). The p-values are based on one-sided tests.

Panel A: Regressions of Changes in Institutional Ownership on Consensus Stock Recommendations and Control Variables by Institution Type

The regression is as follows:

$$\begin{aligned}\Delta Inst_{type=j} = {} & \beta_0 + \beta_{1,a} D\_SBuy + \beta_{1,b} D\_Buy + \beta_{1,c} D\_Sell \\ & + \beta_2 \Delta Beta + \beta_3 \Delta Stdev + \beta_4 \Delta Risk + \beta_5 \Delta Dividend\_yield + \beta_6 \Delta Liquidity \\ & + \beta_7 Ret + \beta_8 Lag(Ret) + \beta_9 Forecast\_revision + \beta_{10} Lag(\Delta Inst) \\ & + \beta_{11} EP + \beta_{12} BP + \beta_{13} Sales\_growth + \varepsilon\end{aligned} \quad (1')$$

where $\Delta Inst_{type=j}$ is the change in the fraction of a firm's shares held by type *j* institutional investors. Firm subscript *i* and quarter subscript *t* are omitted for simplicity.

	Predicted Signs	(1) Bank	(2) Insurance Company	(3) Investment Company	(4) Investment Advisor	(5) Other
N		65,761	59,712	52,884	67,052	56,696
D_SBuy −D_Buy	+	0.0011	0.0006	0.0011	0.0015	0.0004
		(0.001)	(0.001)	(0.010)	(0.002)	(0.026)
D_Sell −D_Buy	–	-0.0010	-0.0005	-0.0010	-0.0011	-0.0005
		(0.001)	(0.002)	(0.011)	(0.001)	(0.021)
D_ SBuy −D_ Sell	+	0.0021	0.0011	0.0021	0.0026	0.0009
		(0.001)	(0.001)	(0.001)	(0.001)	(0.003)

Panel B: Regressions of Changes in Institutional Ownership on Consensus Stock Recommendations and Control Variables by Firm Size

We split the sample into three size-based groups. The regression is as follows:

$$\begin{aligned}\Delta Inst = {} & \beta_0 + \beta_{1,a} D\_SBuy + \beta_{1,b} D\_Buy + \beta_{1,c} D\_Sell \\ & + \beta_2 \Delta Beta + \beta_3 \Delta Stdev + \beta_4 \Delta Risk + \beta_5 \Delta Dividend\_yield + \beta_6 \Delta Liquidity \\ & + \beta_7 Ret + \beta_8 Lag(Ret) + \beta_9 Forecast\_revision + \beta_{10} Lag(\Delta Inst) \\ & + \beta_{11} EP + \beta_{12} BP + \beta_{13} Sales\_growth + \varepsilon\end{aligned} \quad (1)$$

Firm subscript *i* and quarter subscript *t* are omitted for simplicity.

	Predicted signs	(1) Small Firms	(2) Medium Firms	(3) Large Firms
N		24,688	17,272	25,270
D_SBuy −D_Buy	+	0.0064	0.0042	0.0036
		(0.001)	(0.002)	(0.001)
D_Sell−D_Buy	–	-0.0019	-0.0076	-0.0030
		(0.088)	(0.001)	(0.001)
D_ SBuy −D_ Sell	+	0.0083	0.0118	0.0066
		(0.001)	(0.001)	(0.001)

TABLE 4 (Continued)

Panel C: Regressions of Entry, Exit, Adjustment of Holdings on Consensus Stock Recommendations and Control Variables

The regression is as follows:

$$\begin{aligned} Entry, Exit, Adjustment = {} & \beta_0 + \beta_{1,a} D\_SBuy + \beta_{1,b} D\_Buy + \beta_{1,c} D\_Sell \\ & + \beta_2 \Delta Beta + \beta_3 \Delta Stdev + \beta_4 \Delta Risk + \beta_5 \Delta Dividend\_yield + \beta_6 \Delta Liquidity \\ & + \beta_7 Ret + \beta_8 Lag(Ret) + \beta_9 Forecast\_revision + \beta_{10,a} Lag(Entry) + \beta_{10,b} Lag(Exit) \\ & + \beta_{10,c} Lag(Adjustment) + \beta_{11} EP + \beta_{12} BP + \beta_{13} Sales\_growth + \varepsilon \end{aligned} \quad , \qquad (1'')$$

where *Entry* is the fraction of a firm's shares bought in the quarter by institutional investors who enter, i.e., those who do not hold any shares in the firm at the beginning of the quarter; *Exit* is the fraction of a firm's shares sold in the quarter by institutional investors who exit, i.e., those who sell all of their holdings of the firm; *Adjustment* is the change in the fraction of a firm's shares held by institutional investors who hold the firm's shares at both the beginning and the end of the quarter. Firm subscript *i* and quarter subscript *t* are omitted for simplicity.

	Predicted signs	(1) Entry	(2) Exit	(3) Adjustment
N		67,230	67,230	67,230
D_SBuy −D_Buy	+	0.0023	0.0009	0.0012
		(0.001)	(0.057)	(0.004)
D_Sell −D_Buy	–	-0.0023	-0.0004	-0.0016
		(0.001)	(0.198)	(0.001)
D_ SBuy −D_ Sell	+	0.0046	0.0013	0.0028
		(0.001)	(0.005)	(0.001)

TABLE 5 Regressions of Abnormal Order Imbalance on Stock Recommendations and Control Variables

This table reports results from the following regression:

$$\begin{aligned} AD = {} & \beta_{1,a} D\_SBuy + \beta_{1,b} D\_Buy + \beta_{1,c} D\_Sell \\ & + \beta_2 \Delta Beta + \beta_3 \Delta Stdev + \beta_4 \Delta Risk + \beta_5 \Delta Dividend\_yield + \beta_6 \Delta Liquidity \\ & + \beta_7 Ret + \beta_8 Lag(Ret) + \beta_9 Forecast\_revision + \beta_{10} Lag(\Delta Inst) \\ & + \beta_{11} EP + \beta_{12} BP + \beta_{13} Sales\_growth + \varepsilon \end{aligned} \quad (3)$$

The abnormal order imbalance (*AD*) is calculated as the difference between the trading direction measure and its average over the non-event period. The trading direction measure for each half-hour interval is calculated by subtracting the number of seller-initiated large trades from the number of buyer-initiated large trades and then dividing the difference by the total number of large trades for the firm during the sample period. *D_SBuy* (*D_Buy*, *D_Sell*) is 1 if the recommendation is "Strong Buy" ("Buy," "Hold/Sell/Strong Sell") and 0 otherwise. Control variables are defined in Table 1 and are measured in the quarter before the recommendation. To facilitate comparisons, all the control variables are standardized – demeaned and then deflated by the sample standard deviation.

The analyses are based on 1,533 "Strong Buy," 1,306 "Buy," and 1,483 "Hold/Sell/Strong Sell" issued in the period 1997-1998. The table reports the regression results using the following three sets of half-hour intervals around recommendations: [-13,-1], [0,12], and [-6,6]. The p-values are based on one-sided tests for variables with directional predictions and on two-sided tests otherwise.

Panel A: Regression Results without Controls

	Predicted sign	Intervals [-13, -1]	Intervals [0, 12]	Intervals [-6, 6]
D_SBuy	+	0.0011	0.0017	0.0017
		(0.001)	(0.001)	(0.001)
D_Buy	*	0.0007	0.0012	0.0010
		(0.006)	(0.001)	(0.001)
D_Sell	–	-0.0005	-0.0007	-0.0005
		(0.018)	(0.004)	(0.017)
N		38,592	39,303	39,202
Adj. R^2 (%)		0.075	0.168	0.134
Comparisons across Recommendations				
D_SBuy −D_Buy	+	0.0004	0.0005	0.0007
		(0.144)	(0.082)	(0.036)
D_Sell−D_Buy	–	-0.0012	-0.0019	-0.0015
		(0.001)	(0.001)	(0.001)
D_ SBuy −D_ Sell	+	0.0016	0.0024	0.0022
		(0.001)	(0.001)	(0.001)

TABLE 5 (Continued)

Panel B: Multiple Regression Results

	Predicted sign	Intervals [-13, -1]	Intervals [0, 12]	Intervals [-6, 6]
Recommendation indicators				
D_SBuy	+	0.0010	0.0014	0.0015
		(0.001)	(0.001)	(0.001)
D_Buy	*	0.0008	0.0011	0.0009
		(0.006)	(0.001)	(0.003)
D_Sell	–	-0.0003	-0.0004	-0.0005
		(0.107)	(0.066)	(0.046)
Control variables				
ΔBeta	–	0.0000	0.0000	0.0000
		(0.528)	(0.644)	(0.520)
ΔStdev	–	-0.0003	-0.0002	0.0000
		(0.239)	(0.334)	(0.571)
ΔRisk	–	0.0011	0.0004	0.0007
		(0.996)	(0.808)	(0.943)
ΔDividend_yield	+	-0.0005	-0.0002	-0.0001
		(0.998)	(0.813)	(0.606)
ΔLiquidity	+	-0.0001	-0.0002	-0.0002
		(0.770)	(0.871)	(0.862)
Ret	+	-0.0005	-0.0006	-0.0006
		(0.996)	(1.000)	(1.000)
Lag(Ret)	+	0.0005	0.0002	0.0003
		(0.004)	(0.111)	(0.038)
Forecast_revision	+	0.0005	-0.0003	0.0001
		(0.002)	(0.908)	(0.261)
Lag(ΔInst)	+	-0.0002	-0.0000	-0.0003
		(0.873)	(0.560)	(0.916)
EP	–	-0.0006	-0.0006	-0.0008
		(0.001)	(0.001)	(0.001)
BP	–	0.0002	-0.0006	-0.0001
		(0.875)	(0.001)	(0.312)
Sales_growth	+	0.0001	0.0004	0.0002
		(0.298)	(0.009)	(0.179)
N		30,878	31,261	31,282
Adj. R^2 (%)		0.236	0.275	0.266
Comparisons across Recommendations				
D_SBuy −D_Buy	+	0.0002	0.0003	0.0006
		(0.368)	(0.222)	(0.074)
D_Sell−D_Buy	–	-0.0011	-0.0015	-0.0014
		(0.002)	(0.001)	(0.001)
D_ SBuy −D_ Sell	+	0.0013	0.0018	0.0020
		(0.002)	(0.001)	(0.001)

* The coefficient on *D_Buy* is expected to be less than that on *D_SBuy* and greater than that on *D_Sell*.

TABLE 6 Stock Recommendations and Institutional Investors' Superior Performance

This table reports results from the following regressions:

$$Ret_{i,t+1} = \gamma_0 + \gamma_1 \Delta Inst + \gamma_2 MV + \gamma_3 BP + \xi \quad (4a)$$

$$Ret_{i,t+1} = \gamma_0 + \gamma_{1,a}\Delta Inst_{REC} + \gamma_{1,b}\Delta Inst_{Momentum} + \gamma_{1,c}\Delta Inst_{Herding} + \gamma_{1,d}\Delta Inst_{Other} + \gamma_2 MV + \gamma_3 BP + \xi \quad (4b)$$

For simplicity, firm subscript *i* and quarter subscript *t* are omitted from variables except $Ret_{i,t+1}$. $Ret_{i,t+1}$ is the market-adjusted stock return for firm *i* in quarter *t+1*. *MV* is market value at the end of quarter *t*. *ΔInst* and *BP* are defined in Table 1. In regression (4b), *ΔInst* is decomposed into four parts: $\Delta Inst_{REC}$, $\Delta Inst_{Momentum}$, $\Delta Inst_{Herding}$, and $\Delta Inst_{Other}$, representing institutional trading that is explained by stock recommendations, by momentum trading, by herding, and by other factors, respectively. Specifically,

$$\begin{aligned} \Delta Inst_{REC} &= \beta_{1,a} D\_SBuy + \beta_{1,b} D\_Buy + \beta_{1,c} D\_Sell \\ \Delta Inst_{Momentum} &= \beta_7 Ret + \beta_8 Lag(Ret) \\ \Delta Inst_{Herding} &= \beta_{10} Lag(\Delta Inst) \\ \Delta Inst_{Other} &= \Delta Inst - \Delta Inst_{REC} - \Delta Inst_{Momentum} - \Delta Inst_{Herding} \end{aligned} ,$$

where the coefficients are estimated from equation (1):

$$\begin{aligned} \Delta Inst = {} & \beta_0 + \beta_{1,a} D\_SBuy + \beta_{1,b} D\_Buy + \beta_{1,c} D\_Sell \\ & + \beta_2 \Delta Beta + \beta_3 \Delta Stdev + \beta_4 \Delta Risk + \beta_5 \Delta Dividend\_yield + \beta_6 \Delta Liquidity \\ & + \beta_7 Ret + \beta_8 Lag(Ret) + \beta_9 Forecast\_revision + \beta_{10} Lag(\Delta Inst) \\ & + \beta_{11} EP + \beta_{12} BP + \beta_{13} Sales\_growth + \varepsilon \end{aligned} \quad (1)$$

For each quarter *t* (starting from the first quarter of 1995), we estimate regression (1) using all the firm-quarters up to quarter *t*. We use the coefficient estimates and the explanatory variables in quarter *t* to decompose *ΔInst*.

The table reports the average coefficients from quarterly regressions of (4a) and (4b) and the associated time-series p-values in parentheses (Fama and MacBeth 1973). The p-values are based on one-sided tests for variables with directional predictions and on two-sided tests otherwise. To facilitate comparisons between explanatory variables, we use the decile rank of each explanatory variable, which is then scaled to lie between zero and one. The regressions are based on 56,131 firm-quarters from the first quarter of 1995 to the second quarter of 1999.

	Predicted signs	(1)	(2)
Intercept	?	-0.0059	-0.0262
		(0.688)	(0.124)
ΔInst	+	0.0068	
		(0.052)	
$\Delta Inst_{REC}$	+		0.0105
			(0.024)
$\Delta Inst_{Momentum}$	+		0.0249
			(0.058)
$\Delta Inst_{Herding}$	+		0.0045
			(0.111)
$\Delta Inst_{Other}$	?		-0.0113
			(0.004)
MV	–	0.0174	0.0153
		(0.826)	(0.798)
BP	+	0.0029	0.0087
		(0.374)	(0.324)
Average Adj. R^2		0.022	0.028

FIGURE 1 Mean Abnormal Order Imbalance of Large Trades around "Strong Buy"

The analyses are based on 1,533 "Strong Buy" issued in the period 1997-1998. The number of recommendations used in each interval ranges from 835 to 930. The trading direction measure for each half-hour interval surrounding a recommendation (-13 to +25) is calculated by subtracting the number of seller-initiated large trades from the number of buyer-initiated large trades. The difference is then scaled by the total number of large trades for the firm during the sample period. The mean abnormal order imbalance in each half-hour interval within the event window is calculated by comparing the direction measure with its average over the non-event period. Significance tests are based on median comparisons.

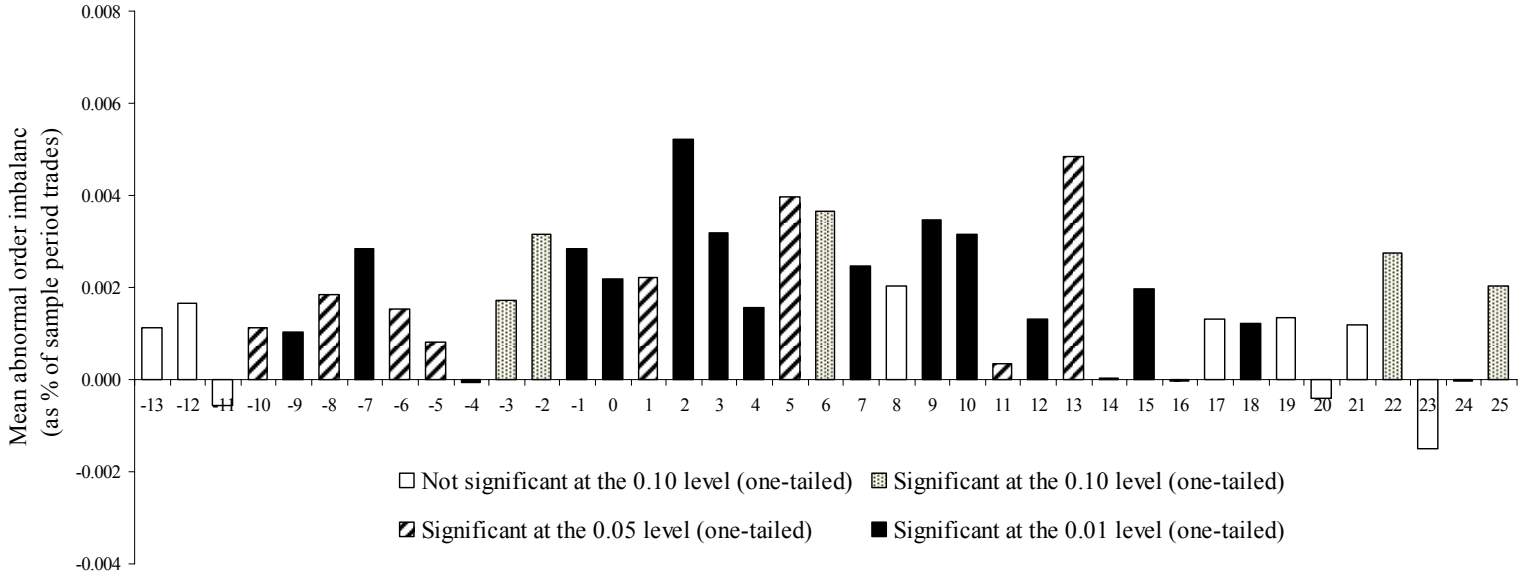

FIGURE 2 Mean Abnormal Order Imbalance of Large Trades around "Buy"

The analyses are based on 1,306 "Buy" issued in the period 1997-1998. The number of recommendations used in each interval ranges from 723 to 826. The trading direction measure for each half-hour interval surrounding a recommendation (-13 to +25) is calculated by subtracting the number of seller-initiated large trades from the number of buyer-initiated large trades. The difference is then scaled by the total number of large trades for the firm during the sample period. The mean abnormal order imbalance in each half-hour interval within the event window is calculated by comparing the direction measure with its average over the non-event period. Significance tests are based on median comparisons.

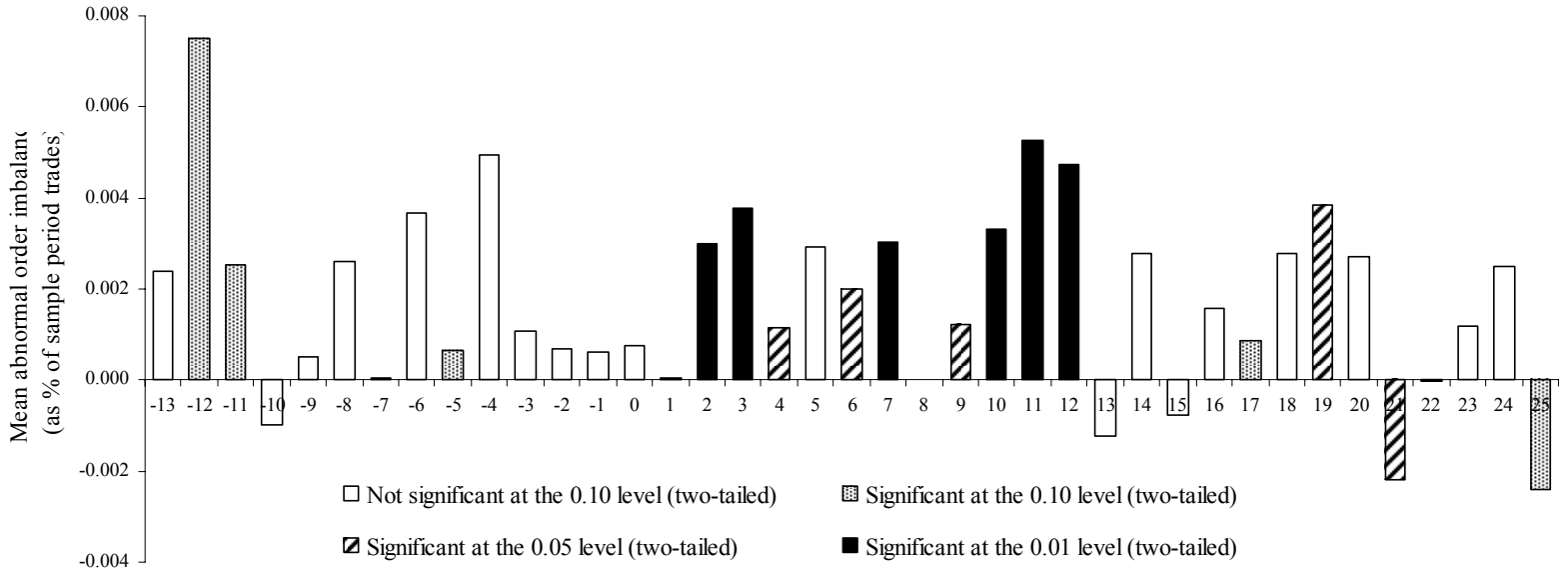

FIGURE 3 Mean Abnormal Order Imbalance of Large Trades around "Hold/Sell/Strong Sell"

The analyses are based on 1,483 "Hold/Sell/Strong Sell" issued in the period 1997-1998. The number of recommendations used in each interval ranges from 895 to 991. The trading direction measure for each half-hour interval surrounding a recommendation (-13 to +25) is calculated by subtracting the number of seller-initiated large trades from the number of buyer-initiated large trades. The difference is then scaled by the total number of large trades for the firm during the sample period. The mean abnormal order imbalance in each half-hour interval within the event window is calculated by comparing the direction measure with its average over the non-event period. Significance tests are based on median comparisons.