# Investor Heterogeneity and Trading Around Earnings Announcements*

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## Abstract

This paper provides new evidence on the role of investor heterogeneity for the firm's information environment. We empirically examine the effects of heterogeneity in the characteristics of the firm's shareholders on the volume and price movements around corporate announcements. We formulate several new measures of heterogeneity in the ability of institutional investors to gather and process information about the firm based on differences in institutional investor size, experience, holding history, and local exposure. We find that differential precision in investor information is positively related to trading volume around earnings announcements. In addition, greater investor heterogeneity is positively related to the magnitude of price reaction.

JEL classification: G10, G12, G14

Keywords: institutional investors, investor heterogeneity, information, trading volume

## 1. Introduction

Institutional ownership has been linked to the information environment of the firm, patterns in the trading of the firm's shares, and corporate decisions. Institutional investors are traditionally regarded as sophisticated investors capable of superior information acquisition and processing and monitoring of managerial decisions. Event studies of corporate announcements often use the overall level of institutional ownership to proxy for the presence of better informed investors. However, the view of institutional investors as a homogeneous sophisticated group does not account for the considerable heterogeneity in institutional investor base. The issue of heterogeneity in the information gathering and processing ability of institutional investors and its impact on the firm's information environment remains understudied. The main question in this paper is how heterogeneity in the precision of investor information affects trading around information releases. Our empirical setting focuses on the heterogeneity in the ability of institutional investors to gather and process information prior to the announcement and its relation to volume and price reaction around earnings surprises.

We hypothesize that heterogeneity in institutional investor ability to gather and process information prior to the announcement and, by consequence, heterogeneity in the precision of their pre-announcement information, increases trading volume around announcements. The theoretical argument about heterogeneity in the precision of investor information and trading volume is based on Kim and Verrecchia (1991b). Announcements of corporate news lead investors to revise their expectations. While new public information is less important to better informed traders, there is more updating in response to the announcement among poorly informed traders. Differential updating among traders with heterogeneous precision of pre-announcement private information generates trading volume. Conceptually, trading volume is

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proportional to heterogeneity across traders and to price reaction magnitude. Empirically, this argument predicts a positive relation between heterogeneity in the precision of investor information[1] prior to the announcement and trading volume around the announcement.

Other models yield an alternative to our main hypothesis, based on an argument about investors' ability to correctly extract the signal of the firm's future prospects from event-period information. The asymmetry between better informed and less informed investors resulting from differences in the ability to extract an accurate signal from the earnings announcement could lead to adverse selection costs for less informed investors[2] and, thus, deter active trading (Wang (1994)). Empirically, this implies a negative relation between heterogeneity and trading volume.

In our empirical implementation we formulate new measures of differential precision of institutional investor information ability based on investor size, experience, holding period, and local exposure. We believe this proposes a more accurate way of delineating investors of varying information gathering and processing ability relative to the classification of institutions based on hedge fund/pension fund/mutual fund/bank/endowment category or their trading horizon, since each group based on those standard institutional investor classifications can exhibit significant variation in informedness and information processing ability. We test our hypotheses using the sample of earnings announcements for two reasons. First, the release of corporate earnings surprises is a well-documented source of relevant new information carefully watched by the market, so it is both relevant and important to investors. Second, unlike other corporate disclosures, earnings releases can be summarized accurately with the magnitude and direction of

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[1] Investor pre-announcement information can stem from acquiring private information and processing public information about firms prior to the announcement. Thus, precision of an investor's pre-announcement information depends on the ability to both gather and process information prior to the announcement. Conceptually and empirically, our main hypothesis does not distinguish between the two aspects, collectively referred to as an investor's information technology.
[2] Adverse selection costs and shareholder heterogeneity are also modeled by Brennan and Thakor (1990) and Lucas and McDonald (1998) in the context of share repurchases.

the surprise, reducing the dimensionality of the problem and mitigating possible concerns about confounding effects and variation in the relevance and nature of the news across firms, thus letting us test our hypotheses in the cleanest possible setting.

Our principal findings are as follows. We find strong evidence that heterogeneity in institutional investor ability to gather and process information has a statistically and economically important effect on excess trading volume around earnings announcements. All of the measures are positively related to trading volume around earnings announcements. In addition to examining volume reaction, we also find that institutional investor heterogeneity is positively related to the magnitude of stock price reaction. Firms with more investor heterogeneity experience a larger negative market reaction to negative earnings surprises and a larger positive market reaction to favorable earnings news.

This paper is related to existing literature. In a more general sense, this work relates to extensive corporate finance research on institutional ownership, the monitoring role of institutional blockholders, and effects of institutions on corporate policy (e.g., Burkart, Gromb, and Panunzi (1997); Cremers and Nair (2005); Bushee (1998); Maug (1998)).

Besides Kim and Verrecchia (1991a,b), several other theoretical papers on investor trading decisions model trader behavior and characterize volume and price reaction in an environment with heterogeneous information and investor disagreement about some underlying fundamental (Karpoff (1986); Grundy and McNichols (1989)). An alternative modeling approach relies on heterogeneity in investor interpretations of common information (Varian (1985); Harris and Raviv (1993); Kandel and Pearson (1995)). Traders receive the same information but apply different likelihood functions, which explains trading volume. Admati and Pfleiderer (1988) introduce strategic interactions between informed and discretionary liquidity

traders into the analysis of trading patterns. In Blume, Easley, and O'Hara (1994), trading volume conveys additional information about signal quality that cannot be inferred from price patterns alone.

Existing empirical work documents the positive relation between trading volume and magnitude of returns or price reaction (e.g., Karpoff (1987); Jain and Joh (1988); Gallant, Rossi, and Tauchen (1992); Atiase and Bamber (1994); see Bamber et al. (2011) for a detailed survey). Studies of volume and price reaction to earnings announcements generally use analyst forecast dispersion to measure pre-announcement disagreement among investors (e.g. Ziebart (1990); Ajinkya and Gift (1985); Ajinkya, Atiase, and Gift (1991); Atiase and Bamber (1994); Bailey, Li, Mao, and Zhong (2003)). Hotchkiss and Strickland (2003) find that price and volume reactions are larger in the presence of aggressive growth and momentum investors. A small number of papers characterize the precision of investor information using institutional ownership data. Namely, Utama and Cready (1997) use total institutional ownership and find that it has a positive effect on trading volume around earnings announcements, which is weaker at high institutional ownership levels. Ali, Klasa, and Li (2008) argue that institutions with medium-sized stakes are better informed than investors with low or high stakes, so they consider total ownership by institutions with 1-5% stakes and find that it has a nonlinear effect on the relation between price reaction and trading volume.

In spite of the number of earnings announcements studies, definitive empirical evidence on the relation between heterogeneity in the precision of investor information and earnings announcements is scarce. As Abarbanell, Lanen, and Verrecchia (1995) point out, standard deviation of analyst forecasts does not capture differential precision in investor information. Defining and quantifying the nature of heterogeneity among investors has been a challenge for

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prior research on investor heterogeneity (Wang (1994)). The few existing papers that have approached the issue of differential precision empirically (Utama and Cready (1997) and Ali, Klasa, and Li (2008)) have not directly addressed heterogeneity in the precision of investor information or empirically linked the degree of differential precision to trading behavior around announcements. Although institutions can be viewed as sophisticated investors, total institutional ownership, total stake of better informed institutional investors, or investor style does not capture heterogeneity in the informedness of institutional investors. Another empirical approach is needed to measure differences in the accuracy or precision of investor information, and the present paper examines this question.

Our paper contributes to existing empirical literature in the following ways.

We examine differences in the ability to acquire and process information among institutional investors, an issue mostly overlooked in existing work that has focused on shareholder incentives, horizons, overall level of institutional ownership, or analyst forecasts. Our approach quantifies heterogeneity in institutional investor ability to acquire and process information and as a result it significantly improves on the literature's understanding of empirical aspects of differential precision in investor information. The analysis in this paper offers direct new evidence in support of the theoretical prediction in Kim and Verrecchia (1991b) that heterogeneity in institutional investor informedness increases trading volume around announcements. In addition, we present evidence that heterogeneity in the precision of investor information increases the magnitude of price reaction, holding the magnitude of the surprise and other characteristics constant. Although we focus on earnings announcements, the paper's findings and proposed measures have broader implications for studies of the firm's information environment.

The remainder of the paper is organized as follows. The second section describes sample construction and variable definitions. The third section discusses the main analysis and robustness tests. The fourth section concludes.

## 2. Data

### 2.1. Sample

The initial set of firms is based on Compustat quarterly data on US firms for 1985-2006. Observations with total assets below $20 mln, financial firms (SIC codes 6000-6999), and regulated utilities (SIC codes 4949-4999) are excluded. Observations with missing data on the main control variables, such as market-to-book, sales growth, dividend yield, and institutional holdings, are eliminated.

The sample contains quarterly earnings announcements. Quarterly earnings announcement dates and announced earnings are obtained from I/B/E/S and Compustat. The earnings surprise is computed by subtracting the I/B/E/S median analyst forecast from the quarterly earnings per share. Unless specified otherwise, earnings forecast errors that are smaller than $.02 are excluded to minimize noise or data issues. Turnover and return information from CRSP daily series for the three-day window around the announcement is required to construct our main dependent variables. Investor heterogeneity variable definitions require the presence of at least two institutional owners in a given quarter based on Thomson Reuters data.

### 2.2. Variables

*Investor heterogeneity*

Unlike the measures used to examine differential precision in related work (analyst forecast dispersion, total institutional ownership, and total ownership of investors with medium-sized stakes), the proxies proposed below directly address the extent of heterogeneity in investor

characteristics associated with the capacity to process and acquire information in general as well as the precision of investor information about a specific firm. All of the measures are based on heterogeneity among investors with stakes in the firm rather than analyst disagreement. It is important to note that our primary interest is heterogeneity in the precision (accuracy) of investor information rather than differences in specific beliefs about the firm's earnings numbers.

Several proxies for heterogeneity in the precision of institutional investor information generating ability are constructed (for details of definitions see the Appendix). The first measure is heterogeneity in investor size, where size is the market value of all portfolio holdings reported by the institution for a given quarter. Large investors are expected to have a higher capacity for processing and acquiring information. Small investors are less likely to have the human and financial resources to overcome fixed costs of private information acquisition and conduct in-depth research into the companies in their portfolio.[3] Thus, a higher level of heterogeneity in investor size would correspond to greater dispersion in the precision of investor information.

The second measure is heterogeneity in investor experience, based on all investors with a stake in the firm in a given quarter. Investor experience is proxied by the number of months the institutional investor has been in the Thomson Financial database with reported holdings in at least one firm (the earliest date is 1980). More established, experienced investors are expected to have refined the general technology for processing public information and acquiring private information as a result of learning from their portfolio decisions over time. In contrast, less

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[3] An argument generating the opposite intuition about the relation between investor size and informedness is also possible, albeit less plausible. The Forbes (2009) article "When should mutual funds close?" suggests that after a certain point the size of a mutual fund may hinder performance. This should not affect our inference. First, we focus on heterogeneity in investor size. Therefore, whether larger size proxies for higher information acquisition capacity (see above) or less attention to individual stocks, variation in investor size reflects heterogeneity in investor informedness about the underlying stocks. Second, our variable definitions aggregate portfolio information to the institutional investor level. For example, we would consider the size of a fund management company as opposed to the size of an individual mutual fund portfolio. Large management companies sometimes cap the size of individual funds by closing them to new investors.

experienced institutional investors are expected to have less precise information about the firm, all else given. Also, for some types of investors, particularly, investment companies and investment advisers, the ability to remain in business over the long term may be evidence of superior capacity for processing and acquiring information, as less informed investors are more likely to liquidate after a short period of time. Overall, more heterogeneity in investor experience reflects more differential precision in investor information.

The third measure is heterogeneity in the length of time the investor has held the sample firm in the portfolio. Holding period is defined as the number of months the institutional investor has continuously held the sample firm in the portfolio and is used to proxy for the investor's informedness about a specific stock. We expect investors that have held the stock the longest to have become better informed about the company. All else equal, a longer period of holding the stock is expected to improve the investor's specific knowledge about the company's prospects and improve the ability to form private forecasts of future earnings by processing past public information and private information acquired about the firm over time.[4] By comparison, all else equal, investors that have held the stock for the shortest period of time are expected to have learnt less about the firm, hence, to have less precise private information, prior to the announcement. Greater heterogeneity in holding period corresponds to more differences in the precision of investor information.

The fourth measure captures variation in local experience across all investors with a stake in the firm. Local experience, or local exposure, of an institutional investor is characterized by

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[4] Variation in holding period may be related to differences in turnover between actively managed portfolios and long-term buy-and-hold investors; however, it does not affect more extensive information gathering about the firm over the course of a longer holding period. However, since propensity for active trading (hence, shorter holding periods) can vary with institution type (see, e.g., Chen, Harford, and Li (2007)), we account for ownership stakes of different types of institutions in the firm in a robustness test.

the combined stake the investor holds in firms located in the same state as the sample firm, as a proportion of the investor's overall portfolio holdings.

*Reaction to earnings announcements*

The main dependent variable in volume reaction analyses is average excess daily trading volume (turnover) in the three-day period around the earnings announcement. Excess trading volume is computed as the difference between average daily turnover during the (-1,+1) event window and average daily turnover over the previous calendar year. Price reaction tests use cumulative three-day return on the firm's shares in excess of the return on the portfolio of firms in the same size decile.

*Explanatory variables*

Volume regressions control for variables identified in related work, including firm size (measured as log of market value of equity), growth and investment opportunities (market-to-book ratio and sales growth), dividend yield, and magnitude of the price reaction to the earnings surprise (absolute value of the announcement return).

Price response regressions replace the magnitude of the price reaction with the magnitude or actual value of the earnings surprise, defined as the difference between announced earnings and median analyst forecast (earnings forecast error), scaled by share price.

To differentiate the effects of interest from other factors associated with institutional presence in the firm, we control for total institutional stake and log of the number of institutional investors. Institutional ownership level is intended to capture the presence of sophisticated investors (compared to less sophisticated individual investors), but it also accounts for possible systematic patterns in the trading behavior of institutions as a group. Robustness tests examine the presence of a 5% blockholder; ownership stakes held by different types of institutional

owners such as banks, insurers, investment companies, investment advisers, and miscellaneous institutions; the total share held by institutions with medium-sized stakes (1-5%); and analyst forecast disagreement, intended to capture pre-announcement information.

Unless specified otherwise, all right-hand-side variables except announcement return and earnings surprise are obtained for the quarter prior to the announcement to mitigate potential simultaneity concerns. The main variables are winsorized at one percent of each tail of the distribution to moderate the potential impact of extreme observations.

## 2.3. Summary statistics

Summary statistics are reported in Panel A of Table 1. For the average firm in our sample, market value of equity is $2.3bln. Firm size is right skewed, with a number of smaller firms in the sample, resulting in the median of $334 mln. Average (median) market-to-book ratio is 2.0 (1.5) and average (median) quarterly sales growth is 5.8% (3.2%), indicating the presence of a number of growth firms. Average dividend yield is 0.2% (0.6% among dividend payers only), with the median firm paying no dividends. The summary statistics for a representative firm in our sample are comparable to related work on institutional ownership and earnings announcements (e.g., Hotchkiss and Strickland, 2003; Ali, Klasa, and Lang, 2008; Utama and Cready, 1997).

[Table 1]

Institutional investors own 49% of the average firm and institutional blockholders (defined as having a 5% or larger stake) are present in over three quarters (77%) of the sample firms.

The median firm beats the consensus analyst forecast for the quarter; however, firms that underperform analyst forecasts announce large negative surprises, so the average earnings surprise is negative. In the sample of negative surprises, the average (median) forecast error is -$.15 (-$.08) per share. Consistent with other work, earnings forecast errors are scaled by share prices, resulting in the average (median) negative earnings surprise of -1.5 (-0.6) cents per dollar of share price. Positive forecast errors tend to be smaller in magnitude: average (median) forecast error is $.08 ($.05) per share, or 0.5 (0.3) cents per dollar of share price.

Average excess daily turnover in the three days around the earnings announcement is 0.46% (median 0.10%). Average (median) absolute value of the cumulative return in the three days around the earnings announcement is 5.8% (4.0%).

For the average firm, heterogeneity in investor size (standard deviation of investor size scaled by mean size of the firm's investors) is 1.8. Heterogeneity in fund experience is 0.5, indicating less variation in our proxy for investor experience. There is slightly more heterogeneity in holding period (average of 0.9), where holding period is the length of time investors have held the present company's stock. Portfolios of institutional investors are usually well diversified across regions, with average dispersion in local exposure of 0.04.

To explore relations between firm characteristics and investor heterogeneity, we tabulate means of the main variables for high and low heterogeneity subsamples in Panel B of Table 1. Larger firms, firms with higher market-to-book ratios, firms that pay low dividends, and firms with more institutional investors and larger overall institutional ownership tend to have a more heterogeneous investor base. Firms with more heterogeneous investors also tend to have higher share prices (in dollar terms) and less analyst disagreement and generate smaller earnings surprises.

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Correlations shown in Panel C are consistent with these observations. We also note that large firms, growth firms, firms with low dividend yields, and firms with high institutional ownership and more institutional investors experience more trading around announcements. Unsurprisingly, trading volume is proportionate to the magnitude of the market reaction. Tabulations and correlations reported above are not intended to establish causal inference about determinants of heterogeneity; however, they underline the need to control for a range of firm characteristics in tests of heterogeneity and volume reaction to announcements.

Some investor heterogeneity variables are correlated. Measures of heterogeneity in investor size and experience have a 0.61 correlation. By comparison, heterogeneity in holding period has 0.13-0.14 correlations with heterogeneity in size and experience and heterogeneity in local exposure has 0.01-0.06 correlations with the first three proxies. To account for possible multicollinearity, specifications where each proxy is included separately are reported alongside specifications containing all four heterogeneity proxies. Also, some heterogeneity measures (primarily, heterogeneity in investor size) are correlated with total institutional ownership and number of institutions. Although we err on the side of including total institutional ownership and number of institutions as controls in the baseline specification since they have low (but positive) correlations with volume, exclusion of these controls does not affect our results.

## 3. Results

### 3.1. Univariate evidence

Univariate tests of trading volume around earnings announcements based on differences in the extent of investor heterogeneity are presented in Table 2. For the purposes of t-tests, subsamples of firms with high investor heterogeneity and low investor heterogeneity are identified using the four proxies for heterogeneity in the informedness (differential precision of

information) of the firm's investors described in the previous section. The top panel compares trading volume reaction to earnings announcements for firms in the top quartile and firms in the bottom quartile of investor heterogeneity. The bottom panel summarizes the results of a similar comparison of the groups of firms with investor heterogeneity above and below the sample median.

[Table 2]

Univariate results show that firms with substantial heterogeneity in investor informedness exhibit higher excess trading volume around earnings surprises. The differences in means are highly statistically significant. The observed differences between high investor heterogeneity and low investor heterogeneity groups are also economically important. Firms in the top quartile of heterogeneity in investor size experience on average 0.78% daily volume reaction on announcement, compared to 0.22% for firms in the bottom quartile. For heterogeneity in investor history, the numbers for the two groups are 0.73% and 0.24%, respectively. Considering that average daily excess trading volume in the three days around an earnings surprise is 0.46% (from Table 1), the difference in volume reaction between firms in the top quartile and firms in the bottom quartile of investor heterogeneity amounts to more than the sample mean.

The differences in means are less stark, albeit still considerable, for investor heterogeneity proxies based on holding period – 0.60% volume reaction for firms in the top quartile, compared to 0.34% for firms in the bottom quartile (the difference amounts to three-fifths of the sample mean) – and local exposure – 0.59% for firms in the top quartile, compared to 0.43% for firms in the bottom quartile (the difference is similarly statistically significant and comprises two-fifths of the average volume reaction in our sample).

Univariate evidence presented in Table 2 empirically supports the hypothesis that heterogeneity in investor informedness increases trading volume around information releases. However, univariate analysis does not allow us to control for a variety of factors that have been linked to trading behavior around announcements, so we turn to multivariate tests.

## 3.2. Multivariate evidence

Our main tests of investor heterogeneity are performed in a multivariate setting, summarized in Table 3. The main specification controls for the magnitude of the market reaction to the earnings surprise and other determinants of trading volume on announcement. When included individually in volume regressions, all of our proxies for differential precision in investor information – heterogeneity in investor size, experience, holding period, and local exposure – enter with significant positive coefficients. Multivariate results obtained using the described measures of investor heterogeneity are consistent with our main hypothesis that differential precision in investor information is positively related to trading volume around releases of new public information.

[Table 3]

Control variables enter with expected signs. Consistent with the Kim and Verrecchia (1991b) prediction that volume reaction is proportionate to the absolute price change, excess trading volume is positively associated with the magnitude of the price reaction to the earnings announcement. Further, growth firms, typically characterized by a higher level of information asymmetry, exhibit a larger volume reaction as earnings information is released to the public. In contrast, mature companies with fewer information asymmetries and more assets in place (low market-to-book ratio, low sales growth, and high dividend yield) exhibit a weaker volume

reaction to earnings news. Consistent with Hotchkiss and Strickland (2003)[5], trading volume around earnings announcements is positively related to total institutional ownership.

Coefficient magnitudes are summarized in the bottom panel. Partial (ceteris paribus) effects of a one standard deviation increase in the explanatory variable are expressed in relative terms as a percentage of the partial effect of a one standard deviation increase in market-to-book ratio, a common proxy for growth and investment opportunities. Consistent with expectations, price reaction magnitude has the largest economic effect on trading volume. Shareholder heterogeneity effects amount to 38-61% of the market-to-book effect. All coefficients remain highly significant (magnitudes range between 20% and 62% of the market-to-book effect) when the four heterogeneity measures are included jointly in the volume regression.

The presented results were based on the sample of all earnings surprises (nontrivial positive and negative earnings forecast errors). To account for the possibility that the observed relation is driven by one type of news (particularly, unfavorable news), the analysis is repeated in samples of negative and positive earnings surprises. The results are shown in Table 4.

[Table 4]

Coefficient estimates are qualitatively similar to the full sample findings of the previous table. When included individually, all heterogeneity coefficients remain significant at least at the 5% level in both samples. Most of the coefficients retain significance when the four measures are included jointly (exceptions are heterogeneity in investor experience in the sample of negative

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[5]    In a study of volatile trading days, Dennis and Strickland (2002) also find a positive association between abnormal turnover and institutional ownership. All else equal, institutions as a group appear to engage in more and/or larger trades around releases of new public information, which is consistent with significantly larger portfolios of institutional investors compared to individual investors.

surprises and heterogeneity in size in the sample of positive surprises[6]). It does not appear that the full sample result is driven by unfavorable earnings news only.

In Panel A of Table 5, all variables are industry mean adjusted at the three-digit SIC level to account for the possibility that unobserved industry characteristics predict both institutional investor heterogeneity and trading volume. Coefficient estimates change very little compared to Table 3.

[Table 5]

The main specification in this paper relates trading volume to the level of investor heterogeneity, holding the magnitude of the price reaction and other factors constant. As an extension of this approach, we consider the possibility that the relation between investor heterogeneity and trading volume is contingent on the magnitude of the price reaction. The magnitude of the price reaction captures the relative importance of the information contained in the announcement (accuracy of new information relative to the accuracy of pre-announcement information) and is positively associated with trading volume. It is plausible that differential precision of investor information amplifies the positive relation between the magnitude of the reaction to the surprise and trading volume. To implement this empirically, in Panel B we include interactions of price reaction magnitude and heterogeneity instead of and in addition to direct heterogeneity terms. The pattern of interaction term results in the multiplicative specification generally supports the above conjecture. In addition to the direct relation between heterogeneity and volume, heterogeneity indirectly affects volume through a higher price reaction magnitude coefficient.

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[6] Multicollinearity could be one possible reason since  heterogeneity in investor size and heterogeneity in investor experience have a correlation of 0.61.

Overall, the main results reveal the role of heterogeneity in institutional investor characteristics for the information environment of the firm and reaction to earnings news. The differential ability of institutional investors to gather and process information prior to the news release results in increased trading when the earnings announcement arrives and resolves uncertainty. The new proxies for differential precision of information proposed in this paper - heterogeneity in investor size, experience, holding period, and local expertise - are positively related to excess trading volume around earnings announcements, all else equal.

## 3.3. Sensitivity tests

Next, we vary sample selection criteria and variable definitions to evaluate the robustness of the findings. The sample is restricted to large earnings surprises in Panel A of Table 6. Since earnings forecast errors tend to be larger for negative surprises than for positive surprises, we focus on announcements with positive forecast errors above ten cents per share and negative forecast errors below negative fifteen cents per share (approximate cutoffs for the top quartile of magnitude). The results continue to hold when only large earnings surprises are considered. Coefficients of interest remain statistically significant and increase in magnitude. Consistent with the previous tables, heterogeneity in investor size, experience, holding period, and local exposure is positively associated with excess daily trading volume around earnings surprises.

[Table 6]

The sample is further restricted to fourth-quarter announcements in Panel B. The estimates are similar, with some coefficients attaining higher magnitudes. All of the coefficients remain significant at least at the 5% level.

Additional control variables are introduced in Panel C. Existing work links institutional blockholders to increased monitoring due to their superior ability to acquire information and

discipline the management (e.g., Cremers and Nair (2005)). We control for the presence of a 5% institutional blockholder. Volume is negatively related to the blockholder dummy. Information acquired by a blockholder could be used for informed trades prior to the announcement and some of it could be dissipated to less informed market participants through the blockholder's trades, resulting in lower trading volume around the announcement itself. To account for any systematic patterns in the trading behavior of different types of institutional investors, we replace total institutional ownership with total stakes of five groups of institutions, based on the Thomson Financial classification: banks, insurers, investment companies, investment advisers, and others (e.g., endowments, pension funds etc.)[7] Ownership by banks, investment advisers, and investment companies is associated with higher trading volume. We also control for disagreement in analyst forecasts prior to the announcement. The variable does not enter significantly after other factors are accounted for. Following Ali, Klasa, and Li (2008), we control for the interaction between the absolute value of announcement return and the combined stake of better-informed investors (defined as having a 1% to 5% stake in the firm). Finally, we control for the log of the firm's share price. Consistent with Karpoff (1986), the coefficient is positive, indicating that lower transaction costs of stocks with higher share prices facilitate trading. Investor heterogeneity coefficients remain highly significant after accounting for the described controls.

In the previous tables, all of the explanatory variables except the magnitude of the price reaction were based on the quarter prior to the announcement. For robustness, contemporaneous relations between investor heterogeneity and trading volume on announcement are considered in

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[7]     Thomson Financial investor type classification is recognized as not being fully accurate, with some investment companies incorrectly classified as 'other institutions', which could explain the significance of the positive coefficient on stake of 'other institutions'. A mitigating factor is that the described variables are included in robustness checks only and none of our main results rely on or are affected by their inclusion or omission.

Panel D. All of the heterogeneity variables remain significant when included individually and three of the four coefficients are significant when the measures are included jointly.

## 3.4. Return reaction

The tests presented so far have focused on excess trading volume. Below we analyze price reaction to earnings announcements.[8] We consider whether heterogeneity in information gathering ability of institutional investors results in a more dramatic price movement around the earnings announcement, controlling for the magnitude of the earnings surprise.

The magnitude of announcement returns is analyzed in Table 7. The dependent variable is the absolute value of the three-day announcement return.

[Table 7]

Firms with more heterogeneity in institutional investor size, experience, and holding period have larger reactions to earnings announcements in absolute terms. Controls enter with expected signs. Price reaction magnitude is increasing in the magnitude of the earnings surprise. More substantial earnings surprises deliver more public information to the market, resulting in a larger price movement. Firm size has a negative coefficient. Market-to-book ratio and sales growth enter with positive signs while dividend yield enters with a negative sign. The market tends to have less information about small firms prior to the announcement, resulting in a greater amount of information updating following the announcement. Similarly, there is more uncertainty about growth firms prior to the announcement, which results in a larger price reaction, all else equal. A similar observation extends to firms that do not pay dividends or pay low dividends. Finally, the number of institutions (in log terms) enters with a positive sign.

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[8] Abbarbanell, Lanen, and Verrecchia (1995) predict a positive effect of dispersion on both trading volume and variance of price change (yielding empirical predictions about absolute value of price reaction) in models with exogenous and endogenous private information acquisition and suggest that their predictions can be extended to investor heterogeneity.

The coefficients are economically significant. For example, a one standard deviation increase in heterogeneity in investor size is associated with 0.63% higher absolute value of the announcement return, all else given. Similarly, a one standard deviation increase in heterogeneity in investor experience is associated with a 0.43% higher announcement return in absolute terms. The effects are of the same order of magnitude as the effect of a one standard deviation change in market-to-book, dividend yield, or absolute value of the earnings surprise.

Consistent results are observed when the price reaction analysis is performed in the samples of negative earnings surprises and positive earnings surprises in Table 8. For the purposes of this analysis the dependent variable is the actual announcement return.

[Table 8]

In Panel A, investor heterogeneity is associated with a more negative price reaction to unfavorable earnings surprises. For an average negative earnings announcement, a one standard deviation increase in heterogeneity in investor size is associated with 0.62% lower three-day announcement return, all else equal; heterogeneity in investor experience – 0.41% lower return, all else equal; heterogeneity in holding period – 0.24% lower return, holding other factors constant. These effects are similar to or greater in magnitude than the partial effects of a one standard deviation change in the earnings surprise, market-to-book ratio, dividend yield, and number of institutional owners, and of the same order of magnitude as the effect of a one standard deviation change in firm size. The coefficients remain significant but have a somewhat lower magnitude when all of the heterogeneity measures are included in one specification.

In Panel B, heterogeneity in investor size and holding period is associated with a more positive announcement return to a favorable earnings surprise. For an average positive earnings

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announcement, the effect of a one standard deviation increase in heterogeneity in investor size (holding period) is a 0.28% (0.10%) higher positive announcement return.

Price reaction results suggest that a high level of heterogeneity in investor informedness is associated with more information updating around earnings announcements. Price reaction magnitude is positively related to heterogeneity in portfolio size, experience, and holding period. The magnitude result holds for negative as well as positive earnings surprises. Holding the magnitude of the surprise constant, firms that underperform analyst forecasts face a larger negative market reaction and firms with favorable earnings news encounter a more positive market reaction when there is more heterogeneity in the precision of pre-announcement information among the firm's investors.

## 3.5. Discussion

Several considerations merit further discussion.

First, the results may be affected by simultaneous relations between dependent and explanatory variables. Similarly to related work examining price and trading behavior around announcements, this potential issue is less likely to present a concern in the event study context. Nonetheless, the main tests use explanatory variables based for the quarter prior to the announcement, which partly mitigates causality concerns since our dependent variables exhibit only a limited degree of persistence. Tests of contemporaneous effects showed comparable results.

Second, earlier in the paper we discussed an alternative to our main hypothesis that yielded the opposite relation between investor heterogeneity and trading volume. Tests revealed a positive relation between differential precision in investor information and trading volume and did not support the alternative prediction (the dampening effect of adverse selection costs in the

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presence of investors with differing ability to process event period information on trading volume). While our findings do not completely rule out the alternative prediction, the main effect outweighs it empirically.

Third, our investor heterogeneity measures focus on existing institutional owners. Similarly to related work that has used data on existing institutional owners, the proposed measures do not consider individuals or prospective investors. In the context of our hypotheses, this does not pose a significant concern. Looking at the information characteristics of existing investors is of primary importance as existing investors' decision to sell to existing or outside investors, hold, or buy additional shares in the firm directly contributes to volume and price reactions to the announcement. Further, exclusion of individual investors from the analysis is not likely to affect our results in a specific direction (although it could bias estimates towards finding insignificance). Empirically, trading by institutional investors has the largest impact. Nevertheless, we explicitly account for variation in the relative importance of individual and institutional investors by controlling for total institutional stake in the firm.

## 4. Conclusions

The paper has considered the effect of shareholder heterogeneity on the firm's information environment by examining volume and price behavior around earnings announcements. We have focused on the role of differences in investor ability to gather and process information and formulated several new measures of differential precision in investor private information based on institutional investor size, investor experience, holding period, and investor exposure to the firm's geographic location. The proposed proxies have enabled us to produce specific new empirical evidence in support of the Kim and Verrecchia (1991b)

hypothesis regarding differential precision and trading volume. We have also provided additional results on the relation between investor heterogeneity and the magnitude of price reaction.

The main findings are as follows. First, even within the group of sophisticated institutional investors, there exists a considerable degree of heterogeneity in the ability to gather and process information about the firm. Second, heterogeneity in the accuracy of shareholder information is associated with higher excess trading volume in response to both positive and negative earnings surprises. Firms with more heterogeneity among existing institutional owners along dimensions such as portfolio size, investor experience, holding duration, and local exposure exhibit higher trading volume overall and higher trading volume per unit of price reaction. All else equal, investor heterogeneity further contributes to a larger price reaction to the announcement of negative as well as positive earnings surprises, suggesting that differences in the accuracy of investor information result in more information updating around earnings releases. The documented effects are economically and statistically significant and robust to alternative sample selection criteria, variable definitions, and control variables.

This work has important implications for future research. Our analysis has emphasized the event study approach to earnings announcements as one of the most common settings for information revelation. However, other corporate announcements that involve public disclosure of value relevant information can be considered in the future, such as dividends, buybacks, spinoffs, and acquisitions. The proposed approach to quantifying informational differences within the firm's investor base can be adapted to broader contexts involving the firm's information environment, from earnings management to dividend signaling.

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# Appendix. Sample and variables.

The sample period is 1985-2006. The sample contains quarterly earnings announcements (trading volume and market reaction during the (-1,+1) window around the announcement). I/B/E/S data on median analyst quarterly earnings forecast and announced quarterly earnings per share, supplemented with Compustat quarterly data on reported earnings as necessary, is used to identify earnings surprises. Unless specified otherwise, earnings forecast errors greater than $.02 in magnitude are used to minimize the impact of coding errors. CRSP daily data is used to compute volume and return reactions to announcement. Firm characteristics are obtained from quarterly Compustat data for US firms, excluding firms with total assets below $20 mln, financial firms (SIC codes 6000-6999), regulated utilities (SIC codes 4949-4999), and observations with missing data on control variables.. Construction of investor heterogeneity characteristics requires the presence of at least two institutional owners with stakes in the firm in a given quarter in Thomson Reuters. Unless specified otherwise, all right-hand-side variables except Announcement return and Earnings surprise, are based on the quarter prior to the announcement.

| Variable | Definition |
|---|---|
| Trading volume | Three-day (-1,+1) average trading volume around the earnings announcement, defined as the excess of average daily turnover in the sample firm's shares over the average daily turnover in the firm's shares in the prior calendar year. Quarterly earnings announcement with positive or negative earnings surprises are considered. Source: CRSP. |
| Announcement return | Three-day (-1,+1) return to the earnings announcement, defined as the cumulative excess return on the sample firm's shares over the size decile portfolio return over the announcement period. Quarterly earnings announcements with positive or negative earnings surprises are considered. Source: CRSP. |
| Announcement return (abs) | Absolute value of Announcement return |
| Investor heterogeneity (size) | Heterogeneity in the size of institutional investors with stakes in the sample firm, defined as the coefficient of variation of $s_i$ (market value of portfolio of institutional investor $i$) based on all institutional investors $i$ with stakes in the firm. Source: Thomson Reuters. |
| Investor heterogeneity (experience) | Heterogeneity in the length of time that institutional investors with stakes in the sample firm have been listed in the 13f filings database, defined as the coefficient of variation of $a_i$ (number of months institutional investor $i$ has been listed in the 13f filings database) based on all institutional investors $i$ with stakes in the firm. Source: Thomson Reuters. |
| Investor heterogeneity (holding period) | Heterogeneity in the length of time that institutional investors with stakes in the sample firm have held the firm's shares, defined as the coefficient of variation of $t_i$ (number of months institutional investor $i$ has held the sample firm's shares) based on all institutional investors $i$ with stakes in the firm. Source: Thomson Reuters. |
| Investor heterogeneity (local exposure) | Heterogeneity in the level of local exposure of institutional investors with stakes in the sample firm, defined as standard deviation of $l_i$ (proportion of institutional investor $i$'s portfolio value invested in companies located in the same state as the sample firm) based on all institutional investors $i$ with stakes in the firm. Source: 13f filings and Compustat (headquarters locations). |
| Earnings surprise | Difference between the firm's quarterly earnings per share and median analyst earnings per share forecast, times hundred, divided by share price. Source: I/B/E/S, Compustat. |
| Earnings surprise (abs) | Absolute value of Earnings surprise |
| Institutional ownership | Total share of institutional investors in the firm. Source: Thomson Reuters. |
| Number of institutions (log) | Log of the number of institutions with a stake in the firm. Source: Thomson Reuters. |
| Market-to-book ratio | Ratio of market value of the firm (market value of equity minus book value of equity plus book value of total assets) to book value of total assets. Source: Compustat. |
| Market value of equity (log) | Log of market value of common equity (common shares outstanding multiplied by end-of-quarter closing prices). Source: Compustat. |
| Dividend yield (%) | Ratio of dividends per share to closing price, multiplied by 100. Source: Compustat |
| Sales growth | Difference in net sales in the current quarter and net sales in the previous quarter, divided by net sales in the previous quarter. |
| Institutional blockholder (5%) | Dummy equal to 1 if a 5% institutional owner is present in the firm; 0 otherwise. |
| Institutional ownership (banks) | Share of institutional investors designated as type 1 in the firm. |
| Institutional ownership (insurers) | Share of institutional investors designated as type 2 in the firm. |
| Institutional ownership (investment companies) | Share of institutional investors designated as type 3 in the firm.. |
| Institutional ownership (investment advisers) | Share of institutional investors designated as type 4 in the firm. |
| Institutional ownership (other) | Share of institutional investors designated as type 5 in the firm. |
| Medium stake | Share of institutional investors with 1-5% stakes in the firm. |
| Analyst disagreement | Standard deviation of analyst earnings forecasts, scaled by the magnitude of the median analyst earnings forecast. Quarterly earnings forecasts are used. At least two analyst earnings forecasts are required for the construction of this variable. Source: I/B/E/S. |
| Price (log) | Log of closing share price. Source: Compustat. |

# Table 1. Summary statistics

*Panel A. Summary statistics*

Summary statistics of the main variables. The sample and variables are defined in the Appendix.

| Variable | Obs. | Mean | Med. | SD |
|---|---|---|---|---|
| Investor heterogeneity (size) | 87645 | 1.761 | 1.692 | 0.468 |
| Investor heterogeneity (experience) | 87645 | 0.507 | 0.506 | 0.106 |
| Investor heterogeneity (holding period) | 87645 | 0.922 | 0.907 | 0.269 |
| Investor heterogeneity (local exposure) | 87645 | 0.041 | 0.033 | 0.032 |
| Trading volume | 87645 | 0.461 | 0.102 | 1.105 |
| Announcement return | 87645 | 0.478 | 0.250 | 8.063 |
| Announcement return (negative) | 39442 | -2.265 | -1.716 | 7.819 |
| Announcement return (positive) | 48203 | 2.722 | 1.974 | 7.550 |
| Announcement return (abs) | 87645 | 5.781 | 3.951 | 5.642 |
| Market-to-book ratio | 87645 | 2.020 | 1.511 | 1.518 |
| Sales growth | 87645 | 0.058 | 0.032 | 0.249 |
| Market value of equity | 87645 | 2,261 | 334 | 11,366 |
| Market value of equity (log) | 87645 | 5.962 | 5.812 | 1.661 |
| Dividend yield (%) | 87645 | 0.212 | 0.000 | 0.350 |
| Institutional ownership | 87645 | 0.485 | 0.480 | 0.244 |
| Number of institutions (log) | 87645 | 4.044 | 4.060 | 1.044 |
| Institutional blockholder (5%) | 87645 | 0.767 | 1.000 | 0.422 |
| Institutional ownership (banks) | 87645 | 0.068 | 0.054 | 0.059 |
| Institutional ownership (insurers) | 87645 | 0.024 | 0.013 | 0.031 |
| Institutional ownership (investment companies) | 87645 | 0.040 | 0.014 | 0.058 |
| Institutional ownership (investment advisers) | 87645 | 0.141 | 0.102 | 0.119 |
| Institutional ownership (other) | 87645 | 0.210 | 0.064 | 0.248 |
| Medium stake | 87645 | 0.215 | 0.201 | 0.125 |
| Earnings surprise | 87645 | -0.405 | 0.074 | 1.995 |
| Earnings surprise (negative) | 39442 | -1.546 | -0.593 | 2.426 |
| Earnings surprise (negative) (not scaled by price) | 39442 | -0.151 | -0.080 | 0.184 |
| Earnings surprise (positive) | 48203 | 0.528 | 0.266 | 0.697 |
| Earnings surprise (positive) (not scaled by price) | 48203 | 0.082 | 0.050 | 0.082 |
| Earnings surprise (abs) | 87645 | 0.986 | 0.370 | 1.781 |
| Analyst disagreement | 68169 | 0.220 | 0.081 | 0.417 |
| Price (log) | 87645 | 2.842 | 2.904 | 0.834 |

*Panel B. Summary statistics of explanatory variables by heterogeneity group*

Summary statistics of the explanatory variables within groups with high and low investor heterogeneity. For each investor heterogeneity measure, observations are assigned to the "high: above median" ("low: below median") group if investor heterogeneity is above (below) the sample median. The sample and variables are defined in the Appendix.

| | Investor heterogeneity (size) | | Investor heterogeneity (experience) | | Investor heterogeneity (holding period) | | Investor heterogeneity (local exposure) | |
|---|---|---|---|---|---|---|---|---|
| | Mean (High) (above median) | Mean (Low) (below median) | Mean (High) (above median) | Mean (Low) (below median) | Mean (High) (above median) | Mean (Low) (below median) | Mean (High) (above median) | Mean (Low) (below median) |
| Market-to-book ratio | 2.237 | 1.803 | 2.267 | 1.772 | 2.133 | 1.907 | 2.137 | 1.902 |
| Sales growth | 0.061 | 0.056 | 0.065 | 0.052 | 0.058 | 0.058 | 0.062 | 0.054 |
| Market value of equity | 4117 | 404 | 3789 | 732 | 2143 | 2378 | 2848 | 1673 |
| Market value of equity (log) | 6.789 | 5.135 | 6.405 | 5.518 | 6.157 | 5.767 | 6.109 | 5.814 |
| Dividend yield (%) | 0.193 | 0.230 | 0.155 | 0.268 | 0.225 | 0.198 | 0.225 | 0.199 |
| Institutional ownership | 0.609 | 0.361 | 0.547 | 0.422 | 0.519 | 0.451 | 0.484 | 0.486 |
| Number of institutions (log) | 4.616 | 3.473 | 4.320 | 3.768 | 4.192 | 3.896 | 4.126 | 3.963 |
| Institutional blockholder (5%) | 0.829 | 0.706 | 0.801 | 0.733 | 0.792 | 0.743 | 0.748 | 0.787 |
| Institutional ownership (banks) | 0.072 | 0.063 | 0.061 | 0.074 | 0.071 | 0.065 | 0.071 | 0.064 |
| Institutional ownership (insurers) | 0.025 | 0.024 | 0.021 | 0.028 | 0.026 | 0.022 | 0.027 | 0.022 |
| Institutional ownership (investment companies) | 0.043 | 0.036 | 0.036 | 0.043 | 0.042 | 0.037 | 0.043 | 0.036 |
| Institutional ownership (investment advisers) | 0.128 | 0.154 | 0.116 | 0.166 | 0.145 | 0.136 | 0.154 | 0.127 |
| Institutional ownership (investment other) | 0.339 | 0.080 | 0.311 | 0.108 | 0.231 | 0.188 | 0.186 | 0.234 |
| Medium stake | 0.268 | 0.163 | 0.240 | 0.191 | 0.236 | 0.195 | 0.216 | 0.214 |
| Analyst disagreement | 0.170 | 0.285 | 0.191 | 0.251 | 0.197 | 0.244 | 0.223 | 0.216 |
| Earnings surprise (abs) | 0.651 | 1.322 | 0.860 | 1.113 | 0.791 | 1.182 | 0.941 | 1.031 |
| Price (log) | 3.100 | 2.584 | 2.911 | 2.774 | 3.003 | 2.682 | 2.892 | 2.793 |

## Panel C. Correlations

Pairwise correlations. The sample and variables are defined in the Appendix.

| | | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) | (14) | (15) | (16) | (17) | (18) | (19) | (20) | (21) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Investor heterogeneity (size) | (1) | | | | | | | | | | | | | | | | | | | | | |
| Investor heterogeneity (experience) | (2) | 0.61 | | | | | | | | | | | | | | | | | | | | |
| Investor heterogeneity (holding period) | (3) | 0.13 | 0.14 | | | | | | | | | | | | | | | | | | | |
| Investor heterogeneity (local exposure) | (4) | 0.01 | 0.06 | 0.00 | | | | | | | | | | | | | | | | | | |
| Trading volume | (5) | 0.16 | 0.16 | 0.10 | 0.06 | | | | | | | | | | | | | | | | | |
| Announcement return (abs) | (6) | 0.00 | 0.08 | 0.02 | 0.04 | 0.43 | | | | | | | | | | | | | | | | |
| Market-to-book ratio | (7) | 0.16 | 0.17 | 0.13 | 0.15 | 0.17 | 0.11 | | | | | | | | | | | | | | | |
| Sales growth | (8) | 0.00 | 0.03 | 0.02 | 0.04 | 0.06 | 0.03 | 0.11 | | | | | | | | | | | | | | |
| Market value of equity (log) | (9) | 0.71 | 0.34 | 0.08 | 0.02 | 0.08 | -0.13 | 0.22 | 0.00 | | | | | | | | | | | | | |
| Dividend yield (%) | (10) | 0.01 | -0.14 | -0.01 | -0.04 | -0.14 | -0.21 | -0.19 | -0.06 | 0.24 | | | | | | | | | | | | |
| Institutional ownership | (11) | 0.55 | 0.29 | 0.12 | -0.04 | 0.19 | -0.04 | 0.02 | -0.02 | 0.54 | 0.04 | | | | | | | | | | | |
| Number of institutions (log) | (12) | 0.72 | 0.33 | 0.11 | 0.00 | 0.11 | -0.11 | 0.12 | -0.03 | 0.93 | 0.24 | 0.69 | | | | | | | | | | |
| Institutional blockholder (5%) | (13) | 0.12 | 0.07 | 0.05 | -0.04 | 0.06 | 0.02 | -0.08 | -0.02 | -0.01 | -0.05 | 0.45 | 0.09 | | | | | | | | | |
| Institutional ownership (banks) | (14) | 0.16 | -0.08 | 0.01 | -0.03 | -0.03 | -0.18 | -0.10 | -0.05 | 0.41 | 0.39 | 0.41 | 0.47 | 0.10 | | | | | | | | |
| Institutional ownership (insurers) | (15) | 0.04 | -0.11 | 0.04 | 0.01 | -0.03 | -0.11 | -0.06 | -0.02 | 0.24 | 0.18 | 0.28 | 0.27 | 0.10 | 0.30 | | | | | | | |
| Institutional ownership (investment companies) | (16) | 0.01 | -0.07 | 0.05 | 0.02 | 0.02 | -0.05 | 0.04 | 0.01 | 0.13 | 0.02 | 0.20 | 0.12 | 0.14 | 0.14 | 0.29 | | | | | | |
| Institutional ownership (investment advisers) | (17) | -0.13 | -0.20 | 0.04 | 0.04 | -0.01 | -0.10 | -0.05 | 0.00 | 0.03 | 0.11 | 0.24 | 0.08 | 0.16 | 0.25 | 0.35 | 0.49 | | | | | |
| Institutional ownership (investment other) | (18) | 0.56 | 0.43 | 0.09 | -0.06 | 0.20 | 0.08 | 0.07 | -0.01 | 0.36 | -0.13 | 0.67 | 0.47 | 0.29 | -0.03 | -0.17 | -0.35 | -0.47 | | | | |
| Medium stake | (19) | 0.43 | 0.21 | 0.17 | -0.02 | 0.21 | -0.02 | 0.05 | 0.00 | 0.41 | 0.01 | 0.81 | 0.57 | 0.22 | 0.33 | 0.26 | 0.20 | 0.27 | 0.50 | | | |
| Analyst disagreement | (20) | -0.16 | -0.08 | -0.06 | 0.02 | -0.04 | 0.02 | -0.10 | -0.03 | -0.18 | -0.04 | -0.13 | -0.17 | -0.01 | -0.09 | -0.03 | -0.04 | -0.01 | -0.08 | -0.12 | | |
| Earnings surprise (abs) | (21) | -0.22 | -0.08 | -0.12 | -0.01 | -0.06 | 0.12 | -0.17 | -0.03 | -0.33 | -0.09 | -0.24 | -0.30 | -0.03 | -0.17 | -0.11 | -0.11 | -0.08 | -0.12 | -0.23 | 0.20 | |
| Price (log) | (22) | 0.41 | 0.11 | 0.20 | -0.01 | 0.09 | -0.17 | 0.27 | 0.03 | 0.74 | 0.27 | 0.48 | 0.65 | 0.03 | 0.43 | 0.28 | 0.23 | 0.22 | 0.17 | 0.42 | -0.24 | -0.43 |

## Table 2. Investor heterogeneity and trading volume: univariate analysis

T-tests of differences in mean *Trading volume* around earnings announcements across groups with high and low investor heterogeneity. For each investor heterogeneity measure, observations are assigned to the "high: top quartile" ("low: bottom quartile") group if investor heterogeneity is in the top quartile (lowest) quartile of the sample; observations are assigned to the "high: above median" ("low: below median") group if investor heterogeneity is above (below) the sample median. The sample and variables are defined in the Appendix. Statistical significance (two-sided hypothesis test) at 0.1%, 1%, and 5% levels is denoted with \*\*\*, \*\*, and \*, respectively.

| | Mean (High) (top quartile) | Mean (Low) (bottom quartile) | Mean(High)-Mean (Low) | Mean(High)-Mean (Low) Mean (All) | |
|---|---|---|---|---|---|
| Investor heterogeneity (size) | 0.777 | 0.218 | 0.559 | 1.2 | *** |
| Investor heterogeneity (experience) | 0.732 | 0.238 | 0.494 | 1.1 | *** |
| Investor heterogeneity (holding period) | 0.599 | 0.337 | 0.262 | 0.6 | *** |
| Investor heterogeneity (local exposure) | 0.592 | 0.426 | 0.166 | 0.4 | *** |
| | Mean (High) (above median) | Mean (Low) (below median) | Mean(High)-Mean (Low) | Mean(High)-Mean (Low) Mean (All) | |
| Investor heterogeneity (size) | 0.650 | 0.271 | 0.379 | 0.8 | *** |
| Investor heterogeneity (experience) | 0.630 | 0.292 | 0.338 | 0.7 | *** |
| Investor heterogeneity (holding period) | 0.527 | 0.394 | 0.133 | 0.3 | *** |
| Investor heterogeneity (local exposure) | 0.477 | 0.444 | 0.033 | 0.1 | *** |

# Table 3. Investor heterogeneity and trading volume: multivariate analysis

Regressions of *Trading volume* on investor heterogeneity measures and control variables. The sample and variables are defined in the Appendix. Robust standard errors with clustering by firm are italicized. Statistical significance at 0.1%, 1%, and 5% levels is denoted with ***, **, and *, respectively.

| | I | | II | | III | | IV | | V | |
|---|---|---|---|---|---|---|---|---|---|---|
| Investor heterogeneity (size) | 0.105 | *** | | | | | | | 0.041 | ** |
| | *0.01* | | | | | | | | *0.02* | |
| Investor heterogeneity (experience) | | | 0.462 | *** | | | | | 0.315 | *** |
| | | | *0.05* | | | | | | *0.05* | |
| Investor heterogeneity (holding period) | | | | | 0.232 | *** | | | 0.220 | *** |
| | | | | | *0.02* | | | | *0.02* | |
| Investor heterogeneity (local exposure) | | | | | | | 1.229 | *** | 1.208 | *** |
| | | | | | | | *0.20* | | *0.20* | |
| Announcement return (abs) | 0.081 | *** | 0.081 | *** | 0.082 | *** | 0.082 | *** | 0.081 | *** |
| | *1.E-03* | | *1.E-03* | | *1.E-03* | | *1.E-03* | | *1.E-03* | |
| Market-to-book ratio | 0.073 | *** | 0.071 | *** | 0.067 | *** | 0.069 | *** | 0.063 | *** |
| | *0.01* | | *0.01* | | *0.01* | | *0.01* | | *0.01* | |
| Sales growth | 0.145 | *** | 0.143 | *** | 0.142 | *** | 0.141 | *** | 0.137 | *** |
| | *0.02* | | *0.02* | | *0.02* | | *0.02* | | *0.02* | |
| Market value of equity (log) | -0.005 | | -0.002 | | 0.013 | | 0.006 | | 0.002 | |
| | *0.01* | | *0.01* | | *0.01* | | *0.01* | | *0.01* | |
| Dividend yield (%) | -0.132 | *** | -0.126 | *** | -0.155 | *** | -0.152 | *** | -0.126 | *** |
| | *0.01* | | *0.01* | | *0.01* | | *0.01* | | *0.01* | |
| Institutional ownership | 0.864 | *** | 0.866 | *** | 0.872 | *** | 0.900 | *** | 0.857 | *** |
| | *0.04* | | *0.03* | | *0.03* | | *0.03* | | *0.03* | |
| Number of institutions (log) | -0.004 | | 0.010 | | -0.001 | | 0.011 | | -0.009 | |
| | *0.02* | | *0.02* | | *0.02* | | *0.02* | | *0.02* | |
| | | | | | | | | | | |
| Obs. | 87645 | | 87645 | | 87645 | | 87645 | | 87645 | |
| R$^2$ | 0.245 | | 0.246 | | 0.248 | | 0.246 | | 0.250 | |

| *Economic magnitudes** | I | II | III | IV | V |
|---|---|---|---|---|---|
| Investor heterogeneity (size) | 44% | | | | 20% |
| Investor heterogeneity (experience) | | 45% | | | 35% |
| Investor heterogeneity (holding period) | | | 61% | | 62% |
| Investor heterogeneity (local exposure) | | | | 38% | 41% |
| Announcement return (abs) | 415% | 424% | 453% | 439% | 480% |
| Market-to-book ratio | 100% | 100% | 100% | 100% | 100% |
| Sales growth | 33% | 33% | 35% | 34% | 36% |
| Market value of equity (log) | -8% | -4% | 21% | 9% | 4% |
| Dividend yield (%) | -42% | -41% | -53% | -51% | -46% |
| Institutional ownership | 191% | 195% | 209% | 209% | 220% |
| Number of institutions (log) | -3% | 10% | -1% | 11% | -10% |

* Partial (ceteris paribus) effect of a 1σ increase in the explanatory variable on trading volume, as a % of the partial effect of a 1σ increase in Market-to-book ratio on trading volume.

# Table 4. Investor heterogeneity and trading volume: negative and positive earnings surprises

## Panel A. Negative earnings surprises

Regressions of *Trading volume* on investor heterogeneity measures and control variables within the subsample of negative earnings surprises. The sample and variables are defined in the Appendix. Robust standard errors with clustering by firm are italicized. Statistical significance at 0.1%, 1%, and 5% levels is denoted with ***, **, and *, respectively.

| | I | | II | | III | | IV | | V | |
|---|---|---|---|---|---|---|---|---|---|---|
| Investor heterogeneity (size) | 0.078 | *** | | | | | | | 0.077 | *** |
| | *0.02* | | | | | | | | *0.02* | |
| Investor heterogeneity (experience) | | | 0.116 | * | | | | | -0.048 | |
| | | | *0.05* | | | | | | *0.06* | |
| Investor heterogeneity (holding period) | | | | | 0.157 | *** | | | 0.153 | *** |
| | | | | | *0.02* | | | | *0.02* | |
| Investor heterogeneity (local exposure) | | | | | | | 0.516 | ** | 0.526 | ** |
| | | | | | | | *0.19* | | *0.19* | |
| Announcement return (abs) | 0.080 | *** | 0.080 | *** | 0.080 | *** | 0.080 | *** | 0.080 | *** |
| | *2.E-03* | | *2.E-03* | | *2.E-03* | | *2.E-03* | | *2.E-03* | |
| Market-to-book ratio | 0.060 | *** | 0.060 | *** | 0.056 | *** | 0.060 | *** | 0.055 | *** |
| | *0.01* | | *0.01* | | *0.01* | | *0.01* | | *0.01* | |
| Sales growth | 0.084 | *** | 0.084 | *** | 0.086 | *** | 0.084 | *** | 0.085 | *** |
| | *0.02* | | *0.02* | | *0.02* | | *0.02* | | *0.02* | |
| Market value of equity (log) | 0.052 | *** | 0.056 | *** | 0.063 | *** | 0.058 | *** | 0.057 | *** |
| | *0.01* | | *0.01* | | *0.01* | | *0.01* | | *0.01* | |
| Dividend yield (%) | -0.062 | *** | -0.069 | *** | -0.077 | *** | -0.076 | *** | -0.066 | *** |
| | *0.01* | | *0.01* | | *0.01* | | *0.01* | | *0.01* | |
| Institutional ownership | 0.945 | *** | 0.961 | *** | 0.956 | *** | 0.973 | *** | 0.942 | *** |
| | *0.04* | | *0.04* | | *0.04* | | *0.04* | | *0.04* | |
| Number of institutions (log) | -0.062 | *** | -0.052 | ** | -0.060 | *** | -0.053 | ** | -0.071 | *** |
| | *0.02* | | *0.02* | | *0.02* | | *0.02* | | *0.02* | |
| Obs. | 39442 | | 39442 | | 39442 | | 39442 | | 39442 | |
| $R^2$ | 0.257 | | 0.256 | | 0.258 | | 0.256 | | 0.258 | |

## Panel B. Positive earnings surprises

Regressions of *Trading volume* on investor heterogeneity measures and control variables within the subsample of positive earnings surprises. The sample and variables are defined in the Appendix. Robust standard errors with clustering by firm are italicized. Statistical significance at 0.1%, 1%, and 5% levels is denoted with ***, **, and *, respectively.

|  | I | | II | | III | | IV | | V | |
|---|---|---|---|---|---|---|---|---|---|---|
| Investor heterogeneity (size) | 0.140 | *** | | | | | | | 0.020 | |
|  | *0.02* | | | | | | | | *0.02* | |
| Investor heterogeneity (experience) | | | 0.828 | *** | | | | | 0.694 | *** |
|  | | | *0.07* | | | | | | *0.08* | |
| Investor heterogeneity (holding period) | | | | | 0.275 | *** | | | 0.259 | *** |
|  | | | | | *0.03* | | | | *0.03* | |
| Investor heterogeneity (local exposure) | | | | | | | 1.791 | *** | 1.733 | *** |
|  | | | | | | | *0.29* | | *0.29* | |
| Announcement return (abs) | 0.082 | *** | 0.082 | *** | 0.083 | *** | 0.083 | *** | 0.081 | *** |
|  | *2.E-03* | | *2.E-03* | | *2.E-03* | | *2.E-03* | | *2.E-03* | |
| Market-to-book ratio | 0.077 | *** | 0.074 | *** | 0.070 | *** | 0.071 | *** | 0.064 | *** |
|  | *0.01* | | *0.01* | | *0.01* | | *0.01* | | *0.01* | |
| Sales growth | 0.176 | *** | 0.173 | *** | 0.167 | *** | 0.168 | *** | 0.161 | *** |
|  | *0.02* | | *0.02* | | *0.02* | | *0.02* | | *0.02* | |
| Market value of equity (log) | -0.058 | *** | -0.055 | *** | -0.032 | ** | -0.043 | *** | -0.047 | *** |
|  | *0.01* | | *0.01* | | *0.01* | | *0.01* | | *0.01* | |
| Dividend yield (%) | -0.198 | *** | -0.177 | *** | -0.230 | *** | -0.223 | *** | -0.179 | *** |
|  | *0.02* | | *0.02* | | *0.02* | | *0.02* | | *0.02* | |
| Institutional ownership | 0.756 | *** | 0.749 | *** | 0.763 | *** | 0.795 | *** | 0.746 | *** |
|  | *0.05* | | *0.05* | | *0.05* | | *0.05* | | *0.04* | |
| Number of institutions (log) | 0.044 | * | 0.059 | ** | 0.051 | * | 0.069 | ** | 0.040 | |
|  | *0.02* | | *0.02* | | *0.02* | | *0.02* | | *0.02* | |
| Obs. | 48203 | | 48203 | | 48203 | | 48203 | | 48203 | |
| $R^2$ | 0.235 | | 0.237 | | 0.237 | | 0.236 | | 0.243 | |

# Table 5. Investor heterogeneity and trading volume: additional tests

*Panel A. Adjusting for industry*

Regressions of *Trading volume* on investor heterogeneity measures and control variables in the sample of earnings surprises. The sample and variables are defined in the Appendix. All variables are industry mean adjusted at the three-digit SIC level. Robust standard errors with clustering by firm are italicized. Statistical significance at 0.1%, 1%, and 5% levels is denoted with ***, **, and *, respectively.

| | I | II | III | IV | V |
|---|---|---|---|---|---|
| Investor heterogeneity (size) | 0.106 *** | | | | 0.044 ** |
| | *0.01* | | | | *0.02* |
| Investor heterogeneity (experience) | | 0.460 *** | | | 0.311 *** |
| | | *0.05* | | | *0.05* |
| Investor heterogeneity (holding period) | | | 0.208 *** | | 0.194 *** |
| | | | *0.02* | | *0.02* |
| Investor heterogeneity (local exposure) | | | | 1.015 *** | 0.986 *** |
| | | | | *0.19* | *0.18* |
| Announcement return (abs) | 0.078 *** | 0.078 *** | 0.079 *** | 0.079 *** | 0.078 *** |
| | *1.E-03* | *1.E-03* | *1.E-03* | *1.E-03* | *1.E-03* |
| Market-to-book ratio | 0.074 *** | 0.073 *** | 0.067 *** | 0.072 *** | 0.066 *** |
| | *0.01* | *0.01* | *0.01* | *0.01* | *0.01* |
| Sales growth | 0.154 *** | 0.152 *** | 0.150 *** | 0.150 *** | 0.147 *** |
| | *0.02* | *0.02* | *0.02* | *0.02* | *0.02* |
| Market value of equity (log) | 0.003 | 0.007 | 0.021 * | 0.014 | 0.008 |
| | *0.01* | *0.01* | *0.01* | *0.01* | *0.01* |
| Dividend yield (%) | -0.076 *** | -0.073 *** | -0.095 *** | -0.100 *** | -0.072 *** |
| | *0.01* | *0.01* | *0.01* | *0.01* | *0.01* |
| Institutional ownership | 0.884 *** | 0.884 *** | 0.896 *** | 0.916 *** | 0.875 *** |
| | *0.04* | *0.03* | *0.03* | *0.03* | *0.03* |
| Number of institutions (log) | -0.014 | 0.001 | -0.010 | 0.003 | -0.014 |
| | *0.02* | *0.02* | *0.02* | *0.02* | *0.02* |
| Obs. | 87645 | 87645 | 87645 | 87645 | 87645 |
| $R^2$ | 0.223 | 0.224 | 0.225 | 0.223 | 0.227 |

## Panel B. Interaction terms approach

Regressions of *Trading volume* on investor heterogeneity measures and interactions between investor heterogeneity measures and Announcement return (abs) and control variables in the sample of earnings surprises. The sample and variables are defined in the Appendix. All variables are industry mean adjusted at the three-digit SIC level. Robust standard errors with clustering by firm are italicized. Statistical significance at 0.1%, 1%, and 5% levels is denoted with ***, **, and *, respectively.

| | I | | II | | III | | IV | | V | | VI | | VII | | VIII | | IX | | X | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Announcement return (abs) * Investor heterogeneity (size) | 0.047 | *** | 0.047 | *** | | | | | | | | | | | | | 0.035 | *** | 0.036 | *** |
| | *3.E-03* | | *3.E-03* | | | | | | | | | | | | | | *3.E-03* | | *3.E-03* | |
| Announcement return (abs) * Investor heterogeneity (experience) | | | | | 0.139 | *** | 0.135 | *** | | | | | | | | | 0.051 | *** | 0.046 | *** |
| | | | | | *0.01* | | *0.01* | | | | | | | | | | *0.01* | | *0.01* | |
| Announcement return (abs) * Investor heterogeneity (holding period) | | | | | | | | | 0.049 | *** | 0.045 | *** | | | | | 0.038 | *** | 0.034 | *** |
| | | | | | | | | | *4.E-03* | | *4.E-03* | | | | | | *4.E-03* | | *4.E-03* | |
| Announcement return (abs) * Investor heterogeneity (local exposure) | | | | | | | | | | | | | 0.075 | * | 0.056 | | 0.029 | | 0.009 | |
| | | | | | | | | | | | | | *0.04* | | *0.03* | | *0.03* | | *0.03* | |
| Investor heterogeneity (size) | | | 0.121 | *** | | | | | | | | | | | | | | | 0.060 | *** |
| | | | *0.01* | | | | | | | | | | | | | | | | *0.02* | |
| Investor heterogeneity (experience) | | | | | | | 0.409 | *** | | | | | | | | | | | 0.311 | *** |
| | | | | | | | *0.04* | | | | | | | | | | | | *0.05* | |
| Investor heterogeneity (holding period) | | | | | | | | | | | 0.165 | *** | | | | | | | 0.148 | *** |
| | | | | | | | | | | | *0.02* | | | | | | | | *0.02* | |
| Investor heterogeneity (local exposure) | | | | | | | | | | | | | | | 0.976 | *** | | | 0.894 | *** |
| | | | | | | | | | | | | | | | *0.18* | | | | *0.17* | |
| Announcement return (abs) | 0.081 | *** | 0.080 | *** | 0.079 | *** | 0.078 | *** | 0.078 | *** | 0.078 | *** | 0.079 | *** | 0.079 | *** | 0.080 | *** | 0.079 | *** |
| | *1.E-03* | | *1.E-03* | | *1.E-03* | | *1.E-03* | | *1.E-03* | | *1.E-03* | | *1.E-03* | | *1.E-03* | | *1.E-03* | | *1.E-03* | |
| Market-to-book ratio | 0.071 | *** | 0.071 | *** | 0.073 | *** | 0.072 | *** | 0.071 | *** | 0.066 | *** | 0.074 | *** | 0.072 | *** | 0.069 | *** | 0.063 | *** |
| | *0.01* | | *0.01* | | *0.01* | | *0.01* | | *0.01* | | *0.01* | | *0.01* | | *0.01* | | *0.01* | | *0.01* | |
| Sales growth | 0.152 | *** | 0.153 | *** | 0.153 | *** | 0.151 | *** | 0.152 | *** | 0.150 | *** | 0.153 | *** | 0.150 | *** | 0.151 | *** | 0.146 | *** |
| | *0.02* | | *0.02* | | *0.02* | | *0.02* | | *0.02* | | *0.02* | | *0.02* | | *0.02* | | *0.02* | | *0.02* | |
| Market value of equity (log) | 0.022 | * | 0.008 | | 0.017 | | 0.009 | | 0.016 | | 0.020 | * | 0.016 | | 0.014 | | 0.021 | * | 0.010 | |
| | *0.01* | | *0.01* | | *0.01* | | *0.01* | | *0.01* | | *0.01* | | *0.01* | | *0.01* | | *0.01* | | *0.01* | |
| Dividend yield (%) | -0.106 | *** | -0.082 | *** | -0.104 | *** | -0.082 | *** | -0.101 | *** | -0.098 | *** | -0.097 | *** | -0.100 | *** | -0.109 | *** | -0.080 | *** |
| | *0.01* | | *0.01* | | *0.01* | | *0.01* | | *0.01* | | *0.01* | | *0.01* | | *0.01* | | *0.01* | | *0.01* | |
| Institutional ownership | 0.895 | *** | 0.866 | *** | 0.908 | *** | 0.885 | *** | 0.907 | *** | 0.896 | *** | 0.909 | *** | 0.915 | *** | 0.895 | *** | 0.859 | *** |
| | *0.03* | | *0.03* | | *0.03* | | *0.03* | | *0.03* | | *0.03* | | *0.03* | | *0.03* | | *0.03* | | *0.03* | |
| Number of institutions (log) | -0.004 | | -0.020 | | 0.002 | | 0.002 | | 0.000 | | -0.009 | | 0.001 | | 0.003 | | -0.003 | | -0.018 | |
| | *0.02* | | *0.02* | | *0.02* | | *0.02* | | *0.02* | | *0.02* | | *0.02* | | *0.02* | | *0.02* | | *0.02* | |
| Obs. | 87645 | | 87645 | | 87645 | | 87645 | | 87645 | | 87645 | | 87645 | | 87645 | | 87645 | | 87645 | |
| $R^2$ | 0.232 | | 0.233 | | 0.228 | | 0.229 | | 0.228 | | 0.229 | | 0.223 | | 0.223 | | 0.236 | | 0.239 | |

# Table 6. Investor heterogeneity and trading volume: alternative sample and variable definitions and additional controls

## Panel A. Large surprises

Regressions of *Trading volume* on investor heterogeneity measures and control variables in the sample of large earnings surprises. An earnings surprise is considered large if its magnitude exceeds ten cents per share for positive surprises and fifteen cents per share for negative surprises (approximate cutoffs for the top quartile of magnitude). The sample and variables are defined in the Appendix. All variables are industry mean adjusted at the three-digit SIC level. Robust standard errors with clustering by firm are italicized. Statistical significance at 0.1%, 1%, and 5% levels is denoted with ***, **, and *, respectively.

| | I | | II | | III | | IV | | V | |
|---|---|---|---|---|---|---|---|---|---|---|
| Investor heterogeneity (size) | 0.162 | *** | | | | | | | 0.106 | *** |
| | *0.03* | | | | | | | | *0.03* | |
| Investor heterogeneity (experience) | | | 0.522 | *** | | | | | 0.254 | ** |
| | | | *0.09* | | | | | | *0.10* | |
| Investor heterogeneity (holding period) | | | | | 0.252 | *** | | | 0.231 | *** |
| | | | | | *0.04* | | | | *0.04* | |
| Investor heterogeneity (local exposure) | | | | | | | 0.918 | ** | 0.910 | ** |
| | | | | | | | *0.34* | | *0.34* | |
| Announcement return (abs) | 0.079 | *** | 0.079 | *** | 0.080 | *** | 0.080 | *** | 0.079 | *** |
| | *2.E-03* | | *2.E-03* | | *2.E-03* | | *2.E-03* | | *2.E-03* | |
| Market-to-book ratio | 0.087 | *** | 0.086 | *** | 0.079 | *** | 0.086 | *** | 0.077 | *** |
| | *0.01* | | *0.01* | | *0.01* | | *0.01* | | *0.01* | |
| Sales growth | 0.171 | *** | 0.169 | *** | 0.167 | *** | 0.169 | *** | 0.164 | *** |
| | *0.03* | | *0.03* | | *0.03* | | *0.03* | | *0.03* | |
| Market value of equity (log) | 0.035 | * | 0.042 | ** | 0.053 | *** | 0.050 | *** | 0.035 | * |
| | *0.02* | | *0.02* | | *0.02* | | *0.02* | | *0.02* | |
| Dividend yield (%) | -0.098 | *** | -0.103 | *** | -0.123 | *** | -0.135 | *** | -0.092 | *** |
| | *0.02* | | *0.02* | | *0.02* | | *0.02* | | *0.02* | |
| Institutional ownership | 0.988 | *** | 0.998 | *** | 1.011 | *** | 1.048 | *** | 0.961 | *** |
| | *0.06* | | *0.06* | | *0.06* | | *0.06* | | *0.06* | |
| Number of institutions (log) | -0.065 | * | -0.046 | | -0.050 | | -0.044 | | -0.060 | * |
| | *0.03* | | *0.03* | | *0.03* | | *0.03* | | *0.03* | |
| | | | | | | | | | | |
| Obs. | 23234 | | 23234 | | 23234 | | 23234 | | 23234 | |
| $R^2$ | 0.235 | | 0.235 | | 0.236 | | 0.233 | | 0.238 | |

*Panel B. Fourth quarter announcements.*

Regressions of *Trading volume* on investor heterogeneity measures and control variables in the sample of large fourth quarter earnings surprises. An earnings surprise is considered large if its magnitude exceeds ten cents per share for positive surprises and fifteen cents per share for negative surprises (approximate cutoffs for the top quartile of magnitude). The sample and variables are defined in the Appendix. All variables are industry mean adjusted at the three-digit SIC level. Robust standard errors with clustering by firm are italicized. Statistical significance at 0.1%, 1%, and 5% levels is denoted with *** , ** , and * , respectively.

| | I | | II | | III | | IV | | V | |
|---|---|---|---|---|---|---|---|---|---|---|
| Investor heterogeneity (size) | 0.190 | *** | | | | | | | 0.113 | * |
| | *0.04* | | | | | | | | *0.05* | |
| Investor heterogeneity (experience) | | | 0.648 | *** | | | | | 0.356 | * |
| | | | *0.15* | | | | | | *0.18* | |
| Investor heterogeneity (holding period) | | | | | 0.279 | *** | | | 0.262 | *** |
| | | | | | *0.07* | | | | *0.07* | |
| Investor heterogeneity (local exposure) | | | | | | | 2.065 | *** | 2.038 | *** |
| | | | | | | | *0.61* | | *0.61* | |
| Announcement return (abs) | 0.087 | *** | 0.087 | *** | 0.088 | *** | 0.088 | *** | 0.087 | *** |
| | *4.E-03* | | *4.E-03* | | *4.E-03* | | *4.E-03* | | *4.E-03* | |
| Market-to-book ratio | 0.087 | *** | 0.086 | *** | 0.078 | *** | 0.084 | *** | 0.072 | *** |
| | *0.02* | | *0.02* | | *0.02* | | *0.02* | | *0.02* | |
| Sales growth | 0.215 | *** | 0.212 | *** | 0.214 | *** | 0.211 | *** | 0.203 | ** |
| | *0.06* | | *0.06* | | *0.06* | | *0.06* | | *0.06* | |
| Market value of equity (log) | 0.009 | | 0.016 | | 0.029 | | 0.023 | | 0.006 | |
| | *0.03* | | *0.03* | | *0.03* | | *0.03* | | *0.03* | |
| Dividend yield (%) | -0.117 | *** | -0.119 | *** | -0.144 | *** | -0.165 | *** | -0.111 | *** |
| | *0.03* | | *0.03* | | *0.03* | | *0.03* | | *0.03* | |
| Institutional ownership | 0.956 | *** | 0.956 | *** | 0.984 | *** | 1.027 | *** | 0.919 | *** |
| | *0.10* | | *0.10* | | *0.10* | | *0.10* | | *0.10* | |
| Number of institutions (log) | -0.007 | | 0.017 | | 0.013 | | 0.022 | | 0.005 | |
| | *0.04* | | *0.04* | | *0.04* | | *0.04* | | *0.04* | |
| | | | | | | | | | | |
| Obs. | 6357 | | 6357 | | 6357 | | 6357 | | 6357 | |
| $R^2$ | 0.252 | | 0.252 | | 0.253 | | 0.253 | | 0.259 | |

## Panel C. Additional controls

Regressions of *Trading volume* on investor heterogeneity measures and baseline and additional control variables in the sample of large earnings surprises. An earnings surprise is considered large if its magnitude exceeds ten cents per share for positive surprises and fifteen cents per share for negative surprises (approximate cutoffs for the top quartile of magnitude).The sample and variables are defined in the Appendix. All variables are industry mean adjusted at the three-digit SIC level. Robust standard errors with clustering by firm are italicized. Statistical significance at 0.1%, 1%, and 5% levels is denoted with [***], [**], and [*], respectively.

| | I | | II | | III | | IV | | V | |
|---|---|---|---|---|---|---|---|---|---|---|
| Investor heterogeneity (fund size) | 0.189 | *** | | | | | | | 0.112 | ** |
| | *0.04* | | | | | | | | *0.04* | |
| Investor heterogeneity (fund history) | | | 0.721 | *** | | | | | 0.452 | *** |
| | | | *0.13* | | | | | | *0.14* | |
| Investor heterogeneity (holding period) | | | | | 0.175 | *** | | | 0.136 | ** |
| | | | | | *0.05* | | | | *0.05* | |
| Investor heterogeneity (local exposure) | | | | | | | 1.382 | *** | 1.337 | *** |
| | | | | | | | *0.40* | | *0.40* | |
| Announcement return (abs) | 0.084 | *** | 0.084 | *** | 0.084 | *** | 0.084 | *** | 0.083 | *** |
| | *3.E-03* | | *3.E-03* | | *3.E-03* | | *3.E-03* | | *3.E-03* | |
| Market-to-book ratio | 0.066 | *** | 0.064 | *** | 0.064 | *** | 0.064 | *** | 0.059 | *** |
| | *0.01* | | *0.01* | | *0.01* | | *0.01* | | *0.01* | |
| Sales growth | 0.136 | *** | 0.133 | *** | 0.134 | *** | 0.131 | *** | 0.129 | *** |
| | *0.04* | | *0.04* | | *0.04* | | *0.04* | | *0.04* | |
| Market value of equity (log) | -0.068 | ** | -0.059 | * | -0.023 | | -0.041 | | -0.066 | ** |
| | *0.02* | | *0.02* | | *0.02* | | *0.02* | | *0.02* | |
| Dividend yield (%) | -0.094 | *** | -0.097 | *** | -0.108 | *** | -0.121 | *** | -0.088 | *** |
| | *0.03* | | *0.03* | | *0.03* | | *0.03* | | *0.03* | |
| Institutional ownership (banks) | 0.689 | *** | 0.673 | *** | 0.600 | *** | 0.544 | ** | 0.764 | *** |
| | *0.17* | | *0.17* | | *0.17* | | *0.17* | | *0.17* | |
| Institutional ownership (insurers) | 0.237 | | 0.272 | | 0.092 | | 0.082 | | 0.246 | |
| | *0.29* | | *0.29* | | *0.29* | | *0.29* | | *0.29* | |
| Institutional ownership (investment companies) | 0.685 | *** | 0.728 | *** | 0.803 | *** | 0.849 | *** | 0.702 | *** |
| | *0.20* | | *0.20* | | *0.20* | | *0.20* | | *0.20* | |
| Institutional ownership (investment advisers) | 0.934 | *** | 0.895 | *** | 0.924 | *** | 0.895 | *** | 0.907 | *** |
| | *0.11* | | *0.11* | | *0.11* | | *0.11* | | *0.11* | |
| Institutional ownership (other) | 0.993 | *** | 0.993 | *** | 1.100 | *** | 1.113 | *** | 0.976 | *** |
| | *0.09* | | *0.08* | | *0.08* | | *0.08* | | *0.09* | |
| Announcement return (abs)*Medium stake | 0.228 | *** | 0.227 | *** | 0.224 | *** | 0.225 | *** | 0.226 | *** |
| | *0.02* | | *0.02* | | *0.02* | | *0.02* | | *0.02* | |
| Announcement return (abs)*Medium stake$^2$ | 0.144 | | 0.142 | | 0.147 | | 0.144 | | 0.149 | |
| | *0.12* | | *0.12* | | *0.12* | | *0.12* | | *0.12* | |
| Number of institutions (log) | -0.014 | | 0.009 | | -0.007 | | 0.011 | | -0.008 | |
| | *0.04* | | *0.04* | | *0.04* | | *0.04* | | *0.04* | |
| Institutional blockholder (5%) | -0.075 | ** | -0.067 | ** | -0.067 | ** | -0.061 | ** | -0.076 | *** |
| | *0.02* | | *0.02* | | *0.02* | | *0.02* | | *0.02* | |
| Earnings surprise (abs) | -0.030 | *** | -0.030 | *** | -0.030 | *** | -0.031 | *** | -0.029 | *** |
| | *4.E-03* | | *4.E-03* | | *4.E-03* | | *4.E-03* | | *4.E-03* | |
| Analyst disagreement | 0.001 | | -0.002 | | -0.005 | | -0.006 | | 0.001 | |
| | *0.02* | | *0.02* | | *0.02* | | *0.02* | | *0.02* | |
| Price (log) | 0.131 | *** | 0.132 | *** | 0.093 | *** | 0.116 | *** | 0.126 | *** |
| | *0.03* | | *0.03* | | *0.03* | | *0.02* | | *0.03* | |
| Obs. | 17155 | | 17155 | | 17155 | | 17155 | | 17155 | |
| $R^2$ | 0.281 | | 0.281 | | 0.280 | | 0.280 | | 0.284 | |

## Panel D. Same-quarter estimates.

Regressions of *Trading volume* on investor heterogeneity measures and control variables. The sample and variables are defined in the Appendix, except that contemporaneous (same-quarter) values of *Trading volume* and *Announcement return* (*abs*) are used. All variables are industry mean adjusted at the three-digit SIC level. Robust standard errors with clustering by firm are italicized. Statistical significance at 0.1%, 1%, and 5% levels is denoted with $^{***}$, $^{**}$, and $^{*}$, respectively.

|  | I | II | III | IV | V |
|---|---|---|---|---|---|
| Investor heterogeneity (size) | 0.117$^{***}$ | | | | 0.024 |
|  | *0.01* | | | | *0.02* |
| Investor heterogeneity (experience) | | 0.594$^{***}$ | | | 0.432$^{***}$ |
|  | | *0.04* | | | *0.05* |
| Investor heterogeneity (holding period) | | | 0.374$^{***}$ | | 0.357$^{***}$ |
|  | | | *0.02* | | *0.02* |
| Investor heterogeneity (local exposure) | | | | 1.132$^{***}$ | 1.098$^{***}$ |
|  | | | | *0.18* | *0.17* |
| Announcement return (abs) | 0.078$^{***}$ | 0.078$^{***}$ | 0.078$^{***}$ | 0.078$^{***}$ | 0.077$^{***}$ |
|  | *1.E-03* | *1.E-03* | *1.E-03* | *1.E-03* | *1.E-03* |
| Institutional ownership | 0.913$^{***}$ | 0.904$^{***}$ | 0.916$^{***}$ | 0.948$^{***}$ | 0.890$^{***}$ |
|  | *0.03* | *0.03* | *0.03* | *0.03* | *0.03* |
| Number of institutions (log) | -0.002 | 0.014 | -0.005 | 0.017 | -0.005 |
|  | *0.02* | *0.02* | *0.02* | *0.02* | *0.02* |
| Market-to-book ratio | 0.081$^{***}$ | 0.079$^{***}$ | 0.069$^{***}$ | 0.078$^{***}$ | 0.067$^{***}$ |
|  | *0.01* | *0.01* | *0.01* | *0.01* | *0.01* |
| Sales growth | 0.152$^{***}$ | 0.150$^{***}$ | 0.146$^{***}$ | 0.149$^{***}$ | 0.143$^{***}$ |
|  | *0.02* | *0.02* | *0.02* | *0.02* | *0.02* |
| Market value of equity (log) | 0.002 | 0.004 | 0.024$^{**}$ | 0.013 | 0.010 |
|  | *0.01* | *0.01* | *0.01* | *0.01* | *0.01* |
| Dividend yield (%) | -0.066$^{***}$ | -0.057$^{***}$ | -0.084$^{***}$ | -0.093$^{***}$ | -0.059$^{***}$ |
|  | *0.01* | *0.01* | *0.01* | *0.01* | *0.01* |
| Obs. | 90530 | 90530 | 90530 | 90530 | 90530 |
| $R^2$ | 0.233 | 0.235 | 0.241 | 0.233 | 0.243 |

## Table 7. Investor heterogeneity and magnitude of price reaction around earnings announcements

Regressions of *Announcement return* (*abs*) on investor heterogeneity measures and control variables in the sample of earnings surprises. The sample and variables are defined in the Appendix. All variables are industry mean adjusted at the three-digit SIC level. Robust standard errors with clustering by firm are italicized. Statistical significance at 0.1%, 1%, and 5% levels is denoted with ***, **, and *, respectively.

| | I | | II | | III | | IV | | V | |
|---|---|---|---|---|---|---|---|---|---|---|
| Investor heterogeneity (size) | 1.344 | *** | | | | | | | 0.935 | *** |
| | *0.07* | | | | | | | | *0.08* | |
| Investor heterogeneity (experience) | | | 4.093 | *** | | | | | 2.417 | *** |
| | | | *0.24* | | | | | | *0.28* | |
| Investor heterogeneity (holding period) | | | | | 0.464 | *** | | | 0.284 | ** |
| | | | | | *0.10* | | | | *0.10* | |
| Investor heterogeneity (local exposure) | | | | | | | 1.000 | | 0.630 | |
| | | | | | | | *0.80* | | *0.79* | |
| Earnings surprise (abs) | 0.301 | *** | 0.300 | *** | 0.314 | *** | 0.308 | *** | 0.301 | *** |
| | *0.02* | | *0.02* | | *0.02* | | *0.02* | | *0.02* | |
| Market-to-book ratio | 0.383 | *** | 0.371 | *** | 0.366 | *** | 0.378 | *** | 0.367 | *** |
| | *0.02* | | *0.02* | | *0.02* | | *0.02* | | *0.02* | |
| Sales growth | 0.403 | *** | 0.388 | *** | 0.398 | *** | 0.401 | *** | 0.389 | *** |
| | *0.08* | | *0.08* | | *0.08* | | *0.08* | | *0.08* | |
| Market value of equity (log) | -0.840 | *** | -0.766 | *** | -0.668 | *** | -0.686 | *** | -0.832 | *** |
| | *0.05* | | *0.05* | | *0.05* | | *0.05* | | *0.05* | |
| Dividend yield (%) | -1.639 | *** | -1.695 | *** | -1.914 | *** | -1.925 | *** | -1.588 | *** |
| | *0.07* | | *0.07* | | *0.08* | | *0.08* | | *0.07* | |
| Institutional ownership | -0.139 | | -0.050 | | 0.169 | | 0.197 | | -0.190 | |
| | *0.16* | | *0.15* | | *0.16* | | *0.16* | | *0.16* | |
| Number of institutions (log) | 0.580 | *** | 0.765 | *** | 0.741 | *** | 0.771 | *** | 0.619 | *** |
| | *0.08* | | *0.08* | | *0.08* | | *0.08* | | *0.08* | |
| Obs. | 87645 | | 87645 | | 87645 | | 87645 | | 87645 | |
| $R^2$ | 0.043 | | 0.043 | | 0.038 | | 0.038 | | 0.045 | |

# Table 8. Investor heterogeneity and price reaction to earnings announcements

## Panel A. Negative earnings surprises

Regressions of *Announcement return* on investor heterogeneity measures and control variables in the sample of negative earnings surprises. The sample and variables are defined in the Appendix. All variables are industry mean adjusted at the three-digit SIC level. Robust standard errors with clustering by firm are italicized. Statistical significance at 0.1%, 1%, and 5% levels is denoted with ***, **, and *, respectively.

| | I | | II | | III | | IV | | V | |
|---|---|---|---|---|---|---|---|---|---|---|
| Investor heterogeneity (size) | -1.334 | *** | | | | | | | -0.872 | *** |
| | *0.14* | | | | | | | | *0.16* | |
| Investor heterogeneity (experience) | | | -3.899 | *** | | | | | -2.399 | *** |
| | | | *0.42* | | | | | | *0.51* | |
| Investor heterogeneity (holding period) | | | | | -0.888 | *** | | | -0.693 | *** |
| | | | | | *0.18* | | | | *0.18* | |
| Investor heterogeneity (local exposure) | | | | | | | 0.839 | | 1.267 | |
| | | | | | | | *1.43* | | *1.40* | |
| Earnings surprise | 0.097 | *** | 0.095 | *** | 0.111 | *** | 0.103 | *** | 0.100 | *** |
| | *0.02* | | *0.02* | | *0.02* | | *0.02* | | *0.02* | |
| Market-to-book ratio | -0.229 | *** | -0.218 | *** | -0.210 | *** | -0.238 | *** | -0.201 | *** |
| | *0.05* | | *0.05* | | *0.05* | | *0.05* | | *0.05* | |
| Sales growth | -0.088 | | -0.074 | | -0.099 | | -0.098 | | -0.082 | |
| | *0.17* | | *0.17* | | *0.17* | | *0.17* | | *0.17* | |
| Market value of equity (log) | 0.494 | *** | 0.449 | *** | 0.351 | *** | 0.375 | *** | 0.476 | *** |
| | *0.08* | | *0.08* | | *0.08* | | *0.08* | | *0.08* | |
| Dividend yield (%) | 0.515 | *** | 0.561 | *** | 0.755 | *** | 0.768 | *** | 0.458 | *** |
| | *0.12* | | *0.12* | | *0.11* | | *0.11* | | *0.12* | |
| Institutional ownership | 0.091 | | -0.040 | | -0.259 | | -0.308 | | 0.172 | |
| | *0.29* | | *0.29* | | *0.29* | | *0.29* | | *0.29* | |
| Number of institutions (log) | -0.447 | ** | -0.630 | *** | -0.565 | *** | -0.610 | *** | -0.478 | *** |
| | *0.14* | | *0.14* | | *0.14* | | *0.14* | | *0.14* | |
| Obs. | 39442 | | 39442 | | 39442 | | 39442 | | 39442 | |
| $R^2$ | 0.007 | | 0.006 | | 0.005 | | 0.004 | | 0.008 | |

## Panel B. Positive earnings surprises

Regressions of *Announcement return* on investor heterogeneity measures and control variables in the sample of positive earnings surprises. The sample and variables are defined in the Appendix. All variables are industry mean adjusted at the three-digit SIC level. Robust standard errors with clustering by firm are italicized. Statistical significance at 0.1%, 1%, and 5% levels is denoted with ***, **, and *, respectively.

| | I | | II | | III | | IV | | V | |
|---|---|---|---|---|---|---|---|---|---|---|
| Investor heterogeneity (size) | 0.603 | *** | | | | | | | 0.666 | *** |
| | *0.12* | | | | | | | | *0.14* | |
| Investor heterogeneity (experience) | | | 0.748 | | | | | | -0.537 | |
| | | | *0.46* | | | | | | *0.54* | |
| Investor heterogeneity (holding period) | | | | | 0.364 | * | | | 0.326 | * |
| | | | | | *0.15* | | | | *0.16* | |
| Investor heterogeneity (local exposure) | | | | | | | -2.496 | | -2.368 | |
| | | | | | | | *1.49* | | *1.49* | |
| Earnings surprise | 0.572 | *** | 0.578 | *** | 0.598 | *** | 0.588 | *** | 0.590 | *** |
| | *0.07* | | *0.07* | | *0.07* | | *0.07* | | *0.07* | |
| Market-to-book ratio | 0.001 | | -0.005 | | -0.015 | | 0.001 | | -0.003 | |
| | *0.03* | | *0.03* | | *0.03* | | *0.03* | | *0.03* | |
| Sales growth | 0.225 | | 0.219 | | 0.211 | | 0.229 | | 0.226 | |
| | *0.15* | | *0.15* | | *0.15* | | *0.15* | | *0.15* | |
| Market value of equity (log) | -0.308 | *** | -0.246 | ** | -0.215 | ** | -0.224 | ** | -0.285 | *** |
| | *0.08* | | *0.08* | | *0.08* | | *0.08* | | *0.08* | |
| Dividend yield (%) | -0.505 | *** | -0.591 | *** | -0.625 | *** | -0.627 | *** | -0.512 | *** |
| | *0.12* | | *0.12* | | *0.12* | | *0.12* | | *0.12* | |
| Institutional ownership | 1.087 | *** | 1.163 | *** | 1.192 | *** | 1.190 | *** | 1.084 | *** |
| | *0.26* | | *0.26* | | *0.25* | | *0.25* | | *0.26* | |
| Number of institutions (log) | -0.067 | | 0.027 | | 0.004 | | 0.024 | | -0.105 | |
| | *0.14* | | *0.14* | | *0.14* | | *0.14* | | *0.14* | |
| Obs. | 48203 | | 48203 | | 48203 | | 48203 | | 48203 | |
| $R^2$ | 0.007 | | 0.007 | | 0.007 | | 0.007 | | 0.007 | |