Institutional Demand and Post-earnings-announcement Return

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ABSTRACT

This paper shows that institutional demand in the pre-announcement period negatively predicts post-earnings-announcement return even after controlling for earnings surprise, past returns, and other stock characteristics. This market inefficiency is distinct from the well-known PEAD anomaly and return reversal, and can even overshadow them. The effect is stronger for stocks with smaller market capitalization, higher arbitrage risk, higher transaction costs and lower investor sophistication, consistent with the hypothesis of limits-to-arbitrage. Moreover, institutional investors trade to exploit market inefficiencies after earnings announcements as arbitrageurs. It suggests a dual role of institutional trading in contributing to and correcting mispricing around earnings announcements.

JEL Classification: G10, G12, G14, M40

Keywords: Institutional trading, Return predictability, Earnings announcement, Limits-to-arbitrage

1. Introduction

The important role played by institutional investors in asset pricing is well recognized. Although a large body of literature has studied the behavior of institutional trading and examined its impact on stock prices, evidence is mixed on the role of institutional investors and the predictive power of institutional trading on stock returns. Using quarterly ownership data, several studies find a positive association between the change of institutional holdings and long-term future stock returns, and conclude that institutional trading reflects the manner in which information is impounded into stock prices.[1] For instance, Sias (2004) finds evidence that institutional demand is weakly but positively related to returns over the following year. In Sias, Turtle and Zykaj (2015), hedge fund demand shocks are shown to be positively related to subsequent returns over the next few quarters. In contrast, other studies document evidence of subsequent return reversals, which suggests that increase in institutional holdings contributes to mispricing.[2] For instance, Dasgupta, Prat and Verardo (2011a) show that persistent institutional trading negatively predicts long-term returns. Edelen, Ince and Kadlec (2016) document a negative relationship between changes in institutional holdings and the subsequent returns in the next 12 to 18 months. Studies more accurately examining institutional trading and its impact on stock price are mainly based on proprietary data of transactions. Nevertheless the evidence is also ambiguous on this matter. Busse, Green and Jegadeesh (2012) and Griffin, Shu and Topaloglu (2012) find no evidence from their trading behavior showing that institutions are informed around specific public news events such as takeovers, earnings announcements and research recommendations, while Hendershott, Livdan,

[1] For examples of the positive association between changes in quarterly institutional ownership and long-term future stock returns, see Wermers (1999), Nofsinger and Sias (1999), Sias (2004), and Sias, Turtle and Zykaj (2015).
[2] For a sample of studies documenting a negative association between changes in quarterly institutional ownership and long-term future stock returns, see Frazzini and Lamont (2008), Dasgupta, Prat and Verardo (2011a), Brown, Wei and Wermers (2014), and Edelen, Ince and Kadlec (2016).

and Schürhoff (2015) provide evidence of informed institutions as news-announcement-day return is predicted by the prior day's institutional order flow.

This paper focuses on institutional demand prior to quarterly earnings announcements and its relationship with post-earnings-announcement return. It also investigates the trading behavior of institutional investors in the post-announcement period to examine whether they exploit market inefficiency for profitability. As pointed out in Bernard, Thomas and Wahlen (1997), the set of information released at earnings announcements is more likely to correct mispricing, relative to other possible information releases. Thus, earnings announcement provides an ideal setting to explore how institutional trading influences the occurrence and correction of market inefficiency. The main findings of the paper can be summarized into four aspects.

First, the paper documents a negative predictive relationship between the Cumulative Abnormal Institutional Demand (CAID) for a stock in the pre-announcement period and the stock's Cumulative Abnormal Return (CAR) over the post-announcement period. Stocks strongly purchased by institutional investors in the pre-announcement period perform significantly worse in the post-announcement period than those strongly sold by them. This relationship is highly significant and robust because it is not subsumed by earnings surprise, past returns of the stocks and stock characteristics such as market capitalization, price, liquidity, idiosyncratic risk and institutional ownership.

Second, Post-Earnings Announcement Drift (PEAD) refers to the phenomenon that after an earnings announcement, CAR of the stock continues to drift in the direction of the earnings surprise. Since first documented by Ball and Brown (1968), this puzzling phenomenon has been recognized as one of the biggest challenges to the efficient market hypothesis. In addition to providing further evidence of the well-known PEAD anomaly, this paper demonstrates that pre-announcement CAID is a distinct driver for return drifts in the post-earnings announcement period. Moreover, the PEAD phenomenon is substantially weakened or even disappears if pre-announcement CAID is on the same side of earnings surprise while the PEAD is intensified if CAID is on the wrong side of earnings surprise.[3]

Third, we test the hypothesis of limits-to-arbitrage in the context that pre-announcement CAID is a stronger negative predictor to post-announcement returns for stocks that are riskier to arbitrage. The hypothesis is proposed by Shleifer and Vishny (1997) and adopted by Mendenhall (2004) to explain underreaction to earnings news and the PEAD anomaly. Consistent with the hypothesis of limits-to-arbitrage, it is found that the negative predictive effect of pre-announcement institutional demand is stronger for smaller stocks and stocks with higher arbitrage risk, higher transaction costs, and lower investor sophistication, even after controlling for earnings surprise, past return, and stock characteristics.[4] Mendendall (2004) argues that if mispricing is caused by investor overreaction there exists a positive relationship between return predictability and arbitrage risk. Therefore, our results represent evidence that the negative predictive relationship between pre-announcement CAID and post-announcement CAR is the result of both overreaction of institutional investors and limits-to-arbitrage impeding arbitrageurs to profit from it.

Fourth, it is found that institutional investors in the post-announcement period act as arbitrageurs to exploit market inefficiency. Post-announcement CAID is positively related to earnings surprise, so that their trading does reduce the PEAD anomaly and enhances market efficiency in the post-announcement period. This finding is consistent with the news-momentum trading behavior of institutional investors documented by Ke and Ramalingegowda (2005). Moreover, post-announcement CAID is negatively related to pre-announcement CAID. It indicates

[3] The same (wrong) side means that the pre-announcement CAID is positive/negative (negative/positive) while the earnings surprise is positive/negative.

[4] In addition to market capitalization of a stock, we consider three aspects of limits-to-arbitrage: arbitrage risk, which is measured by idiosyncratic volatility of stock return; transaction costs, which is related to stock price, bid-ask spread, dollar volume and institutional ownership; and investor sophistication, which is proxied by analyst coverage and number of institutional shareholders.

that when earnings announcements release value-relevant information, institutional investors re-examine their prior beliefs and trade to correct the mispricing caused by themselves.

Our findings contribute to the growing literature studying stock return anomalies by the interaction of institutional trading and market mispricing.[5] Although we are not the first to examine the institutional trading behavior around earnings announcements, the robust and negative relationship between pre-announcement CAID and post-announcement CAR is novel. This market inefficiency caused by institutional investors is a double-bladed sword. It can weaken or even eliminate the PEAD anomaly if pre-announcement CAID and earnings surprise on the same side because the two effects offset each other. However, if they are on the opposite sides, the post-earnings announcement drift causes a double dose as the two effects work together and strengthen return drift in the post-earnings announcement period. Simply attributing the drift to earnings surprise does not provide a complete picture of the market. Apparently, there is a need to control for the component of mispricing caused by pre-announcement institutional demand when examining post-announcement return to avoid misattributing this component to other phenomena.

The evidence of the contrasting roles played by institutional investors in affecting market efficiency is also new. Prior to earnings announcements, institutional investors are likely to be on the wrong side of the market, driving stock price away from the fundamental value of the stock and contributing to mispricing. Nevertheless, after fundamental information is released through earnings announcements, institutional investors trade to correct mispricing as arbitrageurs. While we find little evidence of informed trading from institutional investors prior to earnings announcements, our results suggest that institutional investors are skillful in analyzing earnings

[5] Studies examining the dynamics of anomalies include: Cooper, Gutierrez and Hameed (2004) showing the dependence of momentum profits on the state of the market; Lee and Swaminathan (2000) demonstrating that volume interacts with momentum in predicting future returns; Stambaugh, Yu and Yuan (2012) providing evidence of stronger anomalies during high sentiment periods; and Chordia, Subrahmanyam and Tong (2014) connecting increased liquidity and trading activity with attenuation of anomalies.

news and exploiting valuable trading opportunities when the uncertainty about earnings is resolved. These arbitrage activities help to speed up the price adjustment process. Overall the role of institutional trading in relation to market efficiency is complex and time-varying. Given the dominant role of institutions in the stock market, it highlights the importance of institutional trading as a promising avenue to understand the dynamics of stock price anomalies.

To the extent that institutional trading is attributed to institutional herding, our results also contribute to institutional herding literature by examining its price impact around earnings announcements. Dasgupta, Prat and Verardo (2011b) develop a theoretical model in which institutional herding positively predicts short-term returns but negatively predicts long-term returns in equilibrium. The empirical literature on institutional herding, however, has obtained mixed evidence. Using quarterly ownership data, some studies (see for example, Dasgupta, Prat and Verardo (2011a)) document that the impact of institutional herding is reversed within the following year and attribute them to the destabilizing effect of institutional investors. In contrast, other studies (see for example, Sias (2004)) find a positive or little association between institutional herding and long-term future stock returns, concluding that institutional herding reflects the manner in which information is impounded into stock prices and therefore has a stablishing effect. Using proprietary transaction-level data, Kremer and Nautz (2013) show that institutions in the German stock market exhibit herding behavior on a daily basis followed by return reversal, while Puckett and Yan (2008) report robust evidence of herding at a weekly frequency and its significant influence on market efficiency in the US stock market. In contrast to previous studies focusing on long-term or short-term impact of institutional herding, the paper examines how public news events, earnings announcements in particular, influence the price impact of institutional herding. It is found that although institutional herding drives stock price away from the fundamental value in the pre-announcement period, earnings announcements cause institutions to re-examine their prior belief and to correct market mispricing. It reveals the importance of earnings announcements in eliminating the destabilizing effect of institutional herding, which sheds new insights on the herding behavior.

The remainder of this paper is organized as follows. Section 2 describes data, variable measurements and sample characteristics. Section 3 examines the predictability of post-earnings announcement return and links it to pre-announcement institutional demand, earnings surprise, and pre-announcement return. Section 4 investigates the behavior of institutional investors after earnings announcement. Robustness checks are reported in Section 5. Section 6 concludes.

2. Data and Variable Measurements

2.1 Sample Selection

Most literature concerning institutional trading relies on quarterly ownership data from Form 13F reports.[6] However, quarterly net position changes aggregate trades made at different time points throughout the quarter and cannot detect intra-quarter round-trip trades. The change of quarterly institutional holdings at best is a coarse approximation of trading activities conducted by institutional investors. To better measure stock purchase and sell by institutional investors and distinguish trades before an earnings announcement from those after the announcement, this paper uses ANcerno's institutional client trade data, which records each individual transaction conducted by its clients. The database has been adopted by a number of studies analyzing the trading behavior of institutional investors.[7] ANcerno fully records the detailed transaction history of its institutional clients and variables in each transaction record include the following: a masked ID of institution that initiates a trade, ticker and CUSIP of the traded stock, date of execution, execution price,

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[6] See for example Sias (2004) and Edelen, Ince and Kadlec (2016).

[7] See for example, Puckett and Yan (2011), Choi and Sias (2012), Edelen and Kadlec (2012), Brown, Wei, and Wermers (2014), Cready, Kumas, and Subasi (2014), Green, Jame, Markov, and Subasi (2014), Goetzmann, Kim, Kumar, and Wang (2015).

execution volume, whether it is a buy or sell transaction, and commissions paid to brokers. Unlike most publicly available transaction-level databases such as TAQ, it also allows us to observe the true direction for all executed trades by its clients, eliminating the need of using some algorithms such as the Lee-Ready (1991) algorithm to classify buy and sell trades. Thus, the ANcerno database has a distinctive advantage over quarterly institution holdings databases such as Form 13F of the US Securities and Exchange Commission since it enables us to measure institutional trading at a daily level. ANcerno's institutional clients include pension plan sponsors, mutual fund, and independent investment advisors and they are representative of the whole population of institutional investors. There are a total of 956 buy-side institutions in the ANcerno database, which represent about 8% of the total market volume and 10% of total institutional volume in the US equity market. Puckett and Yan (2011) show that ANcerno data are representative of the institutional investors who file Form 13F and they are free from survivorship and backfill bias.[8] In addition, the characteristics of stocks held and traded by ANcerno institutions are not significantly different from those held and traded by the average 13F institutions as demonstrated by Anand, Irvine, Puckett, and Venkataraman (2012).

Our sample period covers January 1, 2000 to December 31, 2010. To minimize observation errors, we follow Anand, Irvine, Puckett, and Venkataraman (2012) and impose two screens on the ANcerno database: (i) delete orders with volume greater than the stock's CRSP volume on an execution date; and (ii) only include common stocks (with share codes of 10 and 11) listed on NYSE, AMEX, NASDAQ with data available on CRSP. We collect stock price, return, market capitalization and trading volume data from CRSP and earnings announcement and analyst forecast information from I/B/E/S. For each announcement, we require 40 days of data prior to it and 60 days of data after it. We consider pre-announcement period from day −40 to day −1, announcement

[8] See Puckett and Yan (2011) and Anand, Irvine, Puckett, and Venkataraman (2012) for detailed descriptions of the ANcerno database.

period from day 0 to day 1, and post-announcement period from day 2 to day 60, relative to the announcement day.[9] To reduce the effect of subsequent announcement on the post-announcement period, we exclude announcements with no more than 60 days between the current and next announcement days.[10]

2.2 Abnormal Institutional Demand

To characterize abnormal institutional demand around earnings announcements, we adopt a standardized volume imbalance measure.[11] Specifically, we calculate daily imbalance by

$$IM_{i,t} = \frac{buyvolume_{i,t} - sellvolume_{i,t}}{buyvolume_{i,t} + sellvolume_{i,t}}, \tag{1}$$

where $buyvolume_{i,t}$ ($sellvolume_{i,t}$) is the number of shares purchased (sold) by ANcerno institutions for stock *i* on day *t*. Thus, the Abnormal Institutional Demand (AID) on that day can be proxied by the standardized volume imbalance:

$$AID_{i,t} = \frac{IM_{i,t} - \overline{IM_{i,year(t)}}}{std(IM_{i,year(t)})}, \tag{2}$$

where $year(t)$ denotes the year which day *t* belongs to and $\overline{IM_{i,year(t)}}$ and $std(IM_{i,year(t)})$ are sample mean and standard deviation of $IM_{i,t}$ over $year(t)$. Consequently, cumulative abnormal institutional demand over the period $[t, T]$ is:

$$CAID_{i,[t,T]} = \sum_{k=t}^{T} AID_{i,k}. \tag{3}$$

[9] Both day 0 and day 1 are included in the announcement period to control for the effect of after-hour announcements. In robustness checks not reported in this paper, we consider different pre-announcement periods: [−30,−1], [−20,−1], [−10,−1] and different post-announcement periods: [2,70], [2,80], [2,90], [2,120]. They lead to qualitatively similar results.

[10] Our findings are qualitatively similar if we include those announcements in the sample.

[11] Institutional buys (sells) are counted as positive (negative) institutional demand. This procedure of measuring abnormal trading activity is similar to those adopted in previous studies. See for example, Lakonishok and Vermaelen (1986), Sias (2004), Malmendier and Shanthikumar (2007), and Park and Lee (2014). It yields an abnormal institutional demand measure with zero mean and unit variance. In robustness checks, we adopt alternative measure of abnormal institutional demand and obtain qualitatively similar results.

In particular, $CAID_{i,[-40,-1]}$ and $CAID_{i,[2,60]}$ measure pre-announcement and post-announcement cumulative abnormal institutional demands, respectively.

Changes in quarterly institutional ownership are adopted in the literature to examine herding behavior of institutional investors.[12] Institutional demand defined in (3) reveals institutional herding behavior over the horizon $[t, T]$ because positive (negative) CAID arises when institutional investors herd to (herd away from) a stock.

2.3 Abnormal Return and Earnings Surprise

We adopt size-adjusted benchmark to measure abnormal returns.[13] At the beginning of each year, we sort all stocks in NYSE, NASDAQ, and AMEX into deciles based on their market capitalizations. The daily abnormal return of stock *i* is then the difference between its raw return and the average return of all stocks located in the same size decile:

$$AR_{i,t} = R_{i,t} - R_{p,t}, \tag{4}$$

where $R_{i,t}$ is the raw return of stock *i* on day *t* and $R_{p,t}$ is the average return of all stocks located in the same size decile as stock *i*. Cumulative abnormal return is estimated by aggregating abnormal returns through the evaluation window:

$$CAR_{i,[t,T]} = \sum_{k=t}^{T} AR_{i,k}. \tag{5}$$

To capture earnings surprise, we use standardized unexpected earnings (SUE).[14] It is calculated as the difference between the actual quarterly earnings and the mean analyst forecast, divided by the standard deviation of all analyst forecasts. Thus, a positive (negative) SUE

[12] See for example, Nofsinger and Sias (1999), and Brown, Wei, and Wermers (2014).
[13] Size-adjusted abnormal return is widely adopted in the literature (see for example, Bernard and Thomas (1989), Bartov, Radhakrishnan, and Krinsky (2000), Mendenhall (2004), Ng, Rusticus, and Verdi (2008)) for examining return patterns around earnings announcements. We use alternative measures of abnormal return in robustness checks and obtain qualitatively similar results.
[14] Our findings are qualitatively similar if we use market reaction over the announcement period, i.e., the cumulative abnormal return from day 0 to day 1, as a proxy for earnings surprise.

measures positive (negative) market surprise and both very high and very low SUEs indicate big shocks to the market.

2.4 Sample Descriptive Statistics

Our final sample includes 71,198 quarterly earnings announcements of 5,509 stocks over the 11 years of the sample period. Table I presents summary statistics of sample characteristics and key variables used in the analysis. For each announcement, market capitalization ($MktCap$), stock price ($Price$), bid-ask spread ($Spread$), and dollar volume ($DVolume$) are measured as their daily averages in the year prior to the announcement.[15] $Illiquidity$ is measured by the average daily Amihud (2002) illiquidity ratio, multiplied by a factor of 1,000,000. Idiosyncratic volatility ($IdioVolatility$) is estimated as the standard deviation of residuals from regressing daily excess return on Fama-French three factors. Institutional ownership ($INST$) of a stock is the average fraction of shares outstanding held by institutions filling Form 13F, the number of institutional shareholders ($NINST$) is the average number of institutional shareholders, and the analyst coverage ($ACoverage$) is the average number of analysts following the stock on I/B/E/S. All these measures are estimated using the data in the year prior to the announcement. We winsorize the raw SUE scores and stock characteristics at the top and bottom 0.5% to diminish the impact of extreme values.[16] For each announcement, we estimate the CAR and the $CAID$ over the announcement, pre-announcement, and post-announcement periods. Table I shows that the trading behavior of institutional investors as a whole does not exhibit abnormality around earnings announcements, as the average $CAID$ is statistically insignificant over the periods $[0, 1]$, $[-40, -1]$, and $[2, 60]$.

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[15] Following prior studies, such as Ali, Hwang and Trombley (2003), we use the logarithms of market capitalization and dollar volume as stock characteristics because of the distributional properties of these two variables, and denote them as $SIZE$ and $DVOL$.

[16] Our results remain qualitatively similar if we do not winsorize the SUE scores and stock characteristics.

INSERT TABLE I HERE

3. Pre-announcement Institutional Demand and Post-announcement Return Predictability

Although the aggregate demands of institutional investors are not abnormal around earnings announcements, it does not mean there are no unrevealed regularities related to these demands. This section focuses on pre-announcement $CAID$ and examines its relationship with post-announcement CAR. This relationship is then linked to the well-known PEAD anomaly and the short-term return reversal during earnings announcements. It also explores the effect of limits-to-arbitrage on this predictive relationship.

3.1 Pre-announcement Institutional Demand and Subsequent Return

We first sort stocks in our sample into quintiles based on the pre-announcement abnormal institutional demand from day −40 to day −1, i.e., $CAID_{[-40,-1]}$, with Q5 (Q1) being the quintile of stocks strongly bought (sold) by institutional investors.[17] Table II reports their average announcement and post-announcement CAR. It displays a significantly negative relationship between institutional demand and subsequent return, as all CARs in the table monotonically increase when stock quintile moves from Q5 to Q1. During the announcement period (i.e. day 0 and day 1), stocks strongly bought by institutional investors in the pre-announcement period underperform those strongly sold by an average of 79 base points. It suggests that institutional investors do not have private value-relevant information and are not informed about the earnings news. This finding is consistent with Busse, Green, and Jegadeesh (2012) and Griffin, Shu and Topaloglu (2012), who find little or no evidence of information advantages owned by institutional

[17] In this paper, stock sorting is conducted quarter by quarter, corresponding to sample of quarterly earnings announcements.

investors based on transaction-level institutional trading data. More importantly, $CAID_{[-40,-1]}$ negatively predicts post-announcement CARs in a consistent manner. Stocks strongly bought by institutional investors underperform those strongly sold by 72 base points on average during day 2 to day 6. The magnitude of the difference actually increases when we extend the evaluation time horizon and remains significant.[18] Thus, the impact of pre-announcement institutional demand on subsequent return is not short-lived. Kaniel, Liu, Saar and Titman (2012) study the trading of individual investors around earnings announcements using a comprehensive data set from 2000 and 2003. They show that intense aggregate individual investor buying (selling) predicts large positive (negative) abnormal returns on and after earnings announcement dates. To the extent that institutional investors are the counterpart of individual investors as a whole, our finding is consistent with Kaniel, Liu, Saar and Titman (2012).

INSERT TABLE II HERE

This result also links to institutional herding literature to the extent that the CAID is driven by herding behavior of institutional investors. Unlike previous studies using quarterly ownership data to examine institutional herding and long-term future return, we find a negative relationship between institutional herding and future stock returns around earnings announcement through investigating transaction-level institutional trading data. It suggests that institutional trading has a destabilizing effect in the pre-announcement period, pushing stock prices away from their fundamental values.

[18] In unreported robustness checks, we extend the post-announcement period to [2,70], [2,80], [2,90] and [2,120], and obtain qualitatively similar results.

3.2 Earnings Surprise and Post-earnings Announcement Drift

Post-earnings announcement drift (PEAD) refers to the phenomenon that after an earnings announcement CAR continues to drift in the direction of the earnings surprise. This is a robust finding in the literature and is documented as one of the major asset pricing anomalies. The negative relationship between pre-announcement $CAID$ and post-announcement CARs unveiled in the previous subsection raises a question about the connection between this relationship and the PEAD anomaly. To address this question, we sort stocks into quintiles based on the earnings surprise that is measured by standardized unexpected earnings (SUE), where Q5 (Q1) is the quintile of stocks with the highest (lowest) SUE. Panel A of Table III reports the average post-announcement CAR from day 2 to day 60 for each quintile and the corresponding difference between Q5 and Q1. As can be seen, stocks located in the highest SUE quintile outperform those in the lowest SUE quintile by 174 base points and the difference is significant at the 1% level. This evidence suggests the existence of PEAD phenomenon in our sample, although its magnitude is not as profound as those using the data from earlier sample periods.[19]

INSERT TABLE III HERE

In Panel B of Table III, we examine post-announcement CAR conditional on earnings surprise and pre-announcement $CAID$ in order to have a closer look on the two effects. Stocks in the sample are first sorted into quintiles based on SUE. Within each quintile, they are further sorted into quintiles based on $CAID_{[-40,-1]}$. We then report the average $CAR_{[2,60]}$ for each of the 25 groups and the return difference between Q5 and Q1 sorted either by SUE or by $CAID_{[-40,-1]}$. On the one hand, we find that the negative predictive relationship between $CAID_{[-40,-1]}$ and $CAR_{[2,60]}$ remains statistically and economically significant for all quintiles sorted by SUE, as evidenced by

[19] For instance, if we sort our sample into deciles based on SUE, a high minus low portfolio leads to a post-announcement CAR of 2.62%. Whereas using the same return benchmark and evaluation window, Benard and Thomas (1989) find a CAR of 6.31% in their sample period.

the last column of Panel B. It indicates that the predictive effect of pre-announcement abnormal institutional demand on post-announcement abnormal return is strong and not subsumed by that of earnings surprise. Taking the highest (lowest) SUE quintile for example, stocks strongly bought by institutional investors in the pre-announcement period yield a lower post-announcement abnormal return by 1.99% (3.77%), on average, in comparison with stocks strongly sold. On the other hand, the PEAD anomaly, i.e., the positive predictive relationship between SUE and $CAR_{[2,60]}$ exists in three out of the five quintiles (Q5 to Q3) sorted by $CAID_{[-40,-1]}$, as demonstrated by the last row of Panel B. Therefore, the predictive effect of earnings surprise on post-announcement abnormal return is partially subsumed by that of pre-announcement abnormal institutional demand. For instance, in the quintile strongly sold by institutional investors (Q1), the highest SUE stocks do not significantly outperform the lowest SUE stocks in the post-announcement period. All these observations indicate that the predictive negative relationship between pre-announcement $CAID$ and post-announcement CAR is not caused by the PEAD phenomenon.

Combining the effects of $CAID_{[-40,-1]}$ and SUE, we find that the PEAD anomaly is considerably eased or even eliminated by the effect of pre-announcement abnormal institutional demand if the demand is on the same side of SUE. However, the PEAD anomaly is more profound if the demand is on the wrong side of SUE. As shown by cells (Q5, Q5) and (Q1, Q1) in Panel B of Table III, the CARs of stocks with highest (lowest) SUE and strongly bought (sold) by institutional investors in the pre-announcement period do not drift in the direction of SUE and thus they do not exhibit the PEAD phenomenon. On the other hand, stocks with highest (lowest) SUE and strongly sold (bought) by institutional investors in the pre-announcement period experience a very positive (negative) CAR of 1.95% (-2.52%) over the post-announcement period, as can be seen from cells (Q5, Q1) and (Q1, Q5). These figures are considerably larger, in absolute terms, than the CARs of extreme SUE quintiles of 1.04% and -0.70%, reported in Panel A. Since both pre-announcement abnormal institutional demand and earnings surprise can predict post-announcement abnormal return, it is obvious that conditioning on both $CAID_{[-40,-1]}$ and SUE improves the return predictability. Stocks with the lowest $CAID_{[-40,-1]}$ and highest SUE outperform stocks with the highest $CAID_{[-40,-1]}$ and lowest SUE by 447 base points ($= 1.95\% + 2.52\%$) on average, which leads to a long-short portfolio with an annualized return over 20%.

3.3 Reversal to Pre-announcement Return

Evidence of short-term return reversals is documented in the literature, see Jegadeesh (1999) for example. So and Wang (2014) show a six-fold increase in short-term return reversals during earnings announcements relative to non-announcement periods and attribute it to market makers demanding a higher expected return for providing liquidity because of increased inventory risks ahead of earnings announcements. We conduct tests to ensure that our results of the predictive relationship between pre-announcement institutional demand and post-announcement return is not driven by reversal to pre-announcement return. To this end, Panel A of Table IV sorts stocks in the sample into quintiles according to their $CAR_{[-40,-1]}$ and reports the average $CAR_{[2,60]}$ of each quintile and the return difference between Q5 and Q1. It shows a negative relationship between pre-announcement and post-announcement returns, consistent with the return reversal hypothesis. On average, stocks with the most positive pre-announcement CAR underperform stocks with the most negative pre-announcement CAR by 205 base points in the post-announcement period.

INSERT TABLE IV HERE

In Panel B of Table IV, we examine $CAR_{[2,60]}$ by double sorting on $CAR_{[-40,-1]}$ and $CAID_{[-40,-1]}$. According to the last column of Panel B, the negative predictive relationship between $CAID_{[-40,-1]}$ and $CAR_{[2,60]}$ remains statistically and economically significant for all quintiles sorted by $CAR_{[-40,-1]}$. Therefore, the predictive effect of pre-announcement institutional demand on post-announcement return is not subsumed by that of pre-announcement return. For instance, in the quintile with most positive (negative) $CAR_{[-40,-1]}$, i.e., Q5 (Q1), $CAR_{[2,60]}$ of stocks strongly bought by institutional investors in the pre-announcement period is lower than those strongly sold by 280 (553) base points on average. Moreover, the phenomenon of return reversal, i.e., the negative predictive relationship between $CAR_{[-40,-1]}$ and $CAR_{[2,60]}$, exists in only three out of the five quintiles sorted by $CAID_{[-40,-1]}$ (Q1 to Q3), as shown by the last row of Panel B. This implies that the predictive effect of pre-announcement return on post-announcement return is partially subsumed by that of pre-announcement institutional demand. In sum, Table IV indicates that the predictive negative relationship between pre-announcement institutional demand and post-announcement return is not caused by return reversal. If institutional investors trade along with the stock return in the pre-announcement period, i.e., purchase (sell) more as the abnormal return in the period is positive (negative), it leads to more profound return reversal in the post-announcement period. For instance, the average $CAR_{[2,60]}$ in cells (Q5, Q5) and (Q1, Q1) are -2.20% and 3.87%, respectively, which are larger, in absolute terms, than the average $CAR_{[2,60]}$ of the extreme quintiles of $CAR_{[-40,-1]}$, -0.87% and 1.18%. However, if they trade against the return, it substantially softens the return reversal or even makes return continue in the same direction in the post-announcement period. The evidence for this is the positive return of 0.60% in cell (Q5, Q1) and the negative return of -1.66% in cell (Q1, Q5).

3.4 Multivariate Regression Analysis of Post-announcement Return

We further employ a regression framework to more rigorously investigate the predictability of post-announcement abnormal return based on pre-announcement abnormal institutional demand.[20] In this regression, we control for the effects of earnings surprise, pre-announcement abnormal return and stock characteristics:

$$CAR_{[2,60]} = \beta_0 + \beta_1 CAID_{[-40,-1]} + \beta_2 SUE + \beta_3 CAR_{[-40,-1]} + \sum_{i=1}^{5} \gamma_i \times CV_i + \varepsilon. \quad (6)$$

In addition to explanatory variables $CAID_{[-40,-1]}$, SUE and $CAR_{[-40,-1]}$ which have been used in the previous nonparametric analysis, regression (6) includes five stock characteristics of the prior year as control variables (i.e., CV_i): (i) stock size, estimated by the logarithm of the average market capitalization, (ii) stock price, estimated by the average daily closing price, (iii) illiquidity, which is the average daily Amihud illiquidity ratio multiplied by a factor of 1 million, (iv) idiosyncratic volatility, estimated by the standard deviation of residuals from regressing daily excess returns on Fama-French three factors, and (v) institutional ownership, which is the average fraction of shares outstanding held by institutions filling Form 13F.[21] The regression results are reported in column 1 to column 6 of Table V, where two-way cluster-robust t-statistics are presented in parentheses.[22, 23] Apparently, $CAID_{[-40,-1]}$ is a significant predictor of $CAR_{[2,60]}$, which reconfirms the findings obtained through nonparametric analysis in the previous subsections. Although $CAR_{[2,60]}$ is positively correlated with SUE and negatively correlated with $CAR_{[-40,-1]}$, consistent with the existence of PEAD anomaly and return reversal, adding them to the regression has virtually no effect on the coefficient estimate or significance of $CAID_{[-40,-1]}$. It indicates that pre-

[20] In the main analyses, we consider $CAR_{[2,60]}$ as subsequent return to be consistent with the PEAD literature, although the results remain qualitatively similar if we use $CAR_{[0,60]}$ instead of $CAR_{[2,60]}$.

[21] In robustness checks, we re-run all the regressions in this paper by including bid-ask spread, dollar volume, number of institutional shareholders and number of analysts following as additional control variables. The results remain virtually unchanged.

[22] Petersen (2009) examines the different methods used in the literature for estimating standard errors in finance panel data sets and demonstrates the superior and robust performance of the two-way cluster-robust standard errors (CL-2). Gow, Ormazabal and Taylor (2010) review and evaluate the methods commonly used in the accounting literature to correct for cross-sectional and time-series dependence. They find that the two-way cluster-robust standard errors are necessary to produce valid inferences.

[23] To ensure our results are robust to various econometric specifications, we also test the predictive relationship between $CAR_{[2,60]}$ and $CAID_{[-40,-1]}$ using Fama and MacBeth (1973) type regressions with controls for earnings surprise, pre-announcement CAR and stock characteristics. The results also show a significantly negative relationship.

announcement institutional demand is a distinct factor in predicting post-announcement return, separated from earnings surprise or pre-announcement return. Comparing the first three columns in Table V, we find that the explanatory power of $CAID_{[-40,-1]}$ surpasses that of SUE or $CAR_{[-40,-1]}$. Combining those three effects together, the overall explanatory power to post-announcement abnormal return is considerably increased as shown in column 6.

INSERT TABLE V HERE

In Subsection 3.2, we document that the PEAD anomaly is intensified when pre-announcement CAID and earnings surprise are on the opposite side but weakened if they are on the same side. To further examine the robustness of this finding with controlling for pre-announcement CAR and stock characteristics, we consider the following regression specification:

$$CAR_{[2,60]} = \beta_0 + \beta_1 SUE \times \boldsymbol{I}(SUE \times CAID_{[-40,-1]} \geq 0) + \beta_2 SUE \times \boldsymbol{I}(SUE \times CAID_{[-40,-1]} < 0) + \beta_3 CAR_{[-40,-1]} + \sum_{i=1}^{5} \gamma_i \times CV_i + \varepsilon, \quad (7)$$

where indicator function $\boldsymbol{I}(SUE \times CAID_{[-40,-1]} \geq 0)$ takes the value of 1 when $CAID_{[-40,-1]}$ is not on the opposite side of SUE and 0 if otherwise, while $\boldsymbol{I}(SUE \times CAID_{[-40,-1]} < 0)$ takes the value of 1 when $CAID_{[-40,-1]}$ is on the opposite side of SUE and 0 if otherwise. The regression results are reported in columns 7 and 8 of Table V. The regression coefficient of SUE is significantly positive at the 1% level when $CAID_{[-40,-1]}$ and SUE are on the opposite side, but it becomes insignificant otherwise. Thus pre-announcement CAID significantly impacts CAR in the post-announcement period. The profitability of investment strategy exploiting the PEAD anomaly can be substantially improved if pre-announcement CAID is taken into account.

3.5 Limits-to-arbitrage and Post-announcement Return Predictability

The predictability of post-announcement return by pre-announcement institutional demand indicates market inefficiency.[24] Can this predictive relationship be explained by the mispricing hypothesis with limits-to-arbitrage?[25] If a stock is mispriced, arbitrage activities should correct it unless the arbitrage is too risky and/or too costly for the arbitrage profits. Therefore the magnitude of mispricing should be larger when the arbitrage is more limited. It leads us to conjecture that that the negative relationship between pre-announcement CAID and post-announcement CAR is stronger for stocks with more limits-to-arbitrage. In particular, we test the following regression specification:

$$CAR_{[2,60]} = \beta_0 + \beta_1 CAID_{[-40,-1]} + \beta_2 SUE + \beta_3 CAR_{[-40,-1]} + \beta_4 CAID_{[-40,-1]} \times SC + \sum_{i=1}^{5} \gamma_i \times CV_i + \varepsilon, \quad (8)$$

where explanatory variable SC denotes stock characteristics related to limits-to-arbitrage. They are estimated using data of the prior year. Comparing to regression specification (6), the interaction term between $CAID_{[-40,-1]}$ and SC is included to capture the effect of limits-to-arbitrage. The mispricing hypothesis with limits-to-arbitrage is supported if we observe a negative (positive) coefficient of the interaction term for an SC that is positively (negatively) related to limits-to-arbitrage.[26] Panel A of Table VI reports the regression results.

INSERT TABLE VI HERE

[24] Mispricing is examined by looking at subsequent abnormal stock returns in the literature, see for example Sadka and Scherbina (2007), Drake, Guest and Twedt (2014), and Sias, Turtle and Zykaj (2015).

[25] The hypothesis is put forth by Shleifer and Vishny (1997). In the literature, the mispricing hypothesis with limits-to-arbitrage has been adopted to explain various asset pricing anomalies, such as the asset growth anomaly (Lam and Wei (2011)), the book-to-market anomaly (Ali, Hwang and Trombley (2003)), the momentum anomaly (Korajczyk and Sadka (2004)), and the anomaly of post-earnings-announcement drift (Mendenhall (2004)).

[26] If an SC is positively (negatively) related to limits-to-arbitrage, a negative (positive) coefficient of the interaction term implies that the negative relationship between $CAID_{[-40,-1]}$ and $CAR_{[2,60]}$ becomes stronger (weaker) for stocks with more (less) limits-to-arbitrage.

We examine three aspects of limits-to-arbitrage: arbitrage risk, transaction costs and investor sophistication. Shleifer and Vishny (1997) argues the importance of arbitrage risk in the existence of mispricing. Following prior studies (see for example, Wurgler and Zhuravskaya (2002) and Lam and Wei (2011)), we define arbitrage risk as the idiosyncratic part of a stock's return volatility ($IdioVolaility$). As shown in column 1 of Panel A, the regression coefficient on $CAID_{[-40,-1]} \times IdioVolatility$ is significantly negative at the 1% level. It suggests that the negative predictive relationship between $CAID_{[-40,-1]}$ and $CAR_{[2,60]}$ is stronger for stocks with higher idiosyncratic volatility, which is consistent with the limits-to-arbitrage hypothesis as idiosyncratic volatility deters arbitrageurs from taking action to exploit the mispricing caused by pre-announcement institutional demand.

Transaction costs are important determinants of reducing the arbitrage profitability and stocks with higher transaction costs exhibit more limits-to-arbitrage. Following prior studies (see for example Ali, Hwang and Trombley (2004), Mendenhall (2004), and Lam and Wei (2011)), we consider four measures of stock characteristics related to three types of transaction costs: direct transaction costs, indirect transaction costs and costs associated with short selling. Stock price ($Price$) is negatively associated with direct transaction costs and considered as the first measure.[27] Bid-ask spread ($Spread$) is used as an additional measure of direct transaction costs. Indirect transaction costs capture the adverse price effects of trade and the delay in processing the transaction. We use dollar trading volume ($DVOL$) as an inverse measure of indirect transaction costs.[28] The fourth measure of transaction costs is institutional ownership ($INST$), the fraction of shares outstanding held by institutions filling Form 13F. It is easier for investors to borrow shares

[27] Stock price is found to be an inverse proxy to transaction costs in prior studies. For instance, Bhardwaj and Brooks (1992) suggest that the bid-ask spread and the brokerage commission are inversely related to stock price. Stoll (2000) shows that stock price is inversely related to the relative bid-ask spread.
[28] Theoretical arguments suggest that dollar trading volume is an important determinant of indirect transaction costs, see for example Kyle (1985) and Bhushan (1992). For thinly traded stocks, transactions are less likely to be completed quickly and more likely to cause adverse price effects.

of stocks with higher institutional ownership and these stocks are less exposed to the risk of short squeezes (Dechow, Hutton, Meulbroek and Sloan (2001)). Therefore, $INST$ is negatively related to costs of short selling. As shown in columns 2 to 5 of Panel A, the regression coefficient on the interaction term of $CAID_{[-40,-1]}$ and each measure of transaction costs is significant at the 1% level. More specifically, the negative predicative relationship between $CAID_{[-40,-1]}$ and $CAR_{[2,60]}$ is stronger for stocks with a lower stock price, a higher bid-ask spread, a lower dollar trading volume and lower institutional ownership. These findings support the mispricing hypothesis of limits-to-arbitrage because transactions costs make arbitrage opportunities less attractive.

Sophisticated investors are more likely to recognize arbitrage opportunities. Stocks with higher investor sophistication are exposed to less limits-to-arbitrage. Following previous studies (see for example Ali, Hwang and Trombley (2004), Mendenhall (2004), and Lam and Wei (2011)), we use analyst coverage ($ACoverage$), proxied by the number of analysts following the stock on I/B/E/S, and the number of institutional shareholders ($NINST$), proxied by the number of institutional shareholders filling Form 13F, as two measures of investor sophistication.[29] As shown in column 6 and 7 of Panel A, the regression coefficient on the interaction term of $CAID_{[-40,-1]}$ and measure of investor sophistication is significantly positive at the 1% level. It suggests that the negative predicative relationship between $CAID_{[-40,-1]}$ and $CAR_{[2,60]}$ is stronger for stocks with lower investor sophistication, which is consistent with the mispricing hypothesis of limits-to-arbitrage.

Stock size is used as a proxy for arbitrage costs and investor sophistication in prior studies, see for example Lakonishok, Shleifer and Vishny (1994), and larger stocks are expected to be

[29] As argued by Hong, Lim and Stein (2000), stocks with a larger number of analysts following are associated with more market participants having access to sophisticated analyst reports. The number of institutional shareholders is used as a measure of investor sophistication instead of institutional ownership, since institutional ownership is likely to be caused by one or two large but potentially unsophisticated investors (Bartov, Radhakrishnan and Krinsky (2000)).

associated with less limits-to-arbitrage. As shown in column 8 of Panel A, the regression coefficient on the interaction term of $CAID_{[-40,-1]}$ and stock size ($SIZE$) is significantly positive at the 1% level. It suggests that the negative predicative relationship between $CAID_{[-40,-1]}$ and $CAR_{[2,60]}$ is stronger for smaller stocks.

Comparing the regression results in Panel A, we find that the overall explanatory power as measured by Adjusted R^2 is the highest in column 1, where idiosyncratic return volatility is included to proxy arbitrage risk. It suggests the incremental role of arbitrage risk in explaining the predictive relationship between $CAID_{[-40,-1]}$ and $CAR_{[2,60]}$ and is consistent with the argument of Shleifer and Vishny (1997). Overall, our findings strongly support the hypothesis of limits-to-arbitrage in the context of market inefficiency due to institutional trading in the pre-earnings announcement period.

Limits-to-arbitrage is demonstrated to play a role in explaining the PEAD anomaly in the literature (see, for example, Mendenhall (2004)). To ensure the robustness of our findings, we further control for earnings surprise by extending (8) and examining the following regression:

$$CAR_{[2,60]} = \beta_0 + \beta_1 CAID_{[-40,-1]} + \beta_2 SUE + \beta_3 CAR_{[-40,-1]} + \beta_4 CAID_{[-40,-1]} \times SC + \beta_5 SUE \times SC + \sum_{i=1}^{5} \gamma_i \times CV_i + \varepsilon. \quad (9)$$

Panel B of Table VI reports the regression results. Comparing to Panel A, we find that the magnitude and significance of the regression coefficient on $CAID_{[-40,-1]} \times SC$ remains virtually unchanged. It further demonstrates that the negative predictive relationship between pre-announcement CAID and post-announcement CAR is a distinct phenomenon of market inefficiency and can be explained by the mispricing hypothesis of limits-to-arbitrage. Looking at the coefficient on $SUE \times SC$, we find that stocks with higher transaction costs, less investor sophistication and smaller market capitalization exhibit stronger PEAD anomaly. This is consistent with the findings reported in Bartov, Radhakrishnan and Krinsky (2000), Ng, Rusticus and Verdi (2008), Zhang, Cai and Keasey (2013) and Milian (2015).

4. Institutional Demand after Earnings Announcements

The last section documents a distinct market inefficiency caused by pre-announcement institutional demand, which coexists with the PEAD anomaly. This section further examines how institutions trade after earnings announcements and their role in mispricing correction.

4.1 Do Institutional Investors Exploit Market Inefficiencies?

Post-announcement CAR related to pre-announcement CAID and earnings surprise provides arbitrage opportunities to investors. Do institutional investors respond to such opportunities? Table VII displays post-announcement abnormal institutional demand ($CAID_{[2.60]}$) conditional on their pre-announcement abnormal institutional demand ($CAID_{[-40.-1]}$) and/or earnings surprise (SUE). Panel A shows that $CAID_{[2.60]}$ monotonically decreases with $CAID_{[-40.-1]}$ quintiles. This means that after earnings announcements institutional investors buy (sell) more of the stocks that were more strongly sold (bought) by them in the pre-announcement period. Noting the existence of return predictability caused by pre-announcement institutional demand, it indicates that institutional investors trade to exploit mispricing after earnings announcements and contribute to the correction of mispricing. It also implies that pre-announcement institutional herding is fragile to the release of earnings news as the post-announcement institutional trading activities reflect the manner in which the impact of pre-announcement herding is reversed. This evidence supports the herding model of Bikhchandani, Hirshleifer and Welch (1992) regarding the impact of public announcements on herding behavior.

INSERT TABLE VII HERE

On the other hand, when stocks are sorted by SUE, Panel A of Table VII demonstrates that $CAID_{[2,60]}$ monotonically increases with SUE. Stocks in the highest SUE quintile experience significantly more institutional demand in the post-announcement period, compared to stocks in the lowest SUE quintile. Hence, institutional investors as a whole exhibit news-momentum behavior after earnings announcements and trade to exploit the PEAD anomaly. Such arbitrage activities facilitate impounding earnings news into stock prices and correcting mispricing. This evidence is consistent with Ke and Ramalingegowda (2005) and Kaniel, Liu, Saar and Titman (2012), although we use transaction-level institutional trading data from ANcerno while they adopt data from quarterly institutional holdings database and NYSE's CAUD files, respectively.

In Panel B, we further examine $CAID_{[2,60]}$ through double sorting on SUE and $CAID_{[-40,-1]}$ and report the average $CAID_{[2,60]}$ for each of the 25 groups. The last row and column report the differences between extreme quintiles Q5 and Q1 sorted by SUE and by $CAID_{[-40,-1]}$, respectively. All differences are significantly positive or negative at the 1% level. Thus, the impacts of SUE and $CAID_{[-40,-1]}$ on $CAID_{[2,60]}$ are not subsumed by each other, although the latter's impact has a larger magnitude. After earnings announcements, institutional investors exploit two distinct mispricing opportunities: one directly related to earnings news and the other related to pre-announcement institutional demand. Compared to the existing findings in the literature, we observe a more complex post-announcement trading behavior of institutional investors that cannot be solely explained by arbitrage activities exploiting the PEAD anomaly. For instance, stocks strongly bought (sold) by institutional investors in the pre-announcement period with extreme high (low) earnings surprise experience significantly negative (positive) institutional demand after the earnings announcements. This scenario corresponds to the profit-taking behavior of institutional investors who trade in the opposite direction of the earnings news.

4.2 Return-Momentum Trading

Institutions are documented as return-momentum traders in the literature (see, for example, Nofsinger and Sias (1999), Chen, Hong and Stein (2002), and Bennett, Sias, and Starks (2003)). To test whether our findings are distinct from return-momentum trading, we examine post-announcement CAID conditional on pre-announcement CAR and CAID. After sorting stocks into quintiles according to $CAR_{[-40,-1]}$, Panel A of Table VIII reports the average $CAID_{[2,60]}$ of each quintile and the difference between the top and bottom quintiles. Stocks with positive $CAR_{[-40,-1]}$ experience significantly more institutional demand after earnings announcements than stocks with negative $CAR_{[-40,-1]}$, consistent with the return-momentum hypothesis. Panel B of Table VIII further double-sorts stocks according to $CAR_{[-40,-1]}$ and $CAID_{[-40,-1]}$. As can be seen, both $CAR_{[-40,-1]}$ and $CAID_{[-40,-1]}$ affect $CAID_{[2,60]}$, and their effects are not subsumed by each other although the effect of $CAID_{[-40,-1]}$ is much larger in magnitude. In other words, institutional investors exploit the market inefficiency caused by pre-announcement institutional demand.

INSERT TABLE VIII HERE

4.3 Multivariate Regression Analysis of Post-announcement Institutional Demand

To control for potential biases and noise in the above nonparametric analysis that reveals the trading behavior of institutional investors in the post-earnings announcement period, this subsection employs the following regression model to study the issue:

$$CAID_{[2,60]} = \beta_0 + \beta_1 CAID_{[-40,-1]} + \beta_2 SUE + \beta_3 CAR_{[-40,-1]} + \sum_{i=1}^{5} \gamma_i \times CV_i + \varepsilon. \quad (10)$$

The results of this regression are displayed in Table IX. In column 1, regression coefficient on $CAID_{[-40,-1]}$ is significantly negative at the 1% level after controlling for stock characteristics, indicating that institutional investors exploit the return predictability caused by pre-announcement

CAID. In columns 4 to 6 where the effects of SUE and/or $CAR_{[-40,-1]}$ are further controlled for, the magnitude and significance of the regression coefficient on $CAID_{[-40,-1]}$ remain similar to that in column 1. In addition, the regression coefficients on SUE and $CAR_{[-40,-1]}$ are significantly positive at the 1% level. It demonstrates that institutional investors also exploit the PEAD anomaly and behave as return-momentum traders after earnings announcements. In sum, post-announcement institutional trading contributes to the correction of market mispricing caused by pre-announcement institutional demand, earnings surprise or return momentum. It reveals the ability of institutional investors to: firstly, process earnings news; and secondly, exploit market inefficiencies as arbitrageurs.

INSERT TABLE IX HERE

5. Robustness Checks

The relationship between pre-announcement CAID and post-announcement CAR can be sensitive to the choice of pre-announcement and post-announcement time windows. As reported earlier, we have adopted various windows for these periods and find that the negative predictive relationship sustains for different window choices.[30]

To be consistent with the PEAD literature, the text focuses on post-announcement CAR, except for Table II which includes CAR over announcement period. Actually, the negative correlation between pre-announcement CAID and subsequent CAR is significant and robust. All documented findings related to the post-announcement period can be extended to the whole period including both announcement and post-announcement periods. For brevity these results are not

[30] More specifically, we have used [−30,−1], [−20,−1] and [−10,−1] in addition to [−40,−1] for pre-announcement period, and [2,70], [2,80], [2,90] and [2,120] in addition to [2,60] for post-announcement period.

reported in the paper but are available upon request.[31] Moreover, we perform various further tests to examine the robustness of our findings.

5.1 Alternative Measure of Institutional Demand

In our previous analysis, CAID is estimated by standardized volume imbalance based on aggregate trading volume of all ANcerno institutions (see equation (1)). Motivated by the theoretical herding literature, Dasgupta, Prat and Verardo (2011a) propose institutional trade persistence as a measure of institutional trading. Following their intuition, we consider an alternative measure of institutional demand based on the number of days that the stock is net purchased (bought) by institutional investors as a whole. In particular, we calculate a ratio of institutional trading (RIT) for stock *i* during a certain period *k*:

$$RIT_{i,k} = \frac{buydays_{i,k} - selldays_{i,k}}{buydays_{i,k} + selldays_{i,k}}, \tag{11}$$

where $buydays_{i,k}$ is the total number of days that stock *i* is net purchased by ANcerno institutions during the period k and $selldays_{i,k}$ the total number of days that stock *i* is net sold during that period. In particular, $RIT_{i,[-40,-1]}$ denotes the institutional trading ratio during the pre-announcement period. To measure pre-announcement abnormal institutional demand, we subtract it by its yearly benchmark:

$$ARIT_{i,[-40,-1]} = RIT_{i,[-40,-1]} - RIT_{i,year(t)}, \tag{12}$$

where $RIT_{i,year(t)}$ is the institutional trading ratio for the year which the announcement date belongs to. Table X documents the results of the nonparametric analysis using $ARIT_{[-40,-1]}$ instead of $CAID_{[-40,-1]}$ to sort stocks. It reveals findings similar to Table III. On average, stocks strongly sold by institutional investors in the pre-announcement period outperform stocks strongly

[31] Other results of robustness checking mentioned in all footnotes are also available upon request.

purchased by 357 base points in the post-announcement period. Pre-announcement abnormal institutional demand remains as a significant negative predictor to post-announcement abnormal return even after controlling for the effect of earnings surprise.

INSERT TABLE X HERE

5.2 Alternative Measure of Earnings Surprise

Abnormal return at the time of the earnings announcement is used in the literature as an alternative measure of earnings surprise. Table XI sorts stocks using announcement abnormal return ($CAR_{[0,1]}$) instead of SUE. It shows results similar to Table III: $CAR_{[0,1]}$, as an alternative measure of earnings surprise, significantly positively predicts the post-announcement abnormal return. Meanwhile pre-announcement CAID continues to function as a significant negative predictor even after controlling for the announcement abnormal return.[32]

INSERT TABLE XI HERE

5.3 Alternative Measure of Abnormal Return

In our previous analysis, abnormal return is estimated by the difference between the raw return of a stock and its corresponding size-adjusted benchmark. To ensure the robustness of our findings, we consider an alternative measure of abnormal return by matching sample stocks to stocks of similar size and book-to-market (B/M) ratio. We construct 25 portfolios based on the company size at the end of June of the current year, and B/M ratio at the end of December of the previous year. Abnormal return is then calculated as stock return minus average return of the portfolio that the stock falls in. In portfolio construction, we include all stocks in CRSP with share

[32] Based on the alternative measures of abnormal institutional demand and earnings surprise defined in Sections 5.1 and 5.2, we re-examine Table VII and find that pre-announcement abnormal institutional demand remains as a negative predictor to post-announcement abnormal institutional demand, while earning surprise remains as a positive predictor.

codes of 10 and 11, listed in AMEX, NYSE or NASDAQ, and have a positive book value. Table XII is the counterpart of Table III, where post-announcement CAR is estimated based on this alternative measure of abnormal return. As exhibited in Panel A, stocks in the highest SUE quintile outperform stocks in the lowest SUE quintile by 164 base points in the post-announcement period, consistent with the PEAD anomaly. On the other hand, stocks strongly bought by institutional investors in the pre-announcement period underperform stocks strongly purchased by 266 base points, which indicates the predictive relationship between pre-announcement CAID and post-announcement CAR. Panel B further differentiates the effects of SUE and $CAID_{[-40,-1]}$. Looking at the last column, it shows that $CAID_{[-40,-1]}$ is a significant negative predictor to $CAR_{[2,60]}$ even after controlling for SUE, which is consistent with the findings in Table III.

INSERT TABLE XII HERE

5.4 The Effect of Post-announcement Abnormal Institutional Demand

A strong positive relationship between changes in institutional ownership and returns measured over the same period is well documented in the literature (see, for example, Nofsinger and Sias (1999)), which results primarily from price effects associated with institutional trading (Chakravarty (2001)). In order to examine whether our findings are driven by this contemporaneous relationship, we re-run regression specifications (6) and (8) by including $CAID_{[2,60]}$ as an additional control variable. From column 1 in Table XIII, we can see a strong positive relationship between $CAID_{[2,60]}$ and $CAR_{[2,60]}$, which is consistent with the literature. However even after controlling for $CAID_{[2,60]}$, $CAID_{[-40,-1]}$ remains as a significant negative predictor to $CAR_{[2,60]}$ and SUE still continues as a significant positive predictor. It is consistent with the findings in Table V where two distinct market inefficiencies caused by $CAID_{[-40,-1]}$ and SUE coexist. In columns 2 to 6, we re-examine the effect of limits-to-arbitrage on the predictive negative relationship between $CAID_{[-40,-1]}$ and $CAR_{[2,60]}$. Consistent with the findings in Table VI, the negative predictive relationship is stronger for stocks with higher arbitrage risk, higher transaction costs, less investor sophistication and smaller market capitalization.

INSERT TABLE XIII HERE

6. Concluding Remarks

This paper examines the association between institutional trading and market mispricing around earnings announcements, which is exceptionally interesting because the price correction is often particularly strong when earnings news are released. Using nonparametric analysis and regression tests, we provide evidence that pre-announcement abnormal institutional demand is a significant negative predictor to post-announcement abnormal return. This negative predictive relationship is a distinct phenomenon from the PEAD anomaly. Moreover, the PEAD anomaly can be substantially weakened or even eliminated if institutional investors are on the same side of earnings surprise. We also demonstrate that the negative predictive relationship is stronger for stocks with higher arbitrage risk, higher transaction costs, less investor sophistication and smaller market capitalization. This evidence supports the mispricing hypothesis with limits-to-arbitrage.

By examining institutional trading behavior after earnings announcement, we provide evidence that institutions trade to exploit the market inefficiency resulting from pre-announcement CAID and PEAD. Thus, institutional investors play a dual role, which leads to mispricing before earnings announcements but enhances market efficiency after uncertainty about earnings is resolved. The role of institutional trading in relation to market efficiency is complex and time-varying. It is important to note that our interpretation of the results is conditional on whether ANcerno institutional clients are representative of institutional investors as a whole in the US market, despite several studies suggesting that the ANcerno database is broadly representative.

Given the dominant role of institutions in the stock market, this research highlights the importance of institutional trading as a promising avenue to understand the dynamics of stock price anomalies.

The unveiled relationship between pre-announcement CAID and post-announcement CAR is consistent with several theories and interpretations. One possibility for this negative predictive relationship is that institutional investors as a whole overreact to pre-announcement information in the market, leading stock prices to deviate from their fundamental values. A possible source for such overreaction is investor overconfidence about their abilities to acquire or process information. On the one hand, stocks tend to attract more investor attention and media coverage prior to earnings announcements (Drake, Roulstone and Thornock (2012)). As pointed out by Tetlock (2014), market overreaction to media content increases with investor attention. Therefore, our findings might be caused by institutional investors' overreaction to pre-announcement public information. On the other hand, information asymmetry is likely to be more severe prior to important corporate announcements (Chae (2005)). Daniel, Hirshleifer and Subrahmanyam (1998) propose investors' overconfidence, i.e., a tendency to overestimate the precision of their private information, as a source of investors' overreaction. Thus, it is also possible that our results are driven by institutional investors' overreaction to private information signals in the pre-announcement period.

A second possibility is that CAID in the pre-announcement period is attributed to institutional herding. The findings by Nofsinger and Sias (1999) suggest that institutional herding impacts on prices more than herding by individual investors. Sias (2004) classifies the theoretical foundation for institutional herding into five categories: information cascades, investigative herding, reputational herding, fads, and characteristic herding. These motives are not necessarily mutually exclusive and institutional investors may be herded together for a number of reasons. To the extent that CAID is caused by institutional herding, our findings reveal a relationship between pre-announcement institutional herding and subsequent returns. It is likely to destabilize the market and drive stock prices away from their fundamental values. However, our findings also show that pre-announcement institutional herding is fragile to the release of earnings news, and this is consistent with the theoretical herding model of Bikhchandani, Hirshleifer and Welch (1992).[33]

A third possibility is that institutional investors as a whole trade against individual investors who are likely to be better informed and/or more skillful. Moreover, individual investors are compensated as liquidity providers if they take the other side of the trades when institutional investors have an incentive to change their positions and demand immediacy (Kaniel, Saar and Titman (2008)). Kaniel, Liu, Saar and Titman (2012) show that aggregate individual investor buying (selling) predicts large positive (negative) abnormal returns on and after earnings announcement dates and about half of returns can be attributed to private information and the remaining can be attributed to liquidity provision. Despite using a different database, our finding of a negative relationship existing between pre-announcement CAID and post-announcement CAR is consistent with Kaniel, Liu, Saar and Titman (2012) as individual trading as a whole mirrors institution trading.

Of course, the three possible explanations are not necessarily mutually exclusive. While this paper documents a stylized fact of market inefficiency because of institutional trading, it remains to be explored what the driver of this phenomenon is. We leave this for our future research.

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[33] Theoretical models for institutional herding are rich and non-mutually exclusive. We note that our results are not necessarily solely consistent with Bikhchandani, Hirshleifer and Welch (1992).

REFERENCES

Ali, A., Hwang, L., Trombley, M.A., 2003. Arbitrage risk and the book-to-market anomaly. *Journal of Financial Economics* 69, 355–373.

Amihud, Y., 2002. Illiquidity and stock returns: cross-section and time-series effects. *Journal of Financial Markets* 5, 31–56.

Anand, A., Irvine P., Puckett, A., Venkataraman, K., 2012. Performance of institutional trading desks: an analysis of persistence in trading costs. *Review of Financial Studies* 25, 557–598.

Ball, R., Brown, P., 1968. An empirical evaluation of accounting income numbers. *Journal of Accounting Research* 6, 159–178.

Bartov, E., Radhakrishnan, S., Krinsky, I., 2000. Investor sophistication and patterns in stock returns after earnings announcements. *The Accounting Review* 75, 43–63.

Bennett, J. A., Sias, R.W., Starks, L.T., 2003. Greener pastures and the impact of dynamic institutional preferences. *Review of Financial Studies* 16, 1203–1238.

Bernard, V., Thomas, J., 1989. Post-earnings-announcement drift: Delayed price response or risk premium? *Journal of Accounting Research* 27, 1–36.

Bernard, V., Thomas, J., Wahlen, J., 1997. Accounting-based stock price anomalies: Separating market inefficiencies from risk. *Contemporary Accounting Research* 14, 89–136.

Bhardwaj, R.K., Brooks, L.D., 1992. The January anomaly: Effects of low share price, transaction costs, and bid-ask bias. *Journal of Finance* 47, 553–575.

Bhushan, R., 1994. An informational efficiency perspective on the post-earnings announcement drift. *Journal of Accounting and Economics* 18, 45–66.

Bikhchandani, S., Hirshleifer, D., Welch, I. 1992. A theory of fads, fashion, custom, and cultural change as informational cascades. *Journal of Political Economy* 992–1026.

Brown, N.C., Wei, K.D., Wermers, R., 2014. Analyst recommendations, mutual fund herding, and overreaction in stock prices. *Management Science* 60, 1–20.

Busse, J., Green, C., Jegadeesh, N., 2012. Buy-side trades and sell-side recommendations: Interactions and information content. *Journal of Financial Markets* 15, 207–232.

Chae, J., 2005. Trading volume, information asymmetry, and timing information. *Journal of Finance* 60, 413–442.

Chakravarty, S., 2001. Stealth trading: Which traders' trades move prices? *Journal of Financial Economics* 61, 289–307.

Chen, J., Hong, H., Stein, J.C., 2002. Breadth of ownership and stock returns. *Journal of Financial Economics* 66, 171–205.

Chordia, T., Subrahmanyam, A., Tong, Q., 2014. Have capital market anomalies attenuated in the recent era of high liquidity and trading activity? *Journal of Accounting and Economics* 58, 41−58.

Cready. W., Kumas, A., Subasi, M., 2014. Are trade size-based inferences about traders reliable? Evidence from institutional earnings-related trading. *Journal of Accounting Research* 52, 877–909.

Choi, N.Y., Sias, R.W., 2012. Why does financial strength forecast stock returns? Evidence from subsequent demand by institutional investors. *Review of Financial Studies* 25, 1550–1587.

Cooper, M.J., Gutierrez, R.C., Hameed, A., 2004. Market states and momentum. *Journal of Finance* 59, 1345–1365.

Daniel, K.D., Hirshleifer, D., Subrahmanyam, A., 1998. Investor psychology and security market under and over-reactions. *Journal of Finance* 53, 1839–1886.

Dasgupta, A., Prat, A., Verardo, M., 2011a. Institutional trade persistence and long-term equity returns. *Journal of Finance* 66, 635–653.

Dasgupta, A., Prat, A., Verardo, M., 2011b. The price impact of institutional herding. *Review of*

Financial Studies 24, 892–925.
Dechow, P.M., Hutton, A.P., Meulbroek, L., Sloan, R.G., 2001. Short-sellers, fundamental analysis and stock returns. *Journal of Financial Economics* 61, 77–106.
Drake, M.S., Guest, N.M., Twedt, B.J., 2014. The media and mispricing: The role of the business press in the pricing of accounting information. *The Accounting Review* 89, 1673–1701.
Drake, M.S., Roulstone, D.T., Thornock, J.R., 2012. Investor information demand: Evidence from Google searches around earnings announcements. *Journal of Accounting Research* 50, 1001–1040.
Edelen, R.M., Ince, O.S., Kadlec, G.B., 2016. Institutional investors and stock return anomalies. *Journal of Financial Economics* 119, 472−488.
Edelen, R.M., Kadlec, G.B., 2012. Delegated trading and the speed of adjustment in security prices. *Journal of Financial Economics* 103, 294–307.
Fama, E.F., MacBeth, F., 1973. Risk, return, and equilibrium: Empirical tests. *Journal of Political Economy* 81, 607−636.
Frazzini, A., Lamont, O., 2008. Dumb money: Mutual fund flows and the cross-section of stock returns. *Journal of Financial Economics* 88, 299–322.
Goetzmann, W.N., Kim, D., Kumar, A., Wang, Q., 2015. Weather-induced mood, institutional investors, and stock returns. *Review of Financial Studies* 28, 73–111.
Gow, I.D., Ormazabal, G., Taylor, D.J., 2010. Correcting for cross-sectional and time-series dependence in accounting research. *Accounting Review* 85, 483–512.
Green, T.C., Jame, R., Markov, S., Subasi, M., 2014. Broker-hosted investor conferences. *Journal of Accounting and Economics* 58, 142–166.
Griffin, J., Shu, T., Topaloglu, S., 2012. Examining the dark side of financial markets: Do institutions trade on information from investment bank connections? *Review of Financial Studies* 25, 2155–2188.
Hendershott, T., Livdan, D., Schürhoff, N., 2015. Are institutions informed about news? *Journal of Financial Economics* 117, 249–287.
Hong, H., Lim, T., Stein, J.C., 2000. Bad news travels slowly: size, analyst coverage, and the profitability of momentum strategies. *Journal of Finance* 55, 265–295.
Jegadeesh, N. 1990. Evidence of predictable behavior of security returns. *Journal of Finance* 45, 881–898.
Kaniel, R., Saar, G., Titman, S., 2008. Individual investor trading and stock returns. *Journal of Finance* 63, 273–310.
Kaniel, R., Liu, S., Saar, G., Titman, S., 2012. Individual investor trading and return patterns around earnings announcements. *Journal of Finance* 67, 639–680.
Ke, B., Ramalingegowda, S., 2005. Do institutional investors exploit the post-earnings announcement drift? *Journal of Accounting and Economics* 39, 25−53.
Kyle, A., 1985. Continuous auctions and insider trading. *Econometrica* 53, 1315−1335.
Korajczyk, R.A., Sadka, R., 2004. Are momentum profits robust to trading costs? *Journal of Finance* 59, 1039–1082.
Kremer, S., Nautz, D., 2013. Causes and consequences of short-term institutional herding. *Journal of Banking and Finance* 37, 1676–-1686.
Lakonishok, J., Shleifer, A., Vishny, R., 1994. Contrarian investment, extrapolation and risk. *Journal of Finance* 49, 1541−1578.
Lakonishok, J., Vermaelen, T., 1986. Tax-induced trading around ex-dividend days. *Journal of Financial Economics* 3, 287–319.
Lam, E., Wei, J., 2011. Limits-to-arbitrage, investment frictions, and the asset growth anomaly. *Journal of Financial Economics* 102, 127–149.

Lee, C.M., Ready, M.J., 1991. Inferring trade direction from intraday data. *Journal of Finance* 46, 733–746.
Lee, C.M., Swaminathan, B., 2000. Price momentum and trading volume. *Journal of Finance* 105, 1–28.
Lewellen, J., 2011. Institutional investors and the limits of arbitrage. *Journal of Financial Economics* 102, 62–80.
Malmendier, U., Shanthikumar, D., 2007. Are small investors naive about incentives? *Journal of Financial Economics* 85, 457–489.
Mendenhall, R., 2004. Arbitrage risk and post-earnings-announcement drift. *Journal of Business* 77, 875–894.
Milian, J.A., 2015. Unsophisticated arbitrageurs and market efficiency: Overreacting to a history of underreaction? *Journal of Accounting Research* 53, 175–220.
Ng, J., Rusticus, O., Verdi, R.S., 2008. Implications of transaction costs for the post-earnings announcement drift. *Journal of Accounting Research* 46, 661–696.
Nofsinger, J. R., Sias, R., 1999. Herding and feedback trading by institutional and individual investors. *Journal of Finance* 54, 2263–2295.
Park, T.J., Lee, Y., 2014. Informed trading before positive vs. negative earnings surprises. *Journal of Banking and Finance* 49**,** 228–241.
Petersen, M.A., 2009. Estimating standard errors in finance panel data sets: Comparing approaches. *Review of Financial Studies* 22, 435–480.
Puckett, A., and Yan, X., 2008. Short-term institutional herding and its impact on stock prices. Working paper, University of Missouri.
Puckett, A., Yan, X.S., 2011. The interim trading skills of institutional investors. *Journal of Finance* 66, 601–633.
Sadka, R., Scherbina, A., 2007. Analyst disagreement, mispricing, and liquidity. *Journal of Finance* 62, 2367–2403.
Shleifer, A., Vishny, R.W., 1997. The limits of arbitrage. *Journal of Finance* 52, 35–55.
Sias, R., 2004. Institutional herding. *Review of Financial Studies* 17, 165–206.
Sias, R., Turtle, H.J., Zykaj, B., 2015. Hedge fund crowds and mispricing. *Management Science* 62, 764–784.
So, E., Wang, S., 2014. News-driven return reversals: Liquidity provision ahead of earnings announcement. *Journal of Financial Economics* 114, 20–35.
Stambaugh, R.F., Yu, J., Yuan, Y., 2012. The short of it: Investor sentiment and anomalies. *Journal of Financial Economics* 104, 288–302.
Stoll, H.R., 2000. Friction. *Journal of Finance* 55, 1479–1514.
Tetlock, P.C., 2014. Information transmission in finance. *Annual Review of Financial Economics* 6, 365–384.
Wermers, R., 1999. Mutual fund trading and the impact on stock prices. *Journal of Finance* 54, 581–622.
Wurgler, J., Zhuravskaya, E., 2003. Does arbitrage flatten demand curves for stocks? *Journal of Business* 75, 583−608.
Zhang, Q., Cai, C.X., Keasey, K., 2013. Market reaction to earnings news: A unified test of information risk and transaction costs. *Journal of Accounting and Economics* 56, 251−266.

Table I
Summary Statistics of Sample Characteristics

This table presents summary statistics of sample characteristics used in our analysis. We consider quarterly earnings announcements from 1 January 2000 to 31 December 2010 and apply the following restrictions on the sample. Firstly, the stock is required to be a common stock listed on AMEX, NASDAQ, or NYSE. Secondly, it has earnings information available on I/B/E/S. Thirdly, it has 40 (60) days of data prior to (after) an earnings announcement and over 60 days of data between the current and next announcements. In the table, market capitalization ($MktCap$) is the average daily market capitalization of a stock, stock price ($Price$) the average daily closing price, illiquidity ($Illiquidity$) the average daily illiquidity ratio of Amihud (2002) multiplied by a factor of 1 million, idiosyncratic volatility ($IdioVolatility$) the standard deviation of residuals from regressing daily excess returns on Fama-French three factors, institutional ownership ($INST$) the average fraction of shares outstanding held by institutions filling Form 13F, standardized unexpected earnings (SUE) the difference between the actual earnings and the mean analyst forecast divided by the standard deviation of the analyst forecasts, bid-ask spread ($Spread$) the average daily closing bid-ask spread, dollar volume ($DVolume$) the average daily dollar volume, the number of institutional shareholders ($NINST$) the average number of institutional shareholders filling Form 13F, analyst coverage ($ACoverage$) the average number of analysts following the stock on I/B/E/S. All these measures are estimated using data in the year prior to an earnings announcement. CAR in the table is the cumulative abnormal returns while $CAID$ measures cumulative abnormal institutional demand. The subscripts in CAR and $CAID$ denote the dates around an earnings announcement, where event day is day 0.

	Mean	SD	25th	Median	75th
$MktCap$ (in million \$)	5421	21247	318	856	2752
$Price$ (in \$)	27.53	27.59	12.45	22.51	36.10
$Illiquidity$	0.087	0.409	0.001	0.004	0.022
$IdioVolatility$	0.024	0.016	0.017	0.024	0.035
$INST$	0.607	0.266	0.402	0.607	0.820
SUE	0.900	4.226	−0.500	0.714	2.354
$Spread$	0.006	0.009	0.001	0.003	0.008
$DVolume$ (in million \$)	41.56	150.39	1.86	7.19	26.79
$NINST$	145	178.95	39.57	179.60	179.60
$ACoverage$	8.35	6.37	3.60	6.50	11.33
$CAR_{[0,1]}$	0.03%	9.26%	−3.87%	0.07%	4.20%
$CAR_{[-40,-1]}$	0.02%	19.04%	−8.09%	0.22%	8.69%
$CAR_{[2,60]}$	−0.05%	22.76%	−9.80%	−0.09%	10.28%
$CAID_{[0,1]}$	−0.027	1.525	−1.088	−0.027	1.063
$CAID_{[-40,-1]}$	−0.016	11.590	−7.520	0.000	7.600
$CAID_{[2,60]}$	0.147	14.472	−9.112	0.000	9.518

Table II

Post-announcement Abnormal Returns Conditional on Pre-announcement Abnormal Institutional Demand

Daily abnormal institutional demand is measured by standardized trading volume imbalance of institutional investors. Sample stocks are sorted into quintiles based on pre-announcement cumulative abnormal institutional demand ($CAID_{[-40,-1]}$). The table reports the average cumulative abnormal return (CAR) over announcement and post-announcement periods for each $CAID$ quintile and the corresponding differences between Q5 and Q1, where Q5 (Q1) is the quintile of sample stocks strongly bought (sold) by institutions in the pre-announcement period. T-statistics are shown in parentheses. Symbols ***, ** and * indicate significance at the 1%, 5%, and 10% level, respectively.

$CAID_{[-40,-1]}$	$CAR_{[0,1]}$	$CAR_{[2,6]}$	$CAR_{[2,21]}$	$CAR_{[2,41]}$	$CAR_{[2,60]}$
Q5 (strong buy)	-0.33^{***}	-0.32^{***}	-0.36^{***}	-0.90^{***}	-1.48^{***}
	(-4.37)	(-5.39)	(-3.28)	(-5.65)	(-7.49)
Q4	-0.06	-0.18^{***}	-0.11	-0.24	-0.44^{**}
	(-0.74)	(-2.95)	(-1.02)	(-1.57)	(-2.37)
Q3	-0.02	-0.05	0.08	-0.19	-0.40^{*}
	(-0.24)	(-0.24)	(0.65)	(-1.09)	(-1.96)
Q2	0.16^{**}	0.11^{*}	0.55^{***}	0.66^{***}	0.75^{***}
	(1.99)	(1.78)	(5.16)	(4.49)	(4.20)
Q1 (strong sell)	0.45^{***}	0.40^{***}	1.02^{***}	1.28^{***}	1.47^{***}
	(5.75)	(6.29)	(9.20)	(7.87)	(7.80)
Q5−Q1	-0.79^{***}	-0.72^{***}	-1.39^{***}	-2.17^{***}	-2.95^{***}
	(-7.18)	(-8.28)	(-8.86)	(-9.58)	(-10.80)

Table III
Post-announcement Abnormal Return Conditional on Earnings Surprise and/or Pre-announcement Abnormal Institutional Demand

In the table, SUE denotes the standardized unexpected earnings, $CAID_{[-40,-1]}$ is the cumulative abnormal institutional demand from day −40 to day −1, and $CAR_{[2,60]}$ is the cumulative abnormal return from day 2 to day 60. In Panel A, stocks are sorted into quintiles based on SUE or $CAID_{[-40,-1]}$. The average $CAR_{[2,60]}$ and the corresponding difference between Q5 and Q1 are reported for each quintile. In Panel B, stocks are first sorted into quintiles conditional on SUE. Within each quintile, stocks are further sorted into quintiles based on $CAID_{[-40,-1]}$. The average $CAR_{[2,60]}$ of stocks in each of the 25 groups are reported. Also reported are the differences of $CAR_{[2,60]}$ between the quintiles with the highest and lowest SUE (i.e., Q5−Q1 (H−L)) and between the quintiles with strong institutional pre-announcement buy and sell (i.e., Q5−Q1 (Buy−Sell)). T-statistics are shown in parentheses. Symbols ***, ** and * indicate significance at the 1%, 5%, and 10% level, respectively. Returns are reported in percentage terms.

Panel A: $CAR_{[2,60]}$ conditional on SUE or $CAID_{[-40,-1]}$

	Q5	Q4	Q3	Q2	Q1	Q5−Q1
SUE	1.04***	0.13	−0.33*	−0.23	−0.70***	1.74***
	(5.81)	(0.76)	(−1.81)	(−1.16)	(−3.20)	(6.15)
$CAID_{[-40,-1]}$	−1.48***	−0.44**	−0.40*	0.75***	1.47***	−2.95***
	(−7.49)	(−2.23)	(−1.96)	(4.20)	(7.80)	(−10.80)

Panel B: $CAR_{[2,60]}$ conditional on SUE and $CAID_{[-40,-1]}$

	$CAID_{[-40,-1]}$					
SUE	Q5 (strong buy)	Q4	Q3	Q2	Q1 (strong sell)	Q5−Q1 (Buy−Sell)
Q5 (highest)	−0.04	1.11***	0.76*	1.41***	1.95***	−1.99***
	(−0.09)	(2.77)	(1.87)	(3.66)	(5.09)	(−3.50)
Q4	−1.78***	0.21	0.00	0.46	1.78***	−3.55***
	(−4.06)	(0.55)	(−0.01)	(1.26)	(5.01)	(−6.31)
Q3	−1.55***	−1.05**	−0.45	−0.03	1.43***	−2.99***
	(−3.83)	(−2.55)	(−1.04)	(−0.08)	(3.71)	(−5.34)
Q2	−1.56***	−0.84*	−0.67	1.10***	0.82*	−2.38***
	(−3.43)	(−1.96)	(−1.32)	(2.76)	(1.88)	(−3.78)
Q1 (lowest)	−2.52***	−1.66***	−1.48***	0.89*	1.25**	−3.77***
	(−5.26)	(−3.70)	(−2.77)	(1.95)	(2.37)	(−5.29)
Q5−Q1	2.49***	2.72***	2.24***	0.52	0.70	
(H−L)	(3.93)	(4.54)	(3.34)	(0.87)	(1.08)	

Table IV
Post-announcement Abnormal Return Conditional on Pre-announcement Abnormal Return and/or Institutional Demand

In the table, $CAR_{[-40,-1]}$ is the cumulative abnormal return from day −40 to day −1, $CAID_{[-40,-1]}$ is the cumulative abnormal institutional demand from day −40 to day −1, and $CAR_{[2,60]}$ is the cumulative abnormal return from day 2 to day 60. Panel A sorts stocks in the sample into quintiles based on $CAR_{[-40,-1]}$ or $CAID_{[-40,-1]}$. The panel reports the average $CAR_{[2,60]}$ of each quintile and their corresponding differences between Q5 and Q1. In Panel B, stocks are first sorted into quintiles conditional on $CAR_{[-40,-1]}$. Within each quintile, stocks are further sorted into quintiles based on $CAID_{[-40,-1]}$. Panel B reports the average $CAR_{[2,60]}$ of stocks in each of the 25 groups and the differences of $CAR_{[2,60]}$ between the quintiles with the most positive and negative pre-announcement returns (i.e., Q5−Q1 (P−N)) and between the quintiles with strong institutional pre-announcement buy and sell (i.e., Q5−Q1 (Buy−Sell)). T-statistics are shown in parentheses. Symbols ***, ** and * indicate significance at the 1%, 5%, and 10% level, respectively.

Panel A: $CAR_{[2,60]}$ conditional on $CAR_{[-40,-1]}$ or $CAID_{[-40,-1]}$

	Q5	Q4	Q3	Q2	Q1	Q5−Q1
$CAR_{[-40,-1]}$	−0.87***	−0.30**	−0.35***	0.25	1.18***	−2.05***
	(−3.99)	(−2.10)	(−2.48)	(1.58)	(4.50)	(−6.01)
$CAID_{[-40,-1]}$	−1.48***	−0.44**	−0.40*	0.75***	1.47***	−2.95***
	(−7.49)	(−2.23)	(−1.96)	(4.20)	(7.80)	(−10.80)

Panel B: $CAR_{[2,60]}$ conditional on $CAR_{[-40,-1]}$ and $CAID_{[-40,-1]}$

	$CAID_{[-40,-1]}$					
$CAR_{[-40,-1]}$	Q5 (strong buy)	Q4	Q3	Q2	Q1 (strong sell)	Q5−Q1 (Buy−Sell)
Q5 (positive)	−2.20***	−0.44	−2.20***	−0.12	0.60	−2.80***
	(−4.19)	(−0.93)	(−4.39)	(−0.27)	(1.24)	(−3.92)
Q4	−1.04***	−0.23	−0.89***	0.14	0.52	−1.55***
	(−2.95)	(−0.69)	(−2.65)	(0.42)	(1.58)	(−3.24)
Q3	−1.50***	−0.16	−0.98***	0.32	0.57*	−2.07***
	(−4.57)	(−0.49)	(−2.97)	(1.10)	(1.92)	(−4.67)
Q2	−1.27***	0.00	0.49	0.64**	1.37***	−2.64***
	(−3.37)	(−0.01)	(1.32)	(1.95)	(4.24)	(−5.32)
Q1 (negative)	−1.66***	0.24	0.71	2.72***	3.87***	−5.53***
	(−2.83)	(0.42)	(1.11)	(5.21)	(6.64)	(−6.68)
Q5−Q1 (P−N)	−0.54	−0.68	−2.91**	−2.84***	−3.27***	
	(−0.68)	(−0.91)	(−3.57)	(−4.10)	(−4.32)	

Table V
Multivariate Regression Analysis of Post-announcement Abnormal Return

This table presents the regression analysis of predicting post-announcement CAR based on pre-announcement CAID, earnings surprise, pre-announcement CAR and other control variables. Models (1)-(6) consider the following regression specification:

$$CAR_{[2,60]} = \beta_0 + \beta_1 CAID_{[-40,-1]} + \beta_2 SUE + \beta_3 CAR_{[-40,-1]} + \sum_{i=1}^{5} \gamma_i \times CV_i + \varepsilon,$$

where $CAR_{[2,60]}$ is the cumulative abnormal return from day 2 to day 60, and the explanatory variable $CAID_{[-40,-1]}$ is the cumulative abnormal institutional demand from day −40 to day −1, SUE is earnings surprise, and $CAR_{[-40,-1]}$ is the cumulative abnormal return from day −40 to −1. CV_i in the models are control variables, including stock size, stock price, stock illiquidity, idiosyncratic volatility, and institutional ownership of the stock. Models (7)-(8) also consider whether institutional investors are on the wrong side of the earnings surprise or not and adopt the following regression specification:

$$CAR_{[2,60]} = \beta_0 + \beta_1 SUE \times \boldsymbol{I}(SUE \times CAID_{[-40,-1]} \geq 0) + \beta_2 SUE \times \boldsymbol{I}(SUE \times CAID_{[-40,-1]} < 0) + \beta_3 CAR_{[-40,-1]} + \sum_{i=1}^{5} \gamma_i \times CV_i + \varepsilon,$$

where indicator function $\boldsymbol{I}(SUE \times CAID_{[-40,-1]} \geq 0)$ takes the value of 1 when pre-announcement abnormal institutional demand is not on the wrong side of the earnings surprise and 0 if otherwise, while $\boldsymbol{I}(SUE \times CAID_{[-40,-1]} < 0)$ takes the value of 1 when pre-announcement abnormal institutional demand is on the wrong side of the earnings surprise and 0 if otherwise. Standard errors are clustered by stock and calendar quarter (Petersen, 2009) and the two-way cluster-robust t-statistics are reported in parentheses. Symbols ***, ** and * indicate significance at the 1%, 5%, and 10% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Intercept	0.0173	0.0192	0.0166	0.0202	0.0175	0.0209	0.0192	0.0200
	(0.304)	(0.337)	(0.286)	(0.354)	(0.302)	(0.358)	(0.337)	(0.342)
$CAID_{[-40,-1]}$	−0.0008***			−0.0008***	−0.0008***	−0.0008***		
	(−5.465)			(−5.447)	(−5.207)	(−5.172)		
SUE		0.0014**		0.0014**		0.0016***		
		(2.440)		(2.410)		(2.822)		
$CAR_{[-40,-1]}$			−0.0538***		−0.0505***	−0.0539***		−0.0567***
			(−2.676)		(−2.507)	(−2.691)		(−2.887)
$SUE \times \boldsymbol{I}(SUE \times CAID_{[-40,-1]} \geq 0)$							0.0005	0.0008
							(0.868)	(1.394)
$SUE \times \boldsymbol{I}(SUE \times CAID_{[-40,-1]} < 0)$							0.0025***	0.0026***
							(3.693)	(3.909)
Control variables included	YES	YES	YES	YES	YES	YES	YES	YES
Adjusted R^2 (%)	0.296	0.164	0.293	0.370	0.474	0.572	0.198	0.421

Table VI

Post-announcement Abnormal Return Predictability and Limits-to-arbitrage

This table examines the relationship between post-announcement CAR predictability and limits-to-arbitrage by considering regression specification:

$$CAR_{[2,60]} = \beta_0 + \beta_1 CAID_{[-40,-1]} + \beta_2 SUE + \beta_3 CAR_{[-40,-1]} + \beta_4 CAID_{[-40,-1]} \times FC + \beta_5 SUE \times SC + \sum_{i=1}^{5} \gamma_i \times CV_i + \varepsilon,$$

where $CAR_{[2,60]}$ is the cumulative abnormal return from day 2 to day 60, the explanatory $CAID_{[-40,-1]}$ is the cumulative abnormal institutional demand from day −40 to day −1, SUE is the earnings surprise, $CAR_{[-40,-1]}$ is the cumulative abnormal return from day −40 to −1, and SC denotes stock characteristics related to limits-to-arbitrage. We consider eight measures and SCs are estimated over the prior year: (i) idiosyncratic volatility ($IdioVolaility$), measured by the standard deviation of residuals from regressing daily excess returns on Fama-French three factors; (ii) stock price ($Price$), the average daily closing price; (iii) bid-ask spread ($Spread$), the average daily closing bid-ask spread; (iv) dollar volume ($DVOL$), the logarithm of the average daily dollar volume; (v) institutional ownership ($INST$), the average fraction of shares outstanding held by institutions filling Form 13F; (vi) analyst coverage ($ACoverage$), the average number of analysts following the stock on I/B/E/S; (vii) number of institutional shareholders ($NINST$), the average number of institutional shareholders filling Form 13F; and (viii) stock size ($SIZE$), the logarithm of the average daily market capitalization. CV_i in the regression specification are control variables, including stock size, stock price, stock illiquidity, idiosyncratic volatility, and institutional ownership. Models (1)-(8) consider only the interaction term between $CAID_{[-40,-1]}$ and SC that relates to limits-to-arbitrage, while models (9)-(16) also include the interaction term between SUE and SC. Standard errors are clustered by stock and calendar quarter (Petersen, 2009) and the two-way cluster-robust t-statistics are reported in parentheses. Symbols ***, ** and * indicate significance at the 1%, 5%, and 10% level, respectively.

Panel A: Pre-announcement CAID interacted with stock characteristics related to limits-to-arbitrage

	(1)	(2)	(3)	(4)
Intercept	0.0207	0.0213	0.0212	0.0206
	(0.359)	(0.366)	(0.363)	(0.353)
$CAID_{[-40,-1]}$	0.0008***	−0.0012***	−0.0007***	−0.0023***
	(2.943)	(−6.097)	(−4.301)	(−3.495)
SUE	0.0016***	0.0017***	0.0017***	0.0017***
	(2.783)	(2.827)	(2.822)	(2.826)
$CAR_{[-40,-1]}$	−0.0516***	−0.0539***	−0.0538***	−0.0539***
	(−2.605)	(−2.692)	(−2.684)	(−2.684)
$CAID_{[-40,-1]} \times IdioVolatility$	−0.0591***			
	(−4.316)			
$CAID_{[-40,-1]} \times Price$		0.00001***		
		(2.930)		
$CAID_{[-40,-1]} \times Spread$			−0.0215*	
			(−1.794)	
$CAID_{[-40,-1]} \times DVOL$				0.0001**
				(2.163)
Control variables included	YES	YES	YES	YES
Adjusted R^2 (%)	0.82	0.59	0.58	0.58

Panel A of Table VI-*Continued*

	(5)	(6)	(7)	(8)
Intercept	0.0208	0.0205	0.0201	0.0203
	(0.357)	(0.351)	(0.346)	(0.248)
$CAID_{[-40,-1]}$	−0.0016***	−0.0013***	−0.0011***	−0.0059***
	(−4.118)	(−6.142)	(−5.634)	(5.604)
SUE	0.0016***	0.0017***	0.0017***	0.0017***
	(2.818)	(2.827)	(2.823)	(2.822)
$CAR_{[-40,-1]}$	−0.0537***	−0.0538***	−0.0536***	−0.0535***
	(−2.679)	(−2.679)	(−2.673)	(−2.668)
$CAID_{[-40,-1]} \times INST$	0.0013***			
	(2.906)			
$CAID_{[-40,-1]} \times ACoverage$		0.00006***		
		(4.326)		
$CAID_{[-40,-1]} \times NINST$			0.000002***	
			(4.551)	
$CAID_{[-40,-1]} \times SIZE$				0.0002***
				(5.086)
Control variables included	YES	YES	YES	YES
Adjusted R^2 (%)	0.61	0.61	0.61	0.62

Panel B: Both pre-announcement CAID and SUE interacted with stock characteristics related to limits-to-arbitrage

	(9)	(10)	(11)	(12)
Intercept	0.0212	0.0175	0.0176	−0.0089
	(0.367)	(0.303)	(0.301)	(−0.154)
$CAID_{[-40,-1]}$	0.0008***	−0.0012***	−0.0007***	−0.0023***
	(2.621)	(−6.060)	(−4.314)	(−3.369)
SUE	0.0027***	0.0024***	0.0008	0.0210***
	(2.623)	(4.645)	(1.202)	(6.581)
$CAR_{[-40,-1]}$	−0.0512***	−0.0541***	−0.0547***	−0.0543***
	(−2.588)	(−2.696)	(−2.726)	(−2.696)
$CAID_{[-40,-1]} \times IdioVolatility$	−0.0591***			
	(−3.844)			
$CAID_{[-40,-1]} \times Price$		0.00001***		
		(2.869)		
$CAID_{[-40,-1]} \times Spread$			−0.0218*	
			(−1.816)	
$CAID_{[-40,-1]} \times DVOL$				0.0001***
				(2.080)
$SUE \times IdioVolatility$	−0.0350			
	(−0.927)			
$SUE \times Price$		−0.00003		
		(−1.622)		
$SUE \times Spread$			0.1108***	
			(3.047)	
$SUE \times DVOL$				−0.0013***
				(−5.635)
Control variables included	YES	YES	YES	YES
Adjusted R^2 (%)	0.84	0.62	0.64	0.79

Panel B of Table VI-*Continued*

	(13)	(14)	(15)	(16)
Intercept	0.0199	0.0083	0.0064	−0.0065
	(0.341)	(0.142)	(0.111)	(−0.113)
$CAID_{[-40,-1]}$	−0.0016***	−0.0013***	−0.0011***	−0.0059***
	(−4.106)	(−6.121)	(−5.595)	(−5.505)
SUE	0.0036***	0.0027***	0.0024***	0.0278***
	(3.549)	(4.731)	(3.837)	(5.708)
$CAR_{[-40,-1]}$	−0.0539***	−0.0536***	−0.0538***	−0.0543***
	(−2.692)	(−2.675)	(−2.678)	(−2.694)
$CAID_{[-40,-1]} \times INST$	0.0013***			
	(2.895)			
$CAID_{[-40,-1]} \times ACoverage$		0.00006***		
		(4.281)		
$CAID_{[-40,-1]} \times NINST$			0.000002***	
			(4.411)	
$CAID_{[-40,-1]} \times SIZE$				0.0002***
				(4.985)
$SUE \times INST$	−0.0035***			
	(−2.619)			
$SUE \times ACoverage$		−0.0002***		
		(−3.493)		
$SUE \times NINST$			−0.000007***	
			(−2.849)	
$SUE \times SIZE$				−0.0013***
				(−5.096)
Control variables included	YES	YES	YES	YES
Adjusted R^2 (%)	0.64	0.63	0.63	0.74

Table VII

Post-announcement Abnormal Institutional Demand Conditional on Pre-announcement Abnormal Institutional Demand and/or Earnings Surprise

In this table, SUE is the standardized unexpected earnings, $CAID_{[-40,-1]}$ is the cumulative abnormal institutional demand from day −40 to day −1, and $CAID_{[2,60]}$ is the cumulative abnormal institutional demand from day 2 to day 60. In Panel A, we sort stocks into quintiles based on $CAID_{[-40,-1]}$ or SUE and report the average $CAID_{[2,60]}$ of each quintile and the differences between the two extreme quintiles, Q5 and Q1. In Panel B, we first sort stocks into quintiles conditional on SUE. Within each quintile, stocks are further sorted into quintiles based on $CAID_{[-40,-1]}$. We report the average $CAID_{[2,60]}$ for each of the 25 groups of stocks and their differences between the quintiles with the highest and lowest SUE (i.e., Q5−Q1 (H−L)) and between the quintiles with strong buy and sell in the pre-announcement period (i.e., Q5−Q1 (Buy−Sell)). T-statistics are shown in parentheses. Symbols ***, ** and * indicate significance at the 1%, 5%, and 10% level, respectively.

Panel A: $CAID_{[2,60]}$ conditional on $CAID_{[-40,-1]}$ or SUE

	Q5	Q4	Q3	Q2	Q1	Q5−Q1
$CAID_{[-40,-1]}$	−2.12***	−0.62***	0.28**	0.77***	2.44***	−4.56***
	(−16.49)	(−5.02)	(2.47)	(6.31)	(19.44)	(−25.38)
SUE	1.35***	0.90***	0.28**	−0.16	−1.16***	2.51***
	(10.16)	(7.14)	(2.23)	(−1.37)	(−9.89)	(14.16)

Panel B: $CAID_{[2,60]}$ conditional on SUE and $CAID_{[-40,-1]}$

	$CAID_{[-40,-1]}$					
SUE	Q5 (strong buy)	Q4	Q3	Q2	Q1 (strong sell)	Q5−Q1 (Buy−Sell)
Q5 (highest)	−1.06***	0.48*	1.44***	1.74***	3.86***	−4.92***
	(−3.80)	(1.76)	(5.74)	(6.44)	(13.65)	(−12.38)
Q4	−1.17***	0.25	0.43*	1.26***	3.07***	−4.24***
	(−4.19)	(0.92)	(1.69)	(4.70)	(11.42)	(−10.95)
Q3	−2.12***	−0.90***	0.25	0.91***	2.55***	−4.67***
	(−7.38)	(−3.34)	(0.98)	(3.30)	(9.03)	(−11.60)
Q2	−2.12***	−0.93***	−0.04	0.46	1.59***	−3.71***
	(−7.29)	(−3.41)	(−0.15)	(1.31)	(5.61)	(−9.14)
Q1 (lowest)	−4.07***	−1.92***	−0.74***	−0.47*	1.03***	−5.11***
	(−13.64)	(−6.80)	(−3.01)	(−1.69)	(3.67)	(−12.44)
Q5−Q1 (H−L)	3.01***	2.40***	2.18***	2.22***	2.82***	
	(7.37)	(6.12)	(6.20)	(5.69)	(7.07)	

Table VIII
Post-announcement Abnormal Institutional Demand Conditional on Pre-announcement Abnormal Return and/or Institutional Demand

In this table, $CAR_{[-40,-1]}$ is the cumulative abnormal return from day −40 to day −1, $CAID_{[-40,-1]}$ is the cumulative abnormal institutional demand from day −40 to day −1, and $CAID_{[2,60]}$ is the cumulative abnormal institutional demand from day 2 to day 60. Panel A sorts stocks into quintiles according to $CAR_{[-40,-1]}$ or $CAID_{[-40,-1]}$ and reports the average $CAID_{[2,60]}$ of each quintile and the differences between the extreme quintiles Q5 and Q1. Panel B first sorts stocks into quintiles conditional on $CAR_{[-40,-1]}$. Within each quintile, stocks are further sorted into quintiles based on $CAID_{[-40,-1]}$. It reports the average $CAID_{[2,60]}$ of each of the 25 groups of stocks and the differences between top and bottom quintiles of pre-announcement abnormal return or institutional demand. T-statistics are shown in parentheses. Symbols ***, ** and * indicate significance at the 1%, 5%, and 10% level, respectively.

Panel A: $CAID_{[2,60]}$ conditional on $CAR_{[-40,-1]}$ or $CAID_{[-40,-1]}$

	Q5	Q4	Q3	Q2	Q1	Q5−Q1
$CAR_{[-40,-1]}$	0.74***	−0.01	0.25**	0.18	−0.43***	1.17***
	(6.11)	(−0.05)	(2.09)	(1.46)	(−3.52)	(6.80)
$CAID_{[-40,-1]}$	−2.12***	−0.62***	0.28**	0.77***	2.44***	−4.56***
	(−16.49)	(−5.20)	(2.47)	(6.31)	(19.44)	(−25.38)

Panel B: $CAID_{[2,60]}$ conditional on $CAR_{[-40,-1]}$ and $CAID_{[-40,-1]}$

	$CAID_{[-40,-1]}$					
$CAR_{[-40,-1]}$	Q5 (strong buy)	Q4	Q3	Q2	Q1 (strong sell)	Q5−Q1 (Buy−Sell)
Q5 (positive)	−1.37***	0.00	0.65**	1.46***	3.01***	−4.38***
	(−4.81)	(−0.01)	(2.58)	(5.39)	(10.80)	(−10.99)
Q4	−2.11***	−1.41***	0.21	0.56**	2.71***	−4.82***
	(−7.50)	(−5.21)	(0.81)	(2.09)	(10.03)	(−12.36)
Q3	−1.47***	−0.60**	0.08	0.78***	2.51**	−3.99***
	(−5.10)	(−2.24)	0.30	(2.85)	(8.86)	(−9.85)
Q2	−2.18***	−0.27	0.38	0.59**	2.39***	−4.56***
	(−7.63)	(−0.99)	(1.48)	(2.16)	(8.58)	(−11.45)
Q1 (negative)	−3.48***	−0.78***	0.01	0.36	1.69***	−5.18***
	(−11.99)	(−2.79)	(0.06)	(1.29)	(5.90)	(−12.68)
Q5−Q1 (P−N)	2.11***	0.78*	0.63*	1.09***	1.32***	
	(5.19)	(1.97)	(1.81)	(2.82)	(3.29)	

Table IX

Multivariate Regression Analysis of Post-announcement Abnormal Institutional Demand

In this table, we use regression analysis to predict post-announcement CAID based on pre-announcement CAID, earnings surprise, pre-announcement CAR and other control variables. We consider the following regression specification:

$$CAID_{[2,60]} = \beta_0 + \beta_1 CAID_{[-40,-1]} + \beta_2 SUE + \beta_3 CAR_{[-40,-1]} + \sum_{i=1}^{5} \gamma_i \times CV_i + \varepsilon,$$

where $CAID_{[2,60]}$ is the cumulative abnormal institutional demand from day 2 to day 60, $CAID_{[-40,-1]}$ is the cumulative abnormal institutional demand from day -40 to -1, SUE is the standardized unexpected earnings, and $CAR_{[-40,-1]}$ is the cumulative abnormal return from day -40 to -1. The regressions include control variables CV_1 ($Size$), the logarithm of the average market capitalization; CV_2 ($Price$), the average daily closing stock price; CV_3 ($Illiquidity$), the average daily Amihud illiquidity ratio multiplied by a factor of 1 million; CV_4 ($IdioVolatility$), the standard deviation of residuals from regressing daily excess returns on Fama-French three factors; and CV_5 ($INST$), the average fraction of shares outstanding held by institutions filling Form 13F. To mitigate cross-sectional and time-series dependence, we cluster the standard errors by stock and calendar quarter (Petersen, 2009) and report the two-way cluster-robust t-statistics in parentheses. Symbols ***, ** and * indicate significance at the 1%, 5%, and 10% level, respectively.

	Dependent Variable: $CAID_{[2,60]}$					
	(1)	(2)	(3)	(4)	(5)	(6)
Intercept	−0.1896	0.0030	−0.3629	0.1596	−0.2023	0.1251
	(−0.081)	(0.001)	(−0.159)	(0.068)	(−0.085)	(0.053)
$CAID_{[-40,-1]}$	−0.1351***			−0.1349***	−0.1385***	−0.1379***
	(−7.726)			(−7.714)	(−7.965)	(−7.932)
SUE		0.1775***		0.1762***		0.1645***
		(6.250)		(6.210)		(5.732)
$CAR_{[-40,-1]}$			2.6456***		3.2003***	2.8608***
			(5.165)		(6.597)	(5.735)
Control variables included	YES	YES	YES	YES	YES	YES
Adjusted R^2 (%)	1.117	0.285	0.135	1.435	1.344	1.572

Table X
Post-announcement Abnormal Return Conditional on Earnings Surprise and/or Pre-announcement Abnormal Ratio of Institutional Trading

We consider an alternative measure of pre-announcement abnormal institutional demand in relation to the analysis conducted in Table III. During the evaluation period from day −40 to day −1, we calculate a ratio of institutional trading (RIT) based on the numbers of days that the stock is net purchased and net sold by institutional investors. It is subtracted by the benchmark ratio evaluated over the year to form the abnormal ratio of institutional trading, denoted by $ARIT_{[-40,-1]}$. This table examines $CAR_{[2,60]}$, conditional on SUE and/or $ARIT_{[-40,-1]}$, where SUE is the standardized unexpected earnings and $CAR_{[2,60]}$ is the cumulative abnormal return from day 2 to day 60. Panel A sorts stocks based on SUE or $ARIT_{[-40,-1]}$ and reports the average $CAR_{[2,60]}$ of stocks in each quintile and the differences between Q5 and Q1. Panel B reports the results of $CAR_{[2,60]}$ based on double sorting of SUE and $ARIT_{[-40,-1]}$. T-statistics are shown in parentheses. Symbols ***, ** and * indicate significance at the 1%, 5%, and 10% level, respectively. Returns are reported in percentage terms.

Panel A: $CAR_{[2,60]}$ conditional on SUE or $ARIT_{[-40,-1]}$

	Q5	Q4	Q3	Q2	Q1	Q5−Q1
SUE	1.04***	0.13	−0.33*	−0.23	−0.70***	1.74***
	(5.81)	(0.76)	(−1.81)	(−1.16)	(−3.20)	(6.15)
$ARIT_{[-40,-1]}$	−1.49***	−0.17	−0.58***	0.06	2.09***	−3.57***
	(−7.04)	(−0.97)	(−2.98)	(0.37)	(10.54)	(−12.29)

Panel B: $CAR_{[2,60]}$ conditional on SUE and $ARIT_{[-40,-1]}$

	$ARIT_{[-40,-1]}$					
SUE	Q5 (strong buy)	Q4	Q3	Q2	Q1 (strong sell)	Q5−Q1 (Buy−Sell)
Q5 (highest)	0.38	0.89**	0.45	0.72**	2.77***	−2.38***
	(0.85)	(2.32)	(1.19)	(1.98)	(6.74)	(−3.92)
Q4	−1.63***	0.02	−0.05	−0.12	2.20***	−3.83***
	(−3.51)	(0.05)	(−0.14)	(−0.34)	(5.70)	(−6.35)
Q3	−1.75***	−0.21	−1.03**	−0.50	1.85***	−3.59***
	(−3.89)	(−0.56)	(−2.45)	(−1.37)	(4.54)	(−5.93)
Q2	−1.50***	−0.60	−0.57	0.28	1.24***	−2.79***
	(−3.18)	(−1.41)	(−1.15)	(0.72)	(2.77)	(−4.26)
Q1 (lowest)	−2.98***	−0.92**	−1.68***	−0.15	2.22***	−5.20***
	(−5.76)	(−2.11)	(−3.29)	(−0.35)	(3.99)	(−6.85)
Q5−Q1	3.36***	1.81***	2.13***	0.87	0.55	
(H−L)	(4.91)	(3.12)	(3.35)	(1.56)	(0.79)	

Table XI

Post-announcement Abnormal Return Conditional on Abnormal Return on the Announcement Period and/or Pre-announcement Abnormal Institutional Demand

We consider an alternative measure of earnings surprise in relation to the analysis conducted in Table III. Earnings surprise here is proxied by abnormal return on the announcement period [0,1], i.e., $CAR_{[0,1]}$. This table examines post-announcement abnormal return, measured by $CAR_{[2,60]}$, conditional on $CAR_{[0,1]}$ and/or pre-announcement abnormal institutional demand $CAID_{[-40,-1]}$. In Panel A, stocks are sorted into quintiles based on $CAR_{[0,1]}$ or $CAID_{[-40,-1]}$ and the average $CAR_{[2,60]}$ of stocks in each quintile and the differences between Q5 and Q1 are reported. Panel B reports the results of $CAR_{[2,60]}$ based on double sorting of $CAR_{[0,1]}$ and $CAID_{[-40,-1]}$. T-statistics are shown in parentheses. Symbols ***, ** and * indicate significance at the 1%, 5%, and 10% level, respectively. Returns are reported in percentage terms.

Panel A: $CAR_{[2,60]}$ conditional on $CAR_{[0,1]}$ or $CAID_{[-40,-1]}$

	Q5	Q4	Q3	Q2	Q1	Q5−Q1
$CAR_{[0,1]}$	1.08^{***}	0.12	−0.04	-0.41^{**}	-1.03^{***}	2.11^{***}
	(5.41)	(0.79)	(−0.26)	(−2.37)	(−4.15)	(6.62)
$CAID_{[-40,-1]}$	-1.54^{***}	-0.41^{**}	-0.48^{**}	0.90^{***}	1.48^{***}	-3.01^{***}
	(−7.78)	(−2.23)	(−2.32)	(5.08)	(7.87)	(−10.90)

Panel B: $CAR_{[2,60]}$ conditional on $CAR_{[0,1]}$ and $CAID_{[-40,-1]}$

	$CAID_{[-40,-1]}$					
$CAR_{[0,1]}$	Q5 (strong buy)	Q4	Q3	Q2	Q1 (strong sell)	Q5−Q1 (Buy−Sell)
Q5 (highest)	−0.05	0.53	0.25	1.52^{***}	3.25^{***}	-3.30^{***}
	(−0.10)	(1.14)	(0.58)	(3.60)	(7.28)	(−5.10)
Q4	-0.62^{*}	−0.13	0.01	0.62	0.87^{***}	-1.49^{***}
	(−1.66)	(−0.36)	(0.01)	(1.84)	(2.60)	(−2.96)
Q3	-0.64^{*}	0.02	-0.69^{*}	0.87^{***}	0.32	-0.95^{*}
	(−1.76)	(0.04)	(−1.89)	(2.60)	(0.96)	(−1.94)
Q2	-1.68^{***}	-0.69^{*}	-0.78^{*}	0.30	1.09^{***}	-2.77^{***}
	(−4.32)	(−1.79)	(−1.79)	(0.81)	(2.91)	(−5.13)
Q1 (lowest)	-4.50^{***}	-1.47^{***}	-1.02^{*}	0.41	1.61^{***}	-6.11^{***}
	(−7.89)	(−2.83)	(−1.73)	(0.83)	(2.81)	(−7.55)
Q5−Q1	4.45^{***}	2.00^{***}	1.28^{*}	1.10^{*}	1.64^{**}	
(H−L)	(6.02)	(2.91)	(1.69)	(1.68)	(2.24)	

Table XII
Post-announcement Abnormal Return Conditional on Earnings Surprise and/or Pre-announcement Abnormal Institutional Demand with an Alternative Measure of Abnormal Return

This table considers an alternative measure of abnormal return in relation to Table III. Specifically, we construct 25 portfolios based on stock size at the end of June of the current year, and book-to-market ratio at the end of December of the previous year. Abnormal return is then calculated as the difference between stock raw return and the average return of the portfolio the stock falls in. SUE in the table is the standardized unexpected earnings, $CAID_{[-40,-1]}$ is the cumulative abnormal institutional demand from day −40 to day −1, and $CAR_{[2,60]}$ is the cumulative abnormal return from day 2 to day 60. Panel A sorts stocks based on SUE or $CAID_{[-40,-1]}$ and reports the average $CAR_{[2,60]}$ of stocks in each quintile and the differences between Q5 and Q1. Panel B reports the results of $CAR_{[2,60]}$ based on double sorting of SUE and $CAID_{[-40,-1]}$. T-statistics are shown in parentheses. Symbols ***, ** and * indicate significance at the 1%, 5%, and 10% level, respectively. Returns are reported in percentage terms.

Panel A: $CAR_{[2,60]}$ conditional on SUE or $CAID_{[-40,-1]}$

		Q5	Q4	Q3	Q2	Q1	Q5−Q1
SUE	Mean	0.21	−0.60***	−1.60***	−0.99***	−1.44***	1.64***
	t-stat.	(1.26)	(−3.77)	(−6.44)	(−5.45)	(−7.36)	(6.46)
$CAID_{[-40,-1]}$	Mean	−2.14***	−1.14***	−0.93***	−0.18	0.52***	−2.66***
	t-stat.	(−12.13)	(−6.73)	(−4.87)	(−1.09)	(3.10)	(−10.96)

Panel B: $CAR_{[2,60]}$ conditional on SUE and $CAID_{[-40,-1]}$

		$CAID_{[-40,-1]}$					
SUE		Q5 (strong buy)	Q4	Q3	Q2	Q1 (strong sell)	Q5−Q1 (Buy−Sell)
Q5 (high)	Mean	−0.89**	0.17	0.44	0.42	0.87**	−1.76***
	t-stat.	(−2.35)	(0.45)	(1.22)	(1.20)	(2.41)	(−3.37)
Q4	Mean	−1.88	−0.81	−0.90	−0.26	0.87	−2.75***
	t-stat.	(−4.86)	(−2.34)	(−2.43)	(−0.78)	(2.64)	(−5.41)
Q3	Mean	−2.40***	−1.52***	−1.14***	−0.89***	0.66*	−3.06***
	t-stat.	(−6.55)	(−4.19)	(−2.82)	(−2.55)	(1.87)	(−6.02)
Q2	Mean	−2.27***	−1.69***	−0.99***	−0.10	0.10	−2.37***
	t-stat.	(−5.50)	(−4.26)	(−2.17)	(−0.28)	(0.25)	(−4.21)
Q1 (low)	Mean	−3.28***	−1.74***	−1.98**	−0.22	0.07	−3.28***
	t-stat.	(−7.74)	(−4.05)	(−4.13)	(−0.52)	(0.17)	(−5.45)
Q5−Q1	Mean	2.39***	1.91***	2.41***	0.64	0.80	
(H−L)	t-stat.	(4.21)	(3.81)	(3.98)	(1.16)	(1.43)	

Table XIII

Multivariate Regression Analysis of Post-announcement Abnormal Return on Post- and Pre-announcement Abnormal Institutional Demands

This table documents the regression results of post-announcement CAR against post- and pre-announcement CAIDs, earnings surprise and pre-announcement CAR, controlling for stock characteristics in Model (1). The dependent variable is $CAR_{[2,60]}$, the cumulative abnormal return from day 2 to day 60; and explanatory variables include $CAID_{[2,60]}$ and $CAID_{[-40,-1]}$, the cumulative abnormal institutional demand from day 2 to day 60 and from day −40 to day −1, respectively; SUE, the standardized unexpected earnings; $CAR_{[-40,-1]}$, the pre-announcement abnormal return from day −40 to −1. Models (2)-(9) examine the relationship between post-announcement CAR predictability and limits-to-arbitrage after controlling for the effect of post-announcement CAID with reference to Table VI. We consider eight stock characteristics related to limits-to-arbitrage which are estimated over the prior year: (i) idiosyncratic volatility ($IdioVolaility$); (ii) stock price ($Price$); (iii) bid-ask spread ($Spread$); (iv) dollar volume ($DVOL$); (v) institutional ownership ($INST$); (vi) analyst coverage ($ACoverage$); (vii) number of institutional shareholders ($NINST$); and (viii) stock size ($SIZE$). To mitigate cross-sectional and time-series dependence, standard errors are clustered by stock and calendar quarter (Petersen, 2009) and the two-way cluster-robust t-statistics are reported in parentheses. Symbols ***, ** and * indicate significance at the 1%, 5%, and 10% level, respectively.

	(1)	(2)	(3)	(4)	(5)
Intercept	0.0208	0.0207	0.0212	0.0211	0.0205
	(0.356)	(0.357)	(0.365)	(0.361)	(0.352)
$CAID_{[2,60]}$	0.0010***	0.0010***	0.0010***	0.0010***	0.0010***
	(6.594)	(6.587)	(6.609)	(6.587)	(6.595)
$CAID_{[-40,-1]}$	−0.0007***	0.0010***	−0.0011***	−0.0005***	−0.0022***
	(−4.581)	(3.386)	(−5.621)	(−3.559)	(−3.367)
SUE	0.0015**	0.0015**	0.0015**	0.0015**	0.0015**
	(2.569)	(2.529)	(2.573)	(2.569)	(2.573)
$CAR_{[-40,-1]}$	−0.0568***	−0.0545***	−0.0568***	−0.0566***	−0.0567***
	(−2.811)	(−2.728)	(−2.812)	(−2.803)	(−2.803)
$CAID_{[-40,-1]} \times IdioVolatility$		−0.0595***			
		(−4.368)			
$CAID_{[-40,-1]} \times Price$			0.00001***		
			(3.015)		
$CAID_{[-40,-1]} \times Spread$				−0.0229*	
				(−1.953)	
$CAID_{[-40,-1]} \times DVOL$					0.0001**
					(2.233)
Control variables included	YES	YES	YES	YES	YES
Adjusted R^2 (%)	0.98	1.23	1.00	0.99	0.98

Table XIII-*Continued*

	(6)	(7)	(8)	(9)
Intercept	0.0207	0.0204	0.0200	0.0202
	(0.356)	(0.349)	(0.344)	(0.346)
$CAID_{[2,60]}$	0.0010***	0.0010***	0.0010***	0.0010***
	(6.589)	(6.592)	(6.587)	(6.581)
$CAID_{[-40,-1]}$	−0.0015***	−0.0012***	−0.0010***	−0.0058***
	(−3.961)	(−5.794)	(−5.198)	(5.457)
SUE	0.0015**	0.0015**	0.0015**	0.0015**
	(2.565)	(2.574)	(2.570)	(2.569)
$CAR_{[-40,-1]}$	−0.0566***	−0.0566***	−0.0564***	−0.0564***
	(−2.799)	(−2.799)	(−2.793)	(−2.788)
$CAID_{[-40,-1]} \times INST$	0.0014***			
	(3.027)			
$CAID_{[-40,-1]} \times ACoverage$		0.00006***		
		(4.367)		
$CAID_{[-40,-1]} \times NINST$			0.000002***	
			(4.512)	
$CAID_{[-40,-1]} \times SIZE$				0.0002***
				(5.035)
Control variables included	YES	YES	YES	YES
Adjusted R^2 (%)	1.01	1.01	1.01	1.02