Insider Trading, Future Earnings, and Post-Earnings Announcement Drift[⊗]

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Abstract: This paper examines the association between insider trading prior to quarterly earnings announcements and the magnitude of the post-earnings announcement drift (PEAD). We conjecture and find that insider trades reflect insiders' private information about the persistence of earnings news. Thus, insider trades can help investors better understand and incorporate the time-series properties of quarterly earnings into stock prices in a timely and unbiased manner, thereby mitigating PEAD. As predicted, PEAD is significantly lower when earnings announcements are preceded by insider trading. The reduction in PEAD is driven by contradictory insider trades (i.e., net buys before large negative earnings news or net sells before large positive earnings news) and is more pronounced in the presence of more sophisticated market participants. Consistent with investors extracting and trading on insiders' private information, pre-announcement insider trading is associated with smaller market reactions to future earnings news in each of the four subsequent quarters. Overall, our findings indicate insider trading contributes to stock price efficiency by conveying insiders' private information about future earnings and especially the persistence of earnings news.

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Keywords: insider trading; price efficiency; post-earnings announcement drift; predicting earnings

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1. Introduction

While the prior literature shows insiders trade on private information, there has been a long and contentious debate regarding the role of insider trading in financial markets and how it should be regulated.[1] Academics have long posited that insider trading makes financial markets more informationally efficient by incorporating insiders' private information into stock prices (Bernhardt et al., 1995; Carlton and Fischel, 1983; Leland, 1992; Manne, 1966). Despite decades of academic research on insider trading, the extant literature has failed to reach a consensus on the effect of insider trading on stock price efficiency (Bhattacharya, 2014; Hu and Noe, 1997). We contribute to this important debate by examining the association between insider trading and stock price efficiency in the context of quarterly earnings announcements. Accordingly, we provide empirical evidence on the validity of a key assumption made by proponents of insider trading—that insider trading leads to improved stock price efficiency. Our findings are relevant to policymakers, regulators, and other participants in the insider trading debate.

Extensive prior research has investigated the well-documented post-earnings announcement drift (PEAD) anomaly. The most widely accepted and empirically supported explanation is that PEAD arises from investors' failure to fully incorporate the time-series properties of earnings into stock prices in a timely and unbiased manner (Ball and Bartov, 1996; Bartov et al., 2000; Bernard and Thomas, 1989; Freeman and Tse, 1989; Rendleman et al., 1987). Supporting this explanation, prior studies find a predictable and disproportionately large fraction of the PEAD stock returns accrue around the subsequent four quarterly earnings announcements

[1] As Fox et al. (2018) summarize: "Few topics have divided law and economics scholarship as deeply as informed trading by issuer insiders. There is vociferous disagreement not only concerning the justification for prohibiting such insider trading, but whether a prohibition should exist at all."

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(Ball and Bartov, 1996; Bernard and Thomas, 1990, 1989; Freeman and Tse, 1989; Narayanamoorthy, 2006). Furthermore, PEAD returns are negatively associated with earnings volatility due to investors not fully understanding the implications of earnings persistence on the time-series properties of earnings, suggesting that PEAD is not only a function of the magnitude of earnings news, but also its persistence (Cao and Narayanamoorthy, 2012).

Insiders have private information about current and future earnings, and hence, about the persistence of earnings.[2] If insiders use this private information to trade, then their trading may assist outside investors in better understanding the stochastic process underlying earnings. For instance, an insider buy (sell) before positive (negative) earnings news potentially indicates that the insider knows the earnings news will be more persistent than investors would otherwise expect, and vice versa. Consequently, insider trading can provide information about the persistence of earnings news. As a result, by conditioning on insider trading signals when assessing current earnings news, investors can better understand the time-series properties of earnings, and especially the persistence of earnings. This implies insider trading in the pre-earnings announcement period can help mitigate PEAD, and hence, improve stock price efficiency during the post-earnings announcement period. Accordingly, we examine whether PEAD is lower when insider trading precedes quarterly earnings announcements.

We focus on PEAD because it is a robust anomaly, represents a pervasive lack of stock price efficiency, and relates to current and future earnings news for which insiders have an informational advantage (Balakrishnan et al., 2010; Ball and Bartov, 1996; Bernard and Thomas,

[2] It is illegal for insiders to trade while in possession of material nonpublic information (i.e., private information) (Securities and Exchange Acts of 1933 and 1934, Insider Trading Sanctions Act of 1984, Insider Trading and Securities Fraud Enforcement Act of 1988). However, the voluminous empirical literature on insider trading generally finds that insiders frequently trade on the basis of private information, as their trades earn abnormal profits on average (Aboody and Lev, 2000; Jeng et al., 2003; Ravina and Sapienza, 2010; Seyhun, 1986).

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1990; Livnat and Mendenhall, 2006). We base our analyses on quarterly earnings announcements to increase the power of our tests, as the anomalous PEAD returns follow a distinct quarterly pattern (Ball and Bartov, 1996; Bernard and Thomas, 1990). We employ a broad sample of 458,712 firm-quarter observations (14,354 distinct firms) covering the period of 1988 to 2016.

In preliminary analyses, we find the absolute magnitudes of abnormal stock returns around quarterly earnings announcements are significantly smaller when insider trades precede quarterly earnings announcements.[3] These results suggest market participants condition their responses to earnings news in part based on insiders' trades prior to the news.[4] Thus, our evidence is consistent with pre-announcement insider trading partially preempting earnings news, similar to the conclusions of Roulstone (2008) and Udpa (1996).[5]

In our main analyses, we examine whether pre-announcement insider trades are associated with stock price efficiency by examining the magnitude of PEAD over the 120 trading days (approximately six calendar months) following quarterly earnings announcements using portfolio- and regression-based tests. Our portfolio analyses show the absolute magnitude of PEAD is significantly smaller when there is insider trading prior to quarterly earnings announcements. In addition, the magnitude of hedge returns based on a long position in the highest quintile of standardized unexpected earnings (*SUE*) and a short position in the lowest *SUE* quintile is about

[3] Some prior studies focus on insider buys under the assumption that (most) insider sells are driven by liquidity or diversification reasons, rather than by private information (e.g., Lakonishok and Lee, 2001). However, numerous studies find insider sells reflect private information (Badertscher et al., 2011; Cohen et al., 2012; Damodaran and Liu, 1993; Huddart et al., 2007; Ke et al., 2003; Noe, 1999). Accordingly, we examine both buys and sells.

[4] In supplementary tests using data from the pre-Sarbanes-Oxley Act period when insider trades were not required to be disclosed promptly (Bartov and Faurel, 2016), we find the reductions in announcement-period abnormal stock returns are only significant when pre-announcement period insider trades are disclosed before the earnings announcements. We find no significant differences in announcement period returns when the insider trades are disclosed after the earnings announcements.

[5] One interpretation of our results is that investors directly use insider trading signals to update their beliefs. Another possibility is that, after observing insider trading signals, at least some investors search for private information, which then becomes impounded into prices through their trading. In either case, insider trading results in at least some of insiders' private information being, directly or indirectly, incorporated into stock prices.

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29% smaller when earnings announcements are preceded by insider trading compared to when they are not (4.26% versus 5.97%).

Consistent with the portfolio-based results, we find a significant negative association between prior insider trading and PEAD in our regression analyses. These findings indicate stock prices are more efficient in the post-earnings announcement period when insider trading precedes earnings announcements. However, insider trading does not result in fully efficient prices in a timely manner as PEAD is still significant following insider trading. Thus, our findings are consistent with investors failing to fully and promptly incorporate into stock prices the information conveyed by insider trading pertaining to the time-series properties of earnings news and especially the persistence of earnings.

We analyze cross-sectional variation in the negative association between pre-announcement insider trading and PEAD across two dimensions. First, we examine variations related to different types of insider trading signals. We allow the association to vary between "contradictory" insider trades, where net buys (net sells) precede large negative (positive) earnings news, and "other" (noncontradictory) trades (Dargenidou et al., 2018; Hillier and Marshall, 2002; Veenman, 2012). Consistent with contradictory trades being informative about the lower level of persistence for large current earnings news, we find that the negative association between insider trading and PEAD is concentrated among contradictory trades. We also find that the negative association is significantly stronger when insider trades are more likely to be based on private information—that is, when there are multiple insiders trading and when insider trades are opportunistic (Cohen et al., 2012).

Second, we examine cross-sectional variation related to the ability of market participants to analyze insider trading signals and infer insiders' private information about the persistence of

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earnings news. Given their superior motivation, resources, and ability to combine the information from insider trades with their better understanding of the earnings process, we expect that sophisticated market participants, such as institutional investors and financial analysts, can more efficiently extract insiders' private information from their trades and incorporate this information in their trading or forecasting decisions. Consistent with our expectations, we find the negative association between insider trading and PEAD is significantly stronger in firms with greater institutional ownership, analyst coverage, and competition among informed investors (Akins et al., 2012). Taken together, our findings indicate insider trading is negatively associated with PEAD at least in part because it helps sophisticated market participants better understand the time-series properties of earnings news, and especially the persistence of earnings.

To provide corroborating evidence on the mechanism underlying the negative association between insider trading and PEAD, we examine whether insider trading is associated with the direction and magnitude of future earnings news. We find the association between quarter q's earnings news and the earnings news for quarters q+1 and q+2 (q+3 and q+4) is significantly more positive (less negative) when there is insider trading prior to quarter q's earnings announcement. Furthermore, as expected, contradictory (other) trades are negatively (positively) associated with the persistence of earnings news. In other words, current earnings news is more transitory (persistent) in the subsequent quarters when contradictory (other) trades precede earnings announcements, relative to earnings announcements with no preceding insider trading. These results provide evidence that insider trades are useful to investors in determining the persistence of current earnings news and the inferences depend on the type of trade.

Finally, we examine whether insider trading is associated with the magnitude of the market reaction to future earnings news. If investors use the information conveyed by insider trades to

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better understand the implications of current earnings news for future earnings, then we expect the market reaction to future earnings news to be smaller. Consistent with our expectations, insider trading prior to the current quarter's earnings announcement is negatively associated with the magnitude of the market reaction to future earnings news in each of the four subsequent quarters. The negative associations hold for both contradictory and other (noncontradictory) insider trades. These findings further support the argument that insider trading assists investors in anticipating future earnings by providing additional information about the persistence of earnings news.

We contribute to the literature in several ways. First, our results are relevant to the ongoing debate on how insider trading affects financial markets, especially market efficiency (Bhattacharya, 2014; Fox et al., 2018; Hu and Noe, 1997). We contribute to this important debate by providing empirical support for the key assumption made by proponents of insider trading—that insider trading improves stock price efficiency. We find insider trading is negatively associated with a commonly used measure of market inefficiency. As such, our findings are relevant to policymakers, regulators, and academics.[6]

Second, we add to the insider trading literature by showing that one source of private information insiders trade on relates to the persistence of earnings (Huddart et al., 2007; Ke et al., 2003; Piotroski and Roulstone, 2008, 2005). Our evidence indicates insiders' trading decisions are more nuanced than often assumed, as they relate to the persistence of earnings news (and not just their sign) and are especially informative when they contradict large earnings news.

Third, we contribute to the extensive literature on PEAD. This literature finds PEAD is smaller when there are more sophisticated market participants (Akins et al., 2012; Bartov et al., 2000). Our evidence suggests that one factor behind this negative association is the ability of

[6] While our evidence supports assumptions about the positive effects of insider trading on market efficiency, our evidence does not imply that insider trading is socially beneficial, as we do not consider all of its costs and benefits.

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sophisticated market participants to extract information from insider trades related to the persistence of earnings and use it to better understand the time-series properties of quarterly earnings. We also provide useful information to investors on enhancing PEAD-based trading strategies by conditioning on insider trading signals when assessing earnings news.

In the next section, we discuss the prior literature and develop our hypotheses. In Section 3, we discuss our research methodology, sample construction, and descriptive statistics. We present the results of our empirical analyses in Section 4 and conclude in Section 5.

2. Prior literature and hypotheses development

PEAD is a robust, well-documented anomaly whereby stock prices predictably move in the same direction as the earnings news over the subsequent six to 12 months (e.g., Balakrishnan et al., 2010; Ball and Bartov, 1996; Bernard and Thomas, 1990, 1989; Livnat and Mendenhall, 2006). The most widely accepted and empirically supported explanation is that the drift represents investors' failure to fully understand the time-series properties of quarterly earnings in a timely and unbiased fashion (e.g., Ball and Bartov, 1996; Bartov et al., 2000; Bernard and Thomas, 1990; Freeman and Tse, 1989; Rendleman et al., 1987).[7]

Prior research shows that the time-series of quarterly earnings follows an auto-regressive process with positive terms for the first three lags and a negative term for the fourth lag (e.g., Ball and Bartov, 1996; Bernard and Thomas, 1990; Brown and Rozeff, 1988). Under this stochastic process, earnings surprises in the current quarter persist over the subsequent three quarters before partially reversing in the fourth quarter. However, prior studies find that investors do not appear to fully understand this serial correlation. For instance, Bernard and Thomas (1990) finds that

[7] Other non-mutually exclusive explanations for PEAD examined in the literature include, but are not limited to, direct and indirect trading costs (Bhushan, 1994; Chordia et al., 2009; Ng et al., 2008) and arbitrage constraints (Mendenhall, 2004).

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investors form their earnings expectations, at least in part, based on a seasonal random walk model, while Ball and Bartov (1996) shows that investors systematically underestimate the magnitude of the serial correlation in earnings. According to this literature, PEAD results from investors' failure to fully and promptly incorporate the time-series properties of earnings into stock prices in an unbiased manner (e.g., Ball and Bartov, 1996; Bartov et al., 2000; Bernard and Thomas, 1990; Freeman and Tse, 1989; Rendleman et al., 1987; Soffer and Lys, 1999).

Supporting this explanation, prior studies find predictable stock returns around the subsequent four quarterly earnings announcements, where stock return signs correspond to the serial correlation of earnings. Furthermore, a disproportionately large fraction of the PEAD returns accrues around these subsequent earnings announcements (Ball and Bartov, 1996; Bernard and Thomas, 1990, 1989; Freeman and Tse, 1989; Narayanamoorthy, 2006). Moreover, recent work shows that PEAD returns are negatively associated with earnings volatility due to investors not fully understanding the implications of earnings persistence on the time-series properties of earnings (Cao and Narayanamoorthy, 2012). Their results suggest that PEAD is not only a function of the magnitude of earnings news, but also its persistence.

Insiders have private information about their firms' current and future earnings, and this information provides them with valuable trading opportunities. The prior literature indicates that insiders base their trades, at least in part, on private information about future earnings, beyond the current quarter's earnings (Huddart et al., 2007; Ke et al., 2003; Piotroski and Roulstone, 2008, 2005). For example, Piotroski and Roulstone (2005) find net buys during a given year are positively associated with the change in earnings in the subsequent year. In this context, insiders'

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valuations will, directly or indirectly, be based on their private information about future earnings.[8] Thus, we expect insider trades provide valuable signals about future earnings.

In determining the valuation consequences of an earnings announcement, a critical task for investors is to assess the persistence of the earnings news because this determination is important for valuation purposes (Collins and Kothari, 1989; Easton and Zmijewski, 1989; Kormendi and Lipe, 1987; Ohlson, 1989). For example, Cao and Narayanamoorthy (2012) provides evidence that the volatility of past and current earnings helps investors better understand the serial correlation in earnings, which reduces PEAD. However, assessing the persistence of earnings is relatively difficult, as it varies widely across both firms and time and may even vary nonlinearly with the magnitude of the earnings news (Balakrishnan et al., 2010; Freeman and Tse, 1992). Investors can better assess the persistence of earnings news when they have access to additional information that assists them in interpreting the earnings news. Such information helps investors better understand the stochastic process underlying earnings, thereby mitigating PEAD (e.g., Hsu et al., 2021; Zhang, 2012). Consistent with this idea, Zhang (2012) finds that when firms issue more accurate management earnings forecasts, either preceding or contemporaneous with the earnings announcement, PEAD is significantly lower.

In a similar fashion, we posit that insider trading signals assist investors in better understanding the stochastic process underlying earnings by providing additional information about the persistence of current earnings news.[9] To illustrate, an insider buy (sell) before positive

[8] Trading based on private information about more distant future earnings helps insiders avoid any legal, regulatory, and reputational costs associated with trading on private information about the current quarter's earnings (Ke et al., 2003). In addition, Section 16(b) of the Securities and Exchange Act of 1934 requires that insiders hold their trading positions for at least 180 days or their trading profits are subject to forfeiture. This requirement results in insiders using their private information about future quarters' earnings when making their trading decisions.

[9] The basic idea that investors might use insiders' trades to infer their private information about future earnings goes back at least to the work of Givoly and Palmon (1985) and Penman (1985). More recently, Veenman (2012) provides evidence suggesting that insider purchases provide investors with relevant information about future earnings and the persistence of earnings.

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(negative) earnings news potentially indicates that the insider knows that the earnings news will be more persistent than investors would otherwise anticipate. Similarly, an insider buy (sell) before negative (positive) earnings news potentially indicates that the insider knows the earnings news will be more transitory than investors would otherwise expect. In both cases, insider trading provides information about the persistence of current earnings news. As a result, by conditioning on insider trading signals when assessing current earnings news, investors can better understand the time-series properties of earnings, and especially the persistence of earnings. Thus, we expect that insider trading prior to quarterly earnings announcements leads to smaller PEAD.

The idea that investors use the realizations from one signal (i.e., insider trading disclosures) to condition their response to the realization of another signal (i.e., earnings news) is well supported in the accounting literature (e.g., Antle et al., 1994; Bradshaw and Sloan, 2002; Hutton et al., 2003; Li, 2010; Lundholm, 1991; Rees and Sivaramakrishnan, 2007). Theory demonstrates that two signals can be interactively informative so that the inferences from one are conditional on the other (Antle et al., 1994; Gonedes, 1978; Lundholm, 1991).[10] Accordingly, we expect investors combine the information from the *ex-ante* insider trading signal with the current earnings news to better understand the time-series properties of earnings.

In summary, if insiders' trading decisions are based on their private information about future earnings, then we expect investors condition their responses to current earnings news on the private information about the persistence of current earnings news conveyed by insider trades prior to quarterly earnings announcements. Thus, insider trading allows investors to better incorporate the time-series properties of earnings news, and especially the persistence of earnings, into stock

[10] Empirically, Hutton et al. (2003) find that investors only respond to good news management forecasts when they issue verifiable forward-looking statements. The meet-or-beat literature finds that investors' reactions to positive (negative) earnings news are conditional on the realizations of other signals (Brown et al., 2009; Ghosh et al., 2005; Rees and Sivaramakrishnan, 2007).

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prices, which mitigates PEAD, *ceteris paribus*. Accordingly, we make the following hypothesis.

Hypothesis 1: Insider trading is negatively associated with the post-earnings announcement drift in abnormal stock returns.

As discussed above, the magnitude of PEAD is associated with the extent to which investors fail to fully and promptly incorporate the time-series properties of quarterly earnings into stock prices (e.g., Ball and Bartov, 1996; Bernard and Thomas, 1990; Soffer and Lys, 1999). Prior studies indicate that sophisticated market participants (e.g., institutional investors and financial analysts) are better and faster at understanding and incorporating the implications of current earnings news into stock prices. For example, stock prices of firms with high analyst following or institutional ownership incorporate future earnings news earlier than other firms (Ayers and Freeman, 2003; Brennan et al., 1993).

In line with these findings, several studies show that the presence of sophisticated market participants helps mitigate PEAD (e.g., Akins et al., 2012; Bartov et al., 2000; Ben-Rephael et al., 2017; Zhang, 2008). Bartov et al. (2000) conjecture that institutional investors are able to "characterize the autoregressive nature of the process underlying earnings correctly and able to unbiasedly estimate its parameters" and find supporting evidence that institutional ownership is negatively associated with both PEAD and the stock returns around the subsequent quarterly earnings announcements. Zhang (2008) shows that analysts' prompt forecast revisions following quarterly earnings announcements help investors better assess current earnings news, which significantly lowers PEAD. Relatedly, Ben-Rephael et al. (2017) document that institutional investor attention facilitates the incorporation of current earnings news into stock prices, which produces stronger market reactions around earnings news and smaller PEAD. These studies posit that sophisticated market participants are better and faster at assessing the implications of current

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earnings news, resulting in earnings information being more efficiently incorporated into stock prices and, in turn, smaller PEAD.[11]

Above, we hypothesize that insider trades prior to quarterly earnings announcements mitigate PEAD by providing investors with additional information that helps them better understand the time-series properties of earnings news. We expect market participants vary in their ability to extract the information conveyed by insider trades. For insider trades to be informative and reduce PEAD, market participants must i) observe the insider trading disclosures filed with the SEC, ii) infer insiders' private information about (the persistence of) earnings news from the trade disclosures, iii) use this information to update their earnings and valuation forecasts, and finally iv) incorporate this information in their trading or forecasting decisions by the earnings announcement date. This process entails high information acquisition and processing costs as well as an enhanced ability to understand the time-series properties of quarterly earnings and promptly incorporate their implications into stock prices.[12] Given the effort, time and financial constraints, and analytical difficulties involved, we expect sophisticated market participants are more likely to incorporate the relevant information conveyed by insider trades in their trading or forecasting decisions. Thus, we expect that sophisticated market participants' information advantages stem, at least in part, from their superior motivation, resources, and ability to combine the information from insider trades with their better understanding of the stochastic process underlying earnings news. Accordingly, we make the following hypothesis.

Hypothesis 2: The negative association between insider trading and the post-earnings announcement drift in abnormal stock returns is stronger when there are more sophisticated market participants.

[11] Consistent with this idea, Akins et al. (2012) argue that in the presence of institutional investors, stock prices incorporate private information about fundamental value faster. They find that firms with greater competition among institutional investors experience less market inefficiencies and, as a result, lower PEAD.

[12] This process is similar to the one modeled in Kim and Verrecchia (1994), whereby certain investors are able to extract private information by processing public earnings announcements at some cost.

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3. Methodology, sample, and descriptive statistics

3.1. Methodology

To examine the association between pre-earnings announcement insider trading and PEAD, we conduct both portfolio- and regression-based analyses. For our portfolio-based tests, we form portfolios based on the magnitudes of earnings news and pre-announcement insider trading. Consistent with prior studies on PEAD (e.g., Bernard and Thomas, 1990), our primary measure of unexpected earnings is standardized unexpected earnings (SUE), which is estimated using time-series prediction models. Specifically, we estimate expected earnings per share based on a seasonal random walk with a trend model, where the trend is estimated using the most recent 12 quarters of earnings per share. We compute *SUE* as actual earnings per share minus expected earnings per share divided by standard deviation of unexpected earnings over the trend estimation period. We sort all firm-quarter observations and classify them into five equal-size portfolios based on the magnitude of *SUE* in a calendar quarter. The lowest *SUE* quintile ("SUE1") contains the lowest *SUE* (e.g., most negative) and the highest *SUE* quintile ("SUE5") contains the highest *SUE* (e.g., most positive). Following prior research (e.g., Balakrishnan et al., 2010), we compute quintile cutoffs based on the prior quarter's *SUE* distribution to avoid any look-ahead bias.

Next, we independently sort firm-quarter observations and classify them based on the existence of insider trading transactions in the pre-earnings announcement period. As illustrated in Figure 1, we define the pre-earnings announcement (or pre-announcement) period for quarter q as starting two days after the quarterly earnings announcement of quarter q-1 and ending three days before the quarterly earnings announcement of quarter q. We partition firm-quarters into two portfolios, Prior Insider Trading and No Prior Insider Trading, based on whether any insider trading transactions occurred during the pre-earnings announcement period. We only include open

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market stock buys and sells made by officers and directors during the period 1988 to 2016.

For each portfolio, we compute buy-and-hold abnormal stock returns over two windows, [-2, 0] and [1, 120], where day zero is the quarterly earnings announcement date.[13] We measure abnormal stock returns using the Carhart (1997) four-factor model with a 40 trading-day estimation period, starting 55 trading days prior to the earnings announcement date.[14] Since our hypotheses concern the magnitude of PEAD, we also compute stock returns of a hedge portfolio that takes a long position in firms with high unexpected earnings (SUE5) and a short position in firms with low unexpected earnings (SUE1). We compare the magnitudes of the hedge returns across various portfolios. We calculate bootstrap *t*-statistics by simulating 500 long-short stock return differences and contrasting the realized hedge returns against the empirical distributions of these return differences.[15] The use of bootstrap *t*-statistics mitigates concerns of using parametric test statistics (such as skewness bias), raised by Kothari and Warner (1997) and Barber and Lyon (1997), when using long-window stock returns.

For our regression-based analyses, we estimate the following regression model.

$$\begin{aligned} BHAR_{[1,120],i,q} = {} & \alpha_0 + \alpha_1 PriorInsiderTrading_{i,q} + \alpha_2 QSUE_{i,q} + \alpha_3 QSUE_{i,q} * PriorInsiderTrading_{i,q} \\ & + \alpha_4 QInstOwn_{i,q} + \alpha_5 QSUE_{i,q} * QInstOwn_{i,q} + \alpha_6 QSpread_{i,q} \\ & + \alpha_7 QSUE_{i,q} * QSpread_{i,q} + \alpha_8 Bundle_{i,q} + \alpha_9 QSUE_{i,q} * Bundle_{i,q} \\ & + \alpha_{10} QEarnVol_{i,q\text{-}1} + \alpha_{11} QSUE_{i,q} * QEarnVol_{i,q\text{-}1} + \alpha_{12} Beta_{i,q} + \alpha_{13} Size_{i,q} \\ & + \alpha_{14} B/M_{i,q} + \alpha_{15} Momentum_{i,q} + \alpha_{16} BadNews_{i,q} + \alpha_{17} 4thQ_{i,q} \\ & + \sum Quarter\ Fixed\ Effects + \sum Firm\ Fixed\ Effects + \varepsilon_{i,q}, \end{aligned} \quad (1)$$

[13] We also replicate our tests using the window [1, 60]. Untabulated results are qualitatively similar from those tabulated in the paper, and our inferences remain unchanged.

[14] If a firm delists during the return accumulation window, we compute the remaining return by using the CRSP delisting return and reinvesting any remaining proceeds in the appropriate benchmark portfolio.

[15] Bootstrapped *t*-statistics for the null hypothesis of zero long-short stock returns are based on Monte Carlo simulations. We randomly assign firm-quarter observations into each portfolio (e.g., SUE5 & Prior Insider Trading) by matching the number of firm-quarter observations in each portfolio. We simulate 500 long-short stock returns to construct bootstrapped empirical distributions, which we then use to test the statistical significance of the observed long-short stock returns and calculate bootstrapped *t*-statistics. In untabulated tests, we find that significance levels and hence inferences remain unchanged if we use parametric *t*-statistics.

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where $BHAR_{[1,120],i,q}$ is the buy-and-hold abnormal stock returns for firm *i* over the window [1, 120] and day zero is the earnings announcement date of quarter *q*. *QSUE* is the quintile ranking of *SUE*, scaled to range between zero and one.[16] *PriorInsiderTrading* is an indicator variable equal to one if the firm has at least one insider trade during the pre-earnings announcement period and zero otherwise. Our main variable of interest is the *QSUE***PriorInsiderTrading* interaction, whose coefficient estimate represents the extent to which the association between earnings news and PEAD is significantly different when insider trading precedes quarterly earnings announcements, compared to when it does not.

To control for other documented determinants of PEAD, we interact the following four variables with *QSUE*. *QInstOwn* is the quintile ranking of *InstOwn*, scaled to range between zero and one, and *InstOwn* is the percentage of institutional ownership at the beginning of the quarter. Bartov et al. (2000) find that institutional ownership is negatively associated with PEAD. *QSpread* is the quintile ranking of *Spread*, scaled to range between zero and one, and *Spread* is the average daily bid-ask spread during the quarter. Ng et al. (2008) find that liquidity measures, including the bid-ask spread, are positively associated with PEAD. *Bundle* is an indicator variable equal to one if the firm's earnings announcement is bundled with a management forecast of next quarter's earnings and zero otherwise. Zhang (2012) documents that, when quarterly earnings announcements are bundled with management quarterly earnings forecasts, PEAD is reduced. *QEarnVol* is the quintile ranking of *EarnVol*, scaled to range between zero and one, and *EarnVol* is the standard deviation of earnings per share in the quarters *q*-11 to *q*-1. Cao and Narayanamoorthy (2012) find earnings volatility is negatively associated with PEAD. We also include these four variables as main effects for econometric reasons.

[16] We replicate our tests using either the continuous measure of *SUE* or its percentile rank. The untabulated results are qualitatively similar to the tabulated results and our inferences remain unchanged.

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Finally, we include six additional independent variables to control for firm characteristics and factors potentially associated with future abnormal stock returns (e.g., Akins et al., 2012). We include *Beta*, the stock market beta; *Size*, the natural logarithm of market value of equity at the beginning of the quarter; *B/M*, the ratio of the book value of equity to the market value of equity at the beginning of the quarter; *Momentum*, the three-month raw stock returns ending three trading days prior to the earnings announcement date; *BadNews*, an indicator variable equal to one if *SUE* for the quarter is negative and zero otherwise; and *4thQ*, an indicator variable equal to one if the quarter is the fourth fiscal quarter of the year and zero otherwise. We include calendar quarter fixed effects to control for market-wide movements of stock return and firm fixed effects to isolate within-firm variation.[17] Continuous variables are winsorized at 1% and 99% for each quintile of *SUE*. Standard errors are clustered at the firm and calendar quarter levels (Gow et al., 2010).

Insiders frequently trade on private information about the firm. For example, prior research has examined insider trading before major corporate events, such as restatements and SEC comment letters, and its valuation implications (Badertscher et al., 2011; Dechow et al., 2016). Similarly, we investigate to what extent do investors make use of publicly observed insider trading signals when assessing earnings persistence. We do not believe endogeneity or reverse causality is a major concern in our setting.[18] For reverse causality to hold, insiders must be more likely to trade when they anticipate PEAD will be lower. We view this as unlikely because it would result in lower trading profits, which is inconsistent with insiders trading on the basis of private information about future earnings.[19]

[17] Our results are almost identical and our inferences remain unchanged if we exclude the firm fixed effects.
[18] Our inclusion of firms fixed effects in Equation (1) helps address, at least partially, correlated omitted variable issues as well as potential endogeneity concerns related to time-invariant, firm-specific characteristics.
[19] In untabulated tests, we compare the magnitudes of abnormal stock returns for i) the Prior Insider Trading portfolios compounded from the insider trading disclosure date to +120 days after the quarterly earnings announcement date and ii) the No Prior Insider Trading portfolios compounded from days -2 to +120, where date zero is the quarterly earnings announcement date. We find abnormal stock returns for insider trading firms have larger magnitudes than for non-

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3.2. Sample selection

The data in this study come from several sources. Data on insider trades are obtained from the Thomson Reuters insider filings database. We also obtain accounting, stock price, and analyst forecast data from the Compustat quarterly database, the CRSP daily stock database, and the I/B/E/S database, respectively.

Table 1 summarizes the sample selection. We collect all firm-quarter observations from Compustat with calendar quarter end dates between February 1988 and January 2017. This yields 821,209 firm-quarter observations (24,291 distinct firms). We delete observations with missing stock return data on CRSP and observations with missing total assets and number of shares outstanding. We exclude observations with end of quarter stock prices below $1. We restrict our sample to observations with data necessary to compute *SUE*. The final sample of firm-quarter observations includes 458,712 firm-quarters, covering 14,354 distinct firms.

3.3. Descriptive statistics

Table 2 presents descriptive statistics and correlation coefficients for our primary variables. Panel A shows the number of firm-quarter observations in our sample by *SUE* quintile and pre-earnings announcement insider trading. Panel B provides descriptive statistics for all firm-quarters, while Panel C contains descriptive statistics for firm-quarter observations with or without insider trading transactions in the pre-earnings announcement period (Prior Insider Trading and No Prior Insider Trading). Panel D presents correlations for our main variables.

The descriptive statistics in Panel A show 44.2% of the firm-quarters in our sample

insider trading firms for these comprehensive return windows. For example, the returns for the SUE5 portfolios are 7.23% and 5.79%, respectively, while the SUE5 – SUE1 hedge portfolio returns are 10.64% and 8.78%, respectively. These results support our conjecture that it is unlikely that insiders are trading when the total amount of private information is lower.

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have at least one insider trading transaction. This proportion is relatively constant across the *SUE* quintiles (between 43.0% and 45.8%).[20] The descriptive statistics in Panel B show the mean (median) percentage of institutional ownership is 38.3 % (34.5%), across all firm-quarters, 15.7% of earnings announcements are bundled with a management forecast, while *SUE* is negative for just over half (50.8%) of all earnings announcements. Panel C shows observations with no insider trading are smaller, have higher book-to-market ratios, less institutional ownership, and higher bid-ask spreads, compared to observations with insider trading. In addition, observations with insider trading vary significantly from observations without insider trading across other firm-specific variables, including *Beta* and *Momentum*. These differences indicate the need to control for these variables in our regressions. Finally, the correlation coefficients in Panel D show the *PriorInsiderTrading* indicator variable is positively correlated with *Size* (0.23), *InstOwn* (0.26), and *Bundle* (0.15) and negatively correlated with *B/M* (-0.14) and *Spread* (-0.11).

4. Analysis and results

4.1. Quarterly earnings announcement period

We first examine abnormal stock returns around quarterly earnings announcements to show whether investors' reactions to earnings news vary based on prior insider trading. The results are presented in Table 3. Consistent with prior literature, announcement period abnormal stock returns are significantly positive (negative) for the SUE5, SUE4, and SUE3 (SUE2 and SUE1) partitions and the magnitude of returns is decreasing monotonically across the *SUE* partitions. Additionally, the hedge portfolio that takes a long position in SUE5 and a short position in SUE1 generates statistically significant abnormal stock returns of 2.409% (*t*-statistic = 76.58).

If insiders base their trading on private information about future earnings, then investors

[20] The fact that insiders do not concentrate their trades in the extreme *SUE* quintiles is consistent with the results of Core et al. (2006), who do not find evidence that insiders specifically trade to exploit the PEAD anomaly.

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will use this information to update and improve their expectations of current earnings news (Damodaran and Liu, 1993; Kabir and Vermaelen, 1996; Roulstone, 2008; Udpa, 1996). Consistent with this implication, Roulstone (2008) finds that insider trades during a quarter are associated with decreased return volatility and abnormal trading volume around that quarter's earnings announcements. Similarly, Udpa (1996) documents insider trading before quarterly earnings announcements is associated with smaller earnings response coefficients and lower announcement stock return volatility. Collectively, this evidence supports the idea that pre-announcement insider trades at least partially preempt the earnings news.[21]

The results in Table 3, Columns (2) to (4), are consistent with the preemption hypothesis as the average announcement returns are significantly smaller in absolute magnitude for the Prior Insider Trading portfolios, compared to the No Prior Insider Trading portfolios.[22] For each *SUE* partition and the SUE5 – SUE1 hedge portfolio, the announcement returns are significantly smaller in magnitude when at least one insider trade precedes quarterly earnings announcements. In addition, the magnitude of the SUE5 – SUE1 hedge portfolio return is about 25% smaller (2.039 versus 2.713; *t*-statistic = 12.24) for the Prior Insider Trading portfolios, compared to the No Prior Insider Trading portfolios. These results are consistent with pre-announcement insider trades conveying at least some of the insiders' private information about the earnings news.[23]

To the extent the results in Table 3 are driven by investors conditioning their responses to

[21] By itself, preemption of the earnings news will not necessarily lead to lower PEAD. For instance, if insider trades only accelerate the incorporation of information that otherwise would be reflected in stock prices at the subsequent earnings announcement, then this would not lead to an increase in post-announcement price efficiency (Fox et al., 2018).

[22] We exclude the SUE3 portfolio from this discussion as this portfolio essentially consists of observations with no earnings news. Not surprisingly, the difference in announcement returns is not significant for the SUE3 portfolio.

[23] Consistent with prior literature, we find significant market reactions around the disclosures of insider trades (results untabulated). We also find significant stock return drift during the period after the trade disclosure up until the earnings announcement period in the same direction as the insider trades (e.g., positive returns following buys and negative returns after sells). These price movements provide further support for the preemption hypothesis.

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current earnings news based on insider trading signals, it is consistent with Hypothesis 1. However, if investors are instead conditioning on other information that is correlated with insiders' trading decisions, then it would be incorrect to attribute differences in price efficiency to prior insider trading, *per se*. To examine this issue, we distinguish between insider trades disclosed prior to earnings announcements and trades not disclosed until afterward (Huddart et al., 2007). If investors only condition on information correlated with insider trading, there will be similar differences in announcement returns for disclosed and nondisclosed trades. However, if they use the information contained in insider trades, we expect to see differences solely for disclosed trades.

To conduct this analysis, we focus on the pre-Sarbanes-Oxley Act period (e.g., before August 29, 2002), when insider trades were not required to be disclosed until the 10th day of the month following the trade month, which allowed reporting lags of up to 40 days (Bartov and Faurel, 2016). We replicate the analyses in Table 3 including either disclosed or nondisclosed insider trades. In untabulated tests, we find absolute announcement returns are only significantly smaller for the Prior Insider Trading portfolio, compared to the No Prior Insider Trading portfolio, when the insider trades were disclosed prior to earnings announcements; otherwise, there are no significant differences between the two portfolios. These results indicate investors use the information conveyed by disclosed pre-announcement insider trades to condition their responses to earnings news.

4.2. Pre-earnings announcement insider trading and PEAD—Portfolio results

In this section, we examine the association between insider trading and abnormal stock returns over the post-earnings announcement period [1, 120], where day zero is the quarterly earnings announcement date. The PEAD returns for portfolios based on *SUE* and pre-announcement insider trading are presented in Table 4. The full sample results in Column (1)

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replicate the prior literature documenting the PEAD anomaly. Abnormal returns are positive (negative) following positive (negative) earnings news, and returns decrease monotonically across earnings news quintiles. The full sample hedge portfolio that takes a long (short) position in SUE5 (SUE1) generates abnormal stock returns of 5.194% (*t*-statistic = 31.57), which is consistent with the magnitude in prior literature (e.g., Balakrishnan et al., 2010).

The results in Column (2) (Column (3)) show PEAD for Prior Insider Trading (No Prior Insider Trading) observations for each *SUE* quintile as well as the SUE5 – SUE1 hedge portfolio. In each case, the absolute magnitude of the Prior Insider Trading value is smaller than the corresponding No Prior Insider Trading value. For example, while PEAD for SUE5 & No Prior Insider Trading is 3.875%, it is only 2.795% for SUE5 & Prior Insider Trading. The difference of 1.081% is highly significant (*t*-statistic = 5.79). The differences for the other *SUE* quintiles are also significant (*t*-statistics range in absolute values from 2.05 to 5.65). The SUE5 – SUE1 hedge portfolio for the Prior Insider Trading observations (4.257%) is lower than the hedge returns for the No Prior Insider Trading hedge portfolio (5.967%). The difference (1.709%) is highly significant (*t*-statistic = 5.53) and represents a reduction of almost 29%. Thus, the absolute value of PEAD is significantly smaller when it is preceded by insider trading, on average.

Figure 2 displays buy-and-hold abnormal stock returns in the 120 trading days (approximately 180 calendar days) following quarterly earnings announcement dates for SUE1 and SUE5 using Prior Insider Trading and No Prior Insider Trading observations. Figure 2 depicts the main results from Table 4 and illustrates the smaller magnitude of post-earnings announcement returns for Prior Insider Trading observations, compared to No Prior Insider Trading observations. Overall, our evidence is consistent with Hypothesis 1 and shows insider trading during the pre-earnings announcement period is associated with more efficient stock prices in the post-earnings

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announcement period.

4.3. Pre-earnings announcement insider trading and PEAD—Regression results

In this section, we present the results from estimating versions of Equation (1) in Table 5. In Panel A, the Column (1) specification only includes *PriorInsiderTrading*, *QSUE*, and the primary variable of interest, *QSUE*PriorInsiderTrading*, along with quarter fixed effects. In the Column (2) specification, we add the control variables. The Column (3) specification includes the full model in Equation (1), with the control variables as well as quarter and firm fixed effects. The results in Columns (1) through (3) show the *QSUE* coefficients are positive (range from 0.059 to 0.074) and significant (*t*-statistics range from 7.88 to 17.06). These magnitudes are consistent with those reported in the prior literature and show the level of unexpected earnings is positively associated with PEAD.[24] The results in all three columns for the other *QSUE* interaction terms are also consistent with prior literature. Specifically, the *QSUE*QInstOwn, QSUE*Bundle*, and *QSUE*QEarnVol* coefficients are negative and significant, consistent with the findings of Bartov et al. (2000), Cao and Narayanamoorthy (2012), and Zhang (2012), respectively. In addition, the *QSUE*QSpread* coefficients are significantly positive, consistent with the findings of Ng et al. (2008).

In all three columns, the *QSUE*PriorInsiderTrading* coefficients are significantly negative (coefficients range from -0.007 to -0.019 and *t*-statistics range from -1.99 to -4.99).[25] These results

[24] The *PriorInsiderTrading* coefficients capture the abnormal returns during the post-announcement period experienced by firms with prior insider trading that are unrelated to PEAD. In Columns (1) through (3), these coefficients are positive (*t*-statistics range between 1.67 and 2.71), but the magnitudes are modest (range between 0.004 and 0.009).

[25] We examine whether our results are robust to controlling for earnings management given the evidence that insiders opportunistically manage earnings to increase the profitability of their subsequent trades (Beneish and Vargus, 2002; Billings and Buslepp, 2016; Park and Park, 2004). We estimate three alternative specifications of Equation (1): i) we include discretionary accruals, $DACC_q$, and its interaction with *QSUE*, ii) we include lagged discretionary accruals, $DACC_{q-1}$, and its interaction with *QSUE*, iii) we include both current and lagged discretionary accruals and their interactions with *QSUE*. $DACC_q$ is discretionary accruals in quarter *q* estimated using the modified Jones model controlling for the nonlinear effects of firm growth and performance on quarterly accruals following Collins et al.

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indicate the positive association between earnings news and PEAD is significantly smaller when quarterly earnings announcements are preceded by insider trading. The coefficient magnitude in Column 3 indicates that the association between unexpected earnings and PEAD (*QSUE* coefficient of 0.064) is 14.1% lower (= 0.009/0.064) when preceded by insider trading than not. Thus, the estimated magnitudes are economically significant. These findings provide support for Hypothesis 1, as insider trading prior to quarterly earnings announcements is associated with smaller PEAD. As such, they provide empirical support for the key assumption made by proponents of insider trading – that insider trading improves stock price efficiency.[26]

Cross-sectional variation based on trade characteristics

In Table 5 Panel B, we report the results of three analyses that examine cross-sectional variation in the association between insider trading and PEAD. For the first analysis, we identify pre-announcement insider trading that, in aggregate, contradicts or not large earnings news (Dargenidou et al., 2018; Hillier and Marshall, 2002; Veenman, 2012). The PEAD literature shows that future stock returns tend to drift in the same direction as large earnings news. Contradictory pre-announcement insider trades are in the opposite direction as the current earnings news and may indicate that insiders know that the large earnings news will be less persistent than investors

(2017). In each specification, the *QSUE*PriorInsiderTrading* coefficient is significantly negative at the 5% level or better (*t*-statistics range from -2.21 to -2.67). Moreover, we examine whether our results our robust to controlling for prior quarterly losses, given the difficulty in predicting earnings for loss firms (Balakrishnan et al., 2010; Li, 2011). We include a loss indicator variable, $Loss_{q\text{-}1}$, and its interaction with *QSUE* in Equation (1). Our results are robust as the *QSUE*PriorInsiderTrading* coefficient remains significantly negative (coefficient = -0.009 and *t*-statistic = -2.40). Thus, the negative association between insider trading and PEAD is robust to controlling for earnings management and prior losses.

[26] Our hypothesis development is premised on insider trading being motivated, in part, by private information about *future* earnings and thus the persistence of current earnings news. However, trades during the current quarter can also assist investors in assessing the persistence of the prior quarter's earnings news (Dargenidou et al., 2018; Kolasinski and Li, 2010; Veenman, 2012). This evidence calls into question whether our results are driven by insiders trading on past or future earnings news. However, we view this distinction as moot, as earnings surprises are positively correlated. In either case, insiders' trades are based on private information about future earnings.

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would otherwise anticipate.[27] Accordingly, contradictory trades may signal investors that earnings news will not persist. As a result, by conditioning on contradictory insider trades when assessing current earnings news, investors can make more appropriate inferences about the lack of persistence of earnings and incorporate this information into stock prices, thereby mitigating PEAD.

In contrast, other (noncontradictory) pre-announcement insider trades are consistent with the direction of the current earnings news and may indicate that insiders know that the earnings news will persist more than investors would otherwise anticipate. However, because these trades are noncontradictory, it remains unclear whether other trades provide enough information to investors to help decrease the underreaction around the current earnings announcements and therefore mitigate PEAD or whether some level of PEAD persists. The latter outcome would be consistent with the evidence of Dargenidou et al. (2018), who examine the association between director trades during the 10 days following earnings announcements and PEAD in the United Kingdom. They find that contradictory post-announcement trades are associated with lower subsequent price drift, consistent with investors observing these trades and interpreting the related earnings news as being more transitory. They also document that confirmatory post-announcement trades do not mitigate PEAD.[28] According to Dargenidou et al. (2018), this finding suggests that "confirmatory insider trading conveys information to the market that there has been a permanent change in the earnings process" (p. 498). However, as investors may have difficulty calibrating the structural change in the earnings after observing confirmatory trades, "the initial under-reaction to

[27] We test this conjecture about earnings news being less (more) persistent following contradictory (noncontradictory) trades in Section 4.5.

[28] Dargenidou et al. (2018) find that confirming trades (i.e., where the buys (sells) follow large positive (negative) earnings news) are associated with a higher drift during the six months beginning 11 days after earnings announcements relative to observations with no director trades.

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the earnings surprise adjusts as prices continue to move in the same direction as the surprise" (p. 483) resulting in a stronger drift. If descriptive, then we think this delay due to investor uncertainty regarding the earnings process would apply to all noncontradictory trades.[29]

We classify firm-quarters with insider trading in the pre-earnings announcement period based on whether insiders are collectively net buyers (NetBuy) or net sellers (NetSell).[30] We define an insider trading signal as "contradictory" if the firm-quarter observation belongs in the intersection of the SUE5 & NetSell or SUE1 & NetBuy portfolios. All other firm-quarter observations are defined as "other" (i.e., noncontradictory). We estimate Equation (1) after replacing *PriorInsiderTrading* with *PIT_Contradictory* (*PIT_Other*), an indicator variable equal to one if the insider trading during the pre-earnings announcement period contradicts (does not contradict) the earnings news and zero otherwise.

The results are presented in Column (1). The *QSUE*PIT_Contradictory* coefficient is negative and significant (*t*-statistic = -3.63). In comparison, the *QSUE*PIT_Other* coefficient is smaller in magnitude (-0.001 vs. -0.022) and insignificant (*t*-statistic = -0.04). The difference in coefficients is statistically significant (untabulated *p*-value of *F*-test of equal coefficients < 0.01). Thus, consistent with our expectations, contradictory insider trades are associated with lower PEAD, while we do not find evidence indicating that other trades are negatively associated with PEAD.

For the second cross-sectional analysis, we identify the number of insiders who are trading

[29] If other trades are associated with greater uncertainty about the underlying earnings model, then this is consistent with "rational structural uncertainty," whereby investors are initially uncertain about the shift in the underlying earnings process and progressively update their estimates of the valuation parameters with new information (Brav and Heaton, 2002; Francis et al., 2007).

[30] Consistent with prior work (Beneish and Vargus, 2002; Jagolinzer et al., 2011; Piotroski and Roulstone, 2005), we determine the direction of insider trading as the total number of shares bought less the total number of shares sold. We also use net buy transactions (e.g., the number of buy transactions less the number of sell transactions) as an alternative measure of insider trading direction (Huddart et al., 2007; Ke et al., 2003). The untabulated results are qualitatively similar from those tabulated in the paper, and our inferences remain unchanged.

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during the pre-earnings announcement period. While insider trading is often motivated by insiders' private information, insiders also trade for diversification and liquidity reasons. As a result, it can be difficult for investors to infer whether a given trade is based on private information. However, when multiple insiders are trading during a quarter, we expect that the informativeness of multiple trading signals is higher because it is more likely that at least some trades are based on private information. Consistent with this idea, Lakonishok and Lee (2001) and Seyhun (1986) find trades made by multiple insiders are more strongly associated with future abnormal returns than when a single insider trades. Thus, we expect the negative association between insider trading and PEAD is stronger when multiple insiders trade during a given quarter.

We estimate Equation (1) and replace *PriorInsiderTrading* with *PIT_Single* (*PIT_Multi*), an indicator variable equal to one if there is a single insider (are multiple insiders) trading during the pre-announcement period and zero otherwise. The results are presented in Column (2) and show the *QSUE*PIT_Multi* coefficient is negative and significant (*t*-statistic = -2.58). In contrast, the *QSUE*PIT_Single* coefficient is insignificant (*t*-statistic = -1.01). In addition, the *QSUE*PIT_Single* coefficient magnitude is smaller, compared to that of *QSUE*PIT_Multi* (-0.005 vs. -0.012). However, the difference in coefficients is statistically insignificant (untabulated *p*-value of *F*-test of equal coefficients = 0.18). Thus, the results are only directionally consistent with our expectations.

In the third cross-sectional analysis, we classify whether the insider trades are likely to be opportunistic or routine trades, following Cohen et al. (2012). Specifically, if an insider trades in the same month for three consecutive years, then all subsequent trades made by the insider in that same month are classified as routine trades; otherwise subsequent trades are classified as opportunistic. Cohen et al. (2012) find opportunistic trades are more likely to be based on private

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information, as they are more informative about future firm returns, news, and events. Accordingly, we expect the negative association between insider trading and PEAD is more pronounced with opportunistic trades.

We estimate Equation (1) and replace *PriorInsiderTrading* with *PIT_Opportunistic* (*PIT_Routine*), an indicator variable equal to one if there is at least one opportunistic (routine) trade in the pre-earnings announcement period and zero otherwise. As shown in Column (3), the $QSUE_q$*PIT_Opportunistic* coefficient is negative and significant (*t*-statistic = -2.75), while the $QSUE_q$*PIT_Routine* coefficient is insignificant (*t*-statistic = -1.01). However, the difference in coefficients (-0.008 versus -0.013) is not significant (untabulated *p*-value of *F*-test of equal coefficients = 0.65).[31]

Overall, the regression results in Table 5 Panel B provide evidence that stock prices are more efficient in the post-earnings announcement period following insider trading during the pre-announcement period. Furthermore, this association is more pronounced when insider trades are more likely to be based on private information, and especially when insiders engage in contradictory trades.

4.4. The role of sophisticated market participants

Hypothesis 2 predicts that the negative association between insider trading and PEAD is stronger when there are more sophisticated market participants, such as institutional investors and financial analysts. We expect sophisticated market participants have increased incentives and resources to observe disclosures of insider trades, extract insiders' private information about the persistence of earnings news, and incorporate this information in their trading or forecasting decisions in a timely manner. Accordingly, we examine to what extent the association between

[31] The insignificant differences could be due to noise in the Cohen et al. (2012) classification procedure.

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pre-announcement insider trading and PEAD varies with institutional ownership, analyst coverage, and competition among informed investors. We expect firms with higher institutional ownership or analyst coverage have a more negative association between pre-announcement insider trading and PEAD. Furthermore, we expect higher competition among informed investors results in investors more fully extracting insiders' private information from their trades (Akins et al., 2012).

First, we estimate Equation (1) and replace *PriorInsiderTrading* with *PIT_HighIO* and *PIT_LowIO*, where *PIT_HighIO* (*PIT_LowIO*) equals to one if *PriorInsiderTrading* equals to one and the percentage of institutional ownership is (not) in the highest tercile and zero otherwise. Of the 180,285 firm-quarter observations with *PriorInsiderTrading* equal to one, 47% have institutional ownership in the highest tercile, while 53% do not. The results are presented in Column (1) of Table 5 Panel C. Consistent with our expectations, the association between prior insider trading and PEAD is negative and significant when institutional ownership is higher (*t*-statistic = -5.14). In contrast, the association is insignificant when institutional ownership is lower (*t*-statistic = 0.72). The difference in coefficients is statistically significant (untabulated *p*-value of *F*-tests of equal coefficients < 0.01).

Next, we estimate Equation (1) and replace *PriorInsiderTrading* with *PIT_High#A* and *PIT_Low#A*, where *PIT_High#A* (*PIT_Low#A*) equals to one if *PriorInsiderTrading* equals to one and the number of analysts covering the firm is (not) in the highest tercile and zero otherwise. Of the 180,285 firm-quarter observations where *PriorInsiderTrading* equal to one, 41% (59%) have analyst coverage (not) in the highest tercile. Consistent with our expectations, the results in Column (2) show the association between prior insider trading and PEAD is negative and significant when there are high levels of analyst coverage (*t*-statistic = -5.40) but is insignificant when analyst coverage is low (*t*-statistic = 0.95). The difference in coefficients is statistically

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significant (untabulated *p*-value of *F*-tests of equal coefficients < 0.01).

Finally, we estimate Equation (1) and replace *PriorInsiderTrading* with *PIT_HiInformedComp* and *PIT_LoInformedComp*, where *PIT_HiInformedComp* (*PIT_LoInformedComp*) equals to one if *PriorInsiderTrading* equals to one and the HHI value for institutional ownership is (not) in the lowest tercile and zero otherwise. Forty-four percent (56%) of the 168,164 firm-quarter observations with *PriorInsiderTrading* equal to one have high (low) levels of competition among informed investors. The results are presented in Column (3). The association between prior insider trading and PEAD is negative and significant when there are high levels of competition among informed investors (*t*-statistic = -4.75). In contrast, the association is insignificant when there are low levels of competition among informed investors (*t*-statistic = -1.12). The difference in coefficients is statistically significant (untabulated *p*-value of *F*-tests of equal coefficients both < 0.01).

Overall, the results in Panel C of Table 5 show that the negative association between pre-announcement insider trading and PEAD is concentrated in firms with relatively high levels of institutional ownership, analyst coverage or competition among informed investors. These findings are consistent with sophisticated market participants being able to more efficiently extract insiders' private information from their trades and incorporate this information in their trading or forecasting decisions. Thus, they provide empirical support for Hypothesis 2.

4.5. Pre-earnings announcement insider trading and future earnings news

As discussed above, we expect that the negative association between pre-announcement insider trading and PEAD is driven, at least in part, by investors using the information conveyed by insider trades about the persistence of earnings to help them better incorporate the time-series properties of earnings news into stock prices. We conduct two complementary analyses to provide

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evidence on this explanation. First, we examine the ability of pre-announcement insider trading to assist in predicting future earnings. To the extent insiders' trading decisions reflect their private information about the persistence of earnings news, then pre-announcement insider trading should be associated with future earnings news, conditional on current earnings news.

Accordingly, we examine whether the association between the earnings news in quarter q and future earnings news in quarters q+1 to q+4 depends on whether there is insider trading prior to quarter q's earnings announcement. We estimate the following regression model.

$$\begin{aligned} QSUE_{i,q+n} = {} & \alpha_0 + \alpha_1 PriorInsiderTrading_{i,q} + \alpha_2 QSUE_{i,q} + \alpha_3 QSUE_{i,q} * PriorInsiderTrading_{i,q} \\ & + \alpha_4 Beta_{i,q} + \alpha_5 Size_{i,q} + \alpha_6 B/M_{i,q} + \alpha_7 Momentum_{i,q} + \alpha_8 QSpread_{i,q} + \alpha_9 QInstOwn_{i,q} \\ & + \alpha_{10} BadNews_{i,q} + \alpha_{11} 4thQ_{i,q} + \sum Quarter\ Fixed\ Effects + \sum Firm\ Fixed\ Effects + \varepsilon_{i,q+n}, \end{aligned} \quad (2)$$

where $QSUE_{i,q+n}$ is the quintile ranking of *SUE* for firm i, scaled to range between zero and one, for quarter q+n, where $n \in \{1, 2, 3, 4\}$. In Equation (2), the *QSUE*PriorInsiderTrading* coefficient captures whether pre-earnings announcement insider trading reflects insiders' private information about the persistence of current earnings news.

Panel A of Table 6 presents the results. In each specification, the results show *QSUE* for quarter q is significantly and positively associated with *QSUE* in quarters q+1 and q+2. The association is negative and marginally significant for quarter q+3 and is significantly negative for quarter q+4. These patterns are generally consistent with the findings of Bernard and Thomas (1990).[32]

The *QSUE*PriorInsiderTrading* coefficients are positive and significant in each regression for quarters q+1 to q+4 (t-statistics range from 1.66 to 5.86). These results show that, for a given

[32] Bernard and Thomas (1990) find that the association between $QSUE_q$ and $QSUE_{q+3}$ is significantly positive. Untabulated analyses show that the difference in results is due to our inclusion of additional control variables. Specifically, when we exclude either our firm-specific control variables or the fixed effects or both, the association between $QSUE_q$ and $QSUE_{q+3}$ is significantly positive (t-statistics range between 2.20 and 6.57).

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amount of news during the current quarter, the news is more persistent for the next two quarters (q+1 and q+2) and does not reverse to the same extent in following two quarters (q+3 and q+4) when the quarter q's earnings announcement is preceded by an insider trade. This evidence indicates that insider trades are informative about the persistence of earnings news, which allows investors to better incorporate the time-series properties of earnings news into stock prices.

Panel B presents the results after replacing *PriorInsiderTrading* with *PIT_Contradictory* and *PIT_Other*. The *QSUE*PIT_Contradictory* coefficients are negative in each of the regressions for quarters q+1 to q+4, with the magnitudes increasing until reaching q+3. The coefficients are all statistically significant except in the q+1 specification (t-statistics = -0.73, -3.56, -6.94, and -4.98, respectively). These results show that, when current earnings innovations are preceded by contradictory insider trades, the innovations are less persistent in each of the following four quarters. In contrast, the coefficient estimates for *QSUE*PIT_Other* are significantly positive for all four future quarters and the magnitudes are decreasing from quarter to quarter (t-statistics = 8.52, 7.88, 5.67, and 4.30, respectively). Thus, when current earnings innovations are preceded by other insider trades, the innovations are more persistent in each of the subsequent four quarters. Overall, our evidence indicates that both contradictory and noncontradictory trades provide information about the persistence of earnings, but the direction of the association depends crucially on the nature of the insider trades.

Overall, the evidence in Table 6 indicates the insiders' trades are motivated, at least in part, by their private information about the persistence of earnings news. In our second set of analyses, we examine whether investors better understand the time-series properties of earnings news, conditional on pre-announcement insider trades. To the extent they are, then we predict investors react less to future earnings news. Thus, we examine the association between insider trading prior

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to the quarter q earnings announcement and the market reaction to earnings news during quarters q+1 to q+4 by estimating the following regression model for firm i in quarter q.

$$BHAR_{[-2,0],i,q+n} = \alpha_0 + \alpha_1 PriorInsiderTrading_{i,q} + \alpha_2 QSUE_{i,q+n} + \alpha_3 QSUE_{i,q+n} * PriorInsiderTrading_{i,q} + \alpha_4 Beta_{i,q+n} + \alpha_5 Size_{i,q+n} + \alpha_6 B/M_{i,q+n} + \alpha_7 Momentum_{i,q+n} + \alpha_8 QSpread_{i,q+n} + \alpha_9 QInstOwn_{i,q+n} + \alpha_{10} BadNews_{i,q+n} + \alpha_{11} 4thQ_{i,q+n} + \sum Quarter\ Fixed\ Effects + \sum Firm\ Fixed\ Effects + \varepsilon_{i,q+n}, \quad (3)$$

where $n \in \{1, 2, 3, 4\}$ and $BHAR_{[-2,0],i,q+n}$ is the buy-and-hold abnormal stock returns for firm i over the window [-2, 0] with day zero the earnings announcement date of quarter q+n. In Equation (3), the $QSUE_{q+n}$*$PriorInsiderTrading_q$ coefficient captures whether insider trading in the current quarter's pre-announcement period is associated with the magnitude of the market reaction to future earnings news.

Panel A of Table 7 presents the results. The $QSUE_{q+n}$*$PriorInsiderTrading_q$ coefficients are significantly negative for all four future quarters q+1 through q+4 (t-statistics range from -6.26 to -9.19). These results indicate pre-announcement insider trading is negatively associated with the magnitude of the market reaction to future earnings news. Thus, they suggest that investors can use the private information conveyed by insider trades to better understand the persistence of earnings news. Accordingly, they can better anticipate future earnings news, and hence react less strongly.

Panel B presents the results after replacing *PriorInsiderTrading* with *PIT_Contradictory* and *PIT_Other*. The $QSUE_{q+n}$*$PIT_Contradictory_q$ and $QSUE_{q+n}$*PIT_Other_q coefficients are significantly negative for all four future quarters (t-statistics range from -4.24 to -9.12). These results indicate both contradictory and other pre-announcement insider trades are negatively associated with the magnitude of the market reaction to earnings news over the next four quarters. In addition, the $QSUE_{q+n}$*$PIT_Contradictory_q$ coefficients are similar in magnitude to both their $QSUE_{q+n}$*PIT_Other_q counterparts (estimates range from -0.005 to -0.007) and the corresponding

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$QSUE_{q+n}$*$PriorInsiderTrading_q$ coefficients in Panel A.

Overall, the findings from Tables 6 and 7 suggest that insider trades allow investors to better understand the time-series properties of earnings by informing them about the persistence of earnings news. These results illustrate a mechanism through which insider trading is negatively associated with PEAD. In addition, different types of insider trades have different implications regarding earnings persistence: contradictory trades indicate large current earnings innovations are less persistent, while other (noncontradictory) trades indicate they are more persistent (Table 6 Panel B). Furthermore, investors appear to appropriately interpret the different persistence implications of contradictory and other insider trades, as both types of trades are associated with smaller market reactions to future earnings news (Table 7 Panel B). Contradictory trades are associated with lower PEAD, consistent with investors incorporating into stock prices the information from these trades about the lower persistence of the large earnings news (Table 5 Panel B). However, as discussed above, other (noncontradictory) trades are not associated with lower PEAD as these trades are not inconsistent with the direction of the earnings news and, hence, investors are still underreacting to current earnings news and need time to evaluate the structural change in the earnings process.

Our final set of analyses is motivated by the results in Panel C of Table 5, which show that the negative association between prior insider trading and PEAD is significantly stronger in the presence of more sophisticated market participants. We attribute these results to sophisticated market participants having greater incentives, resources, and ability to extract insiders' private information from their trades and incorporate it in their trading or forecasting decisions in a timely manner. If correct, this implies that the negative association between prior insider trading and abnormal returns around future earnings announcements is stronger when there are more

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sophisticated market participants. Accordingly, we estimate Equation (3) and sequentially replace *PriorInsiderTrading* with i) *PIT_HighIO* and *PIT_LowIO*, ii) *PIT_High#A* and *PIT_Low#A*, and iii) *PIT_HiInformedComp* and *PIT_LoInformedComp*. The corresponding results are presented in Panel C of Table 7 Columns (1) to (4), (5) to (8), and (9) to (12), respectively.

The results in Columns (1) to (12) show that each of the *QSUE*PIT_High* coefficients is negative and highly significant for each measure of sophisticated market participants and for each of the subsequent four quarters (*t*-statistics range from -8.71 to -14.84). The coefficients range between -0.008 and -0.015, with magnitudes larger than their Table 7 Panel A counterparts, which range between -0.005 and -0.006. In contrast, the *QSUE*PIT_Low* coefficients are smaller in magnitude as they range between -0.001 and -0.003. Furthermore, of the 12 *QSUE*PIT_Low* coefficients, five are insignificant, three are significant at the 10% level, and two are significant at the 5%, and two at the 1% level. For each regression, the difference in coefficients is statistically significant (untabulated *p*-value of *F*-tests of equal coefficients < 0.01 for all 12 tests). Thus, the results in Panel C provide strong evidence that the negative association between insider trading in the current quarter's pre-announcement period and abnormal returns around the subsequent four earnings announcements is significantly stronger when there is a greater concentration of sophisticated market participants.

Overall, the results in Tables 5 through 7 indicate the important role that sophisticated market participants play in using insider trading disclosures to increase market efficiency. Specifically, insider trades provide incremental information about the persistence of the current quarter's earnings news (Table 6). When there is more involvement by sophisticated market participants, these insider trades are more negatively associated with PEAD (Table 5 Panel C) and abnormal returns around future earnings news (Table 7 Panel C). Together, these results indicate

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that sophisticated market participants can more efficiently extract insiders' private information about the persistence of earnings news from insider trades and incorporate this information in their trading or forecasting decisions.

5. Conclusion

The PEAD literature suggests this anomaly is, in part, due to investors' failure to fully understand the time-series properties of quarterly earnings in a timely and unbiased fashion. We investigate whether insider trades convey insiders' private information about the persistence of earnings news. If insider trading helps investors better incorporate the time-series properties of earnings into stock prices, then we expect it improves stock price efficiency during the post-earnings announcement period.

In our main analyses, we find stock prices are, on average, more efficient during the post-earnings announcement period when earnings news is preceded by insider trading. The negative association between pre-announcement insider trading and PEAD is stronger when trades are more likely to reflect insiders' private information (i.e., when there are trades by multiple insiders or by opportunistic insiders). We also find that, while insider trades that contradict the earnings news are negatively associated with PEAD, other (noncontradictory) trades are not significantly associated with PEAD.

To provide evidence on the underlying mechanism, we examine the association between pre-announcement insider trading and future earnings news, as well as the market reaction to future earnings news. We find prior insider trades are significantly associated with the persistence of the current quarter's earnings news for each of the four subsequent quarters. In addition, the magnitude of the market reaction to earnings news during the four subsequent quarters is lower when insiders trade during the pre-announcement period. Combined, our evidence indicates insider trading helps

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investors better understand the time-series properties of earnings, and more specifically, the persistence of earnings, which mitigates PEAD.

Our analyses also highlight the important role of sophisticated market participants in this process. The negative association between insider trading and PEAD is significantly stronger in settings with high levels of sophisticated market participants, who are better able to observe, interpret, and incorporate insider trading signals in their trading or forecasting decisions; that is, when institutional ownership, analyst coverage, and competition among institutional investors is relatively high. Furthermore, the negative association between insider trading and the market reaction to future earnings news is also significantly lower when there are more sophisticated market participants.

Our study contributes to the long and important debate on the role of insider trading in financial markets and whether insider trading should be more stringently regulated. An important issue in this debate is whether insider trading leads to more efficient stock prices. Our findings suggest pre-announcement insider trading is associated with higher stock price efficiency following quarterly earnings announcements, which is at least partly due to insiders' trades conveying their private information about future earnings and the persistence of earnings news. While this evidence alone does not indicate insider trading restrictions should be relaxed, it does support theoretical arguments that insider trading results in more efficient stock prices.

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Appendix: Definitions

4thQ	Indicator variable equal to one if the quarter is the fourth fiscal quarter of the year, zero otherwise.
BadNews	Indicator variable equal to one if *SUE* for the quarter is negative, zero otherwise.
Beta	Estimated from a market model regression for each firm with a 40-trading-day estimation period, starting 55 trading days prior to the earnings announcement date.
BHAR	Abnormal stock returns measured using the Carhart (1997) four-factor model with a 40-trading-day estimation period, starting 55 trading days prior to the earnings announcement date. For firms that delist during the return accumulation window, we compute the remaining stock return by using the CRSP delisting return and reinvesting any remaining proceeds in the appropriate benchmark portfolio.
B/M	Ratio of the book value of equity to the market value of equity, at the beginning of the quarter.
Bundle	Indicator variable equal to one if the firm's earnings announcement is bundled with a management forecast of next quarter's earnings, zero otherwise.
EarnVol	Standard deviation of quarterly earnings per share, estimated using the most recent 11 quarters.
HiInformedComp (*LoInformedComp*)	Indicator variable equal to one if the concentration of institutional ownership (measured following the Herfindahl-Hirschman Index (HHI) approach) is (not) in the lowest tercile at the beginning of the quarter, zero otherwise.
InstOwn	Percentage of institutional ownership at the beginning of the quarter.
Loss	Indicator variable equal to one if the firm's earnings are strictly negative, zero otherwise.
Momentum	Three-month raw stock returns ending three trading days prior to the earnings announcement date.
PriorInsiderTrading	Indicator variable equal to one if the firm has insider trading transactions (buys or sells) in the pre-earnings announcement period, zero otherwise.
PIT_Contradictory	Indicator variable equal to one if the firm-quarter is classified into SUE5 & NetSell or SUE1 & NetBuy (i.e., "contradictory"), zero otherwise. SUE5 (SUE1) is the highest (lowest) *SUE* quintile using cut-off points based on the prior calendar quarter's *SUE* distribution. NetBuy (NetSell) corresponds to firm-quarters with net insider buys (sells) in the pre-earnings announcement period.

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PIT_Other	Indicator variable equal to one if *PriorInsiderTrading* equals to one and the firm-quarter is not classified as "contradictory" (i.e., SUE5 & NetSell or SUE1 & NetBuy), zero otherwise.
PIT_High#A (*PIT_Low#A*)	Indicator variable equal to one if *PriorInsiderTrading* equals to one and the number of analysts who issued earnings forecasts during the quarter is (not) in the highest tercile during the quarter, zero otherwise.
PIT_HighIO (*PIT_LowIO*)	Indicator variable equal to one if *PriorInsiderTrading* equals to one and the percentage of institutional ownership is (not) in the highest tercile at the beginning of the quarter, zero otherwise.
PIT_HiInformedComp (*PIT_LoInformedComp*)	Indicator variable equal to one if *PriorInsiderTrading* equals to one and the concentration of institutional owners is (not) in the lowest tercile, zero otherwise.
PIT_Multi (*PIT_Single*)	Indicator variable equal to one if *PriorInsiderTrading* equals to one and there are multiple insiders (is a single insider) trading in the pre-earnings announcement period, zero otherwise.
PIT_Opportunistic (*PIT_Routine*)	Indicator variable equal to one if *PriorInsiderTrading* equals to one and there is at least one opportunistic (routine) trade in the pre-earnings announcement period, zero otherwise. If an insider trades in the same month for three consecutive years, then all subsequent trades made by this insider in that same month are classified as routine trades, otherwise the subsequent trades are classified as opportunistic trades.
Pre-Earnings Announcement Period	The period starting from two days after the quarterly earnings announcement of the prior quarter to three days before the quarterly earnings announcement of the current quarter.
Size	Natural logarithm of the market value of equity (in $M) at the beginning of the quarter.
Spread	Average daily bid-ask spread during the quarter.
SUE	Standardized unexpected quarterly earnings calculated based on a seasonal random walk with trend model, estimated using the most recent 12 quarters of earnings per share.

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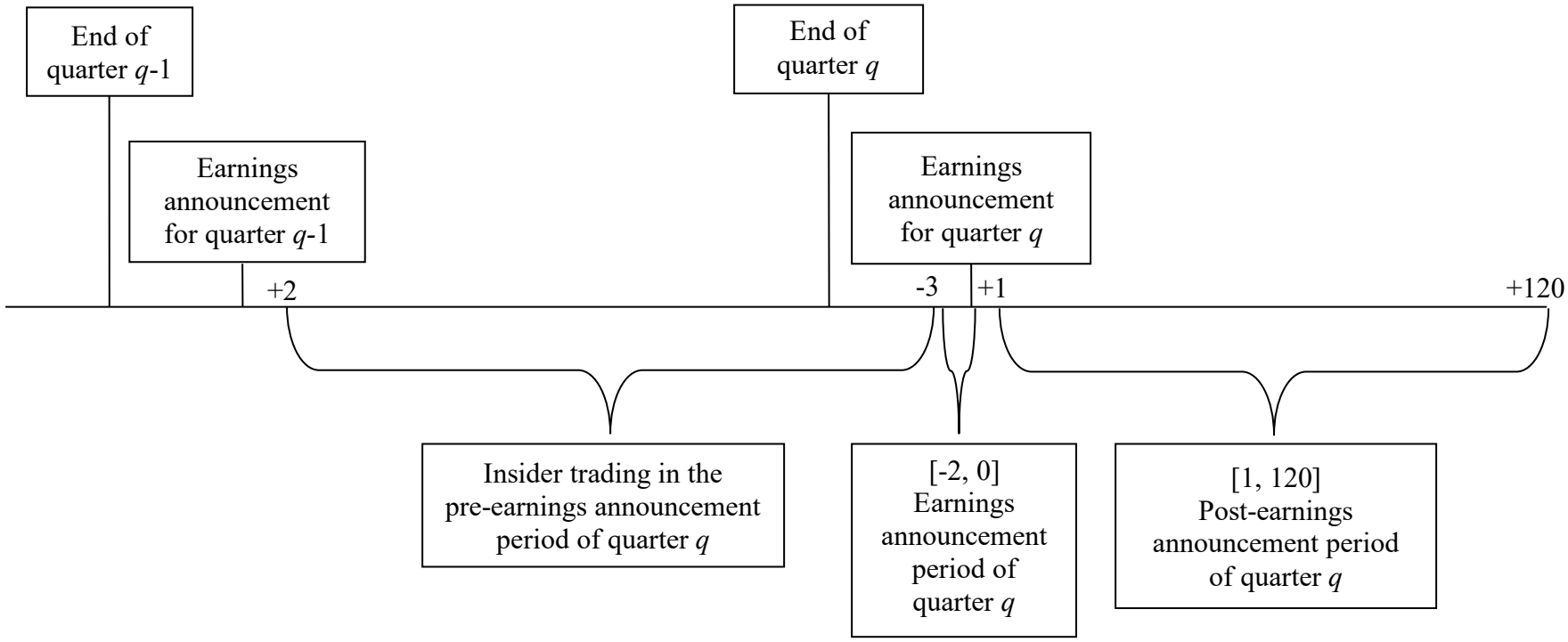
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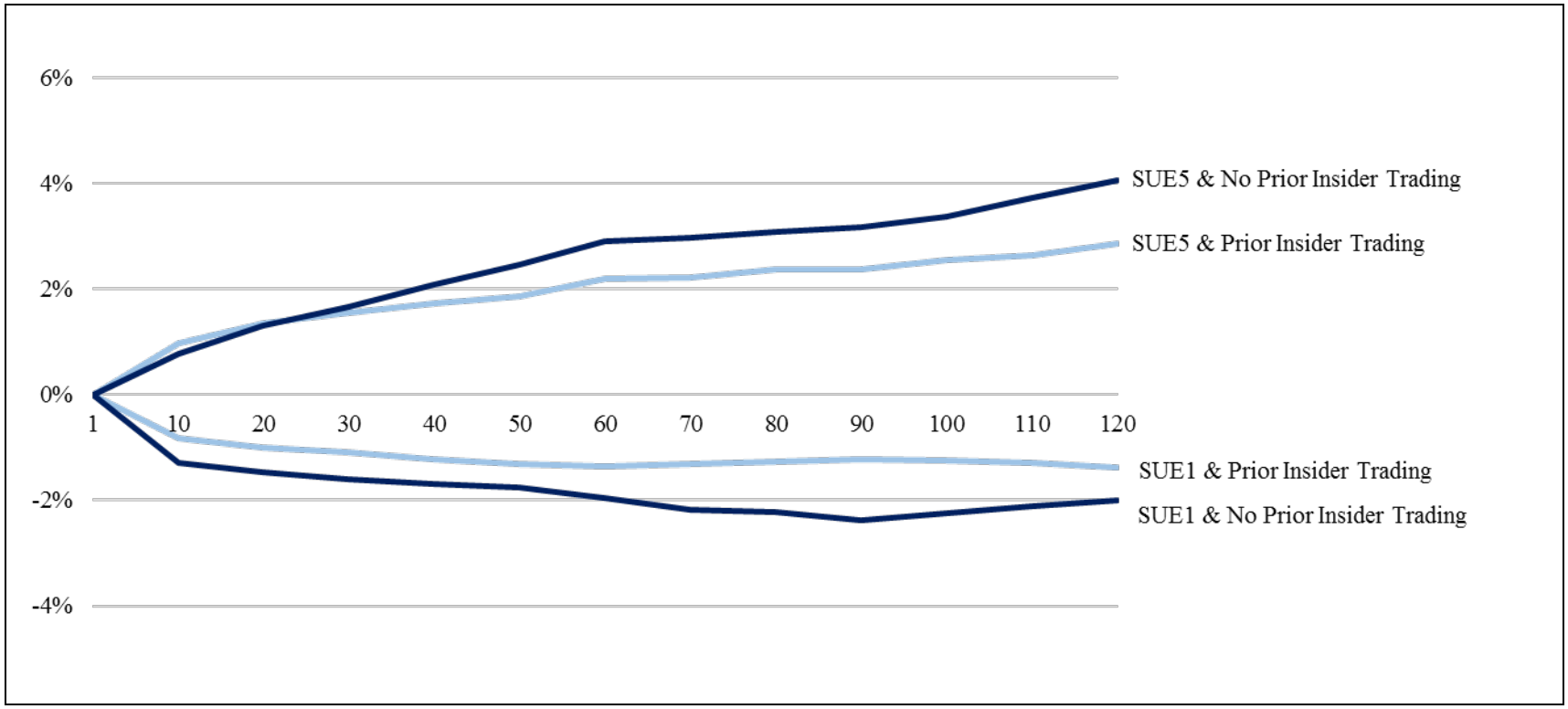
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Figure 1
Timeline of Pre-Earnings Announcement and Post-Earnings Announcement Periods



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Figure 2
Abnormal Stock Returns Following Quarterly Earnings Announcements



Notes: This figure presents buy-and-hold abnormal stock returns for the window [1, 120], where day zero is the quarterly earnings announcement date. The sample covers calendar years 1988 to 2016. Firm-quarter observations are independently sorted and classified based on *SUE* and pre-earnings announcement insider trading. We classify firm-quarter observations into quintiles from highest *SUE* (SUE5) to lowest *SUE* (SUE1) using cut-off points based on the prior quarter's *SUE* distribution. We partition firm-quarters into two portfolios, Prior Insider Trading and No Prior Insider Trading, based on whether or not there is at least one insider trading transaction during the pre-earnings announcement period. See the Appendix for additional variable definitions.

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Table 1
Sample Selection

Sample Selection Criteria for Firm-Quarters	Number of Firm-Quarters	Number of Distinct Firms
All firm-quarter observations from Compustat with calendar quarter end dates from February 1988 to January 2017	821,209	24,291
After excluding observations with missing stock return data for calculating the Carhart (1997) four-factor abnormal stock returns on CRSP	559,774	16,662
After excluding observations with missing beginning-of-the-quarter total assets or number of shares outstanding	534,336	15,999
After excluding firm-quarters with stock price less than $1 at the end of the quarter	516,864	15,879
After excluding firm-quarter observations without required data to compute *SUE* (e.g., quarterly earnings data on Compustat for at least 13 consecutive quarters)	458,712	14,354
Final Sample of Firm-Quarters	**458,712**	**14,354**

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Table 2
Descriptive Statistics and Correlation Coefficients

Panel A: Observations by SUE Quintile and Pre-Earnings Announcement Insider Trading

	All	Prior Insider Trading	Percentage w/ Prior Insider Trading	No Prior Insider Trading
All	458,712	202,732	44.2%	255,980
SUE5	91,675	42,016	45.8%	49,659
SUE4	91,381	40,780	44.6%	50,601
SUE3	91,545	39,693	43.4%	51,852
SUE2	92,036	39,599	43.0%	52,437
SUE1	92,075	40,644	44.1%	51,431

Panel B: Descriptive Statistics for All Firm-Quarters

	Q1	Mean	Median	Q3	Std. Dev.
$BHAR_{[-2,0]}$ (%)	-2.800	0.324	0.092	3.179	6.843
$BHAR_{[1,120]}$ (%)	-19.293	0.699	-0.732	17.628	39.734
SUE	-1.915	-0.529	-0.044	1.703	5.728
PriorInsiderTrading	0.000	0.442	0.000	1.000	0.497
InstOwn	0.087	0.383	0.345	0.648	0.310
Spread	0.023	0.042	0.035	0.053	0.026
Bundle	0.000	0.157	0.000	0.000	0.364
EarnVol	0.080	0.325	0.162	0.349	0.501
Beta	0.259	0.806	0.767	1.293	0.855
Size	4.226	5.770	5.654	7.170	2.065
B/M	0.298	0.644	0.528	0.840	0.532
Momentum	-0.100	0.035	0.019	0.142	0.247
BadNews	0.000	0.508	1.000	1.000	0.500
4thQ	0.000	0.245	0.000	0.000	0.430

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Table 2 (Cont'd)

Panel C: Descriptive Statistics for All Firm-Quarters by Pre-Earnings Announcement Insider Trading

		Prior Insider Trading	No Prior Insider Trading	*p*-value for difference in mean (median) from t-test (Wilcoxon rank-sum test)
$BHAR_{[-2,0]}$ (%)	Mean	0.337	0.314	*0.25*
	Median	0.137	0.054	*< 0.01*
$BHAR_{[1,120]}$ (%)	Mean	0.700	0.698	*0.99*
	Median	-0.523	-0.915	*< 0.01*
SUE	Mean	-0.491	-0.559	*< 0.01*
	Median	0.000	-0.074	*< 0.01*
PriorInsiderTrading	Mean	1.000	0.000	*< 0.01*
	Median	1.000	0.000	*< 0.01*
InstOwn	Mean	0.473	0.312	*< 0.01*
	Median	0.491	0.231	*< 0.01*
Spread	Mean	0.038	0.044	*< 0.01*
	Median	0.032	0.037	*< 0.01*
Bundle	Mean	0.216	0.109	*< 0.01*
	Median	0.000	0.000	*< 0.01*
EarnVol	Mean	0.315	0.334	*< 0.01*
	Median	0.161	0.162	*0.07*
Beta	Mean	0.905	0.728	*< 0.01*
	Median	0.870	0.671	*< 0.01*
Size	Mean	6.298	5.351	*< 0.01*
	Median	6.247	5.159	*< 0.01*
B/M	Mean	0.563	0.708	*< 0.01*
	Median	0.466	0.587	*< 0.01*
Momentum	Mean	0.042	0.029	*< 0.01*
	Median	0.028	0.011	*< 0.01*
BadNews	Mean	0.501	0.513	*< 0.01*
	Median	1.000	1.000	*< 0.01*
4thQ	Mean	0.261	0.233	*< 0.01*
	Median	0.000	0.000	*< 0.01*

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Table 2 (Cont'd)

Panel D: Pearson Correlations (Below Diagonal) and Spearman Correlations (Above the Diagonal)

		(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)
(a)	$BHAR_{[-2,0]}$ (%)	**1.00**	**0.04**	**0.12**	**0.01**	0.01	0.00	0.00	**0.00**	**-0.01**	**-0.01**	0.00	**-0.01**	**-0.10**	**0.01**
(b)	$BHAR_{[1,120]}$ (%)	**0.04**	**1.00**	**0.05**	**0.01**	**0.00**	**-0.07**	**0.02**	0.00	**-0.07**	**0.01**	**0.04**	**0.03**	**-0.04**	**0.01**
(c)	*SUE*	**0.09**	**0.03**	**1.00**	**0.01**	-0.01	**-0.03**	**0.00**	**0.04**	**-0.01**	**0.01**	0.00	**0.12**	**-0.87**	0.00
(d)	*PriorInsiderTrading*	**0.00**	**0.00**	**0.01**	**1.00**	**0.26**	**-0.10**	**0.15**	**0.00**	**0.12**	**0.23**	**-0.14**	**0.04**	**-0.01**	**0.03**
(e)	*InstOwn*	**-0.01**	**-0.01**	**-0.01**	**0.26**	**1.00**	**-0.11**	**0.34**	**0.16**	**0.29**	**0.44**	**-0.16**	**0.03**	**0.00**	**0.01**
(f)	*Spread*	**0.02**	**-0.03**	**-0.04**	**-0.11**	**-0.18**	**1.00**	**-0.13**	**-0.06**	**0.17**	**-0.44**	**-0.03**	**-0.09**	**0.03**	**0.02**
(g)	*Bundle*	-0.01	**0.01**	0.00	**0.15**	**0.36**	**-0.14**	**1.00**	**0.05**	**0.16**	**0.32**	**-0.12**	**0.02**	**0.00**	0.00
(h)	*EarnVol*	**0.00**	0.00	**0.05**	**-0.02**	0.10	**0.01**	**-0.01**	**1.00**	**0.10**	**0.22**	**0.13**	**0.01**	**-0.02**	**-0.02**
(i)	*Beta*	**-0.01**	**-0.07**	**-0.01**	**0.10**	**0.27**	**0.13**	**0.13**	**0.08**	**1.00**	**0.34**	**-0.18**	0.00	0.01	0.00
(j)	*Size*	**-0.03**	**-0.02**	**0.01**	**0.23**	**0.46**	**-0.43**	**0.31**	**0.13**	**0.29**	**1.00**	**-0.33**	**0.09**	**-0.01**	0.00
(k)	*B/M*	**0.01**	**0.04**	**-0.03**	**-0.14**	**-0.17**	**0.11**	**-0.12**	**0.10**	**-0.14**	**-0.34**	**1.00**	**0.05**	**0.00**	**0.01**
(l)	*Momentum*	**-0.01**	**0.02**	**0.11**	**0.03**	0.00	**-0.01**	0.00	**0.01**	0.00	**0.04**	**0.07**	**1.00**	**-0.10**	**0.04**
(m)	*BadNews*	**-0.10**	**-0.04**	**-0.54**	**-0.01**	**0.00**	**0.02**	**0.00**	**-0.02**	0.01	**-0.01**	**-0.01**	**-0.10**	**1.00**	**0.01**
(n)	*4thQ*	**0.01**	**0.01**	**-0.03**	**0.03**	**0.01**	**0.03**	0.00	**-0.02**	**0.00**	**0.00**	**0.01**	**0.03**	**0.01**	**1.00**

Notes: This table presents number of observations (Panel A), as well as selected descriptive statistics for all firm-quarters (Panel B) and for firm-quarters with prior and no prior insider trading (Panel C), based on whether there are, or not, insider trading transactions in the pre-earnings announcement period. Panel D presents Pearson (Spearman) correlation coefficients below (above) the diagonal, where bolded correlations are statistically significant (p-values < 0.10). The sample covers calendar years 1988 to 2016 and consists of 458,712 firm-quarter observations (14,354 distinct firms). $BHAR_{[-2,0]}$ and $BHAR_{[1,120]}$ are buy-and-hold abnormal stock returns around and following quarterly earnings announcements for the windows [-2, 0] and [1, 120], respectively, where day zero is the quarterly earnings announcements date. *SUE* is standardized unexpected quarterly earnings. *PriorInsiderTrading* is an indicator variable equal to one if the firm has insider trading transactions in the pre-earnings announcement period, zero otherwise. *InstOwn* is the percentage of institutional ownership at the beginning of the quarter. *Spread* is the average daily bid-ask spread during the quarter. *Bundle* is an indicator variable equal to one if the firm's earnings announcement is bundled with a management forecast of next quarter's earnings, zero otherwise. *EarnVol* is the standard deviation of quarterly earnings per share. *Beta* is estimated from a market model regression for each firm prior to the earnings announcement date. *Size* is the natural logarithm of the market value of equity at the beginning of the quarter. *B/M* is the ratio of the book value of equity to the market value of equity, at the beginning of the quarter. *Momentum* is the three-month raw stock returns ending three trading days prior to the earnings announcement date. *BadNews* is an indicator variable equal to one if *SUE* for the quarter is negative, zero otherwise. *4thQ* is an indicator variable equal to one if the quarter is the fourth fiscal quarter of the year, zero otherwise. All continuous variables are winsorized at 1% and 99% within each *SUE* quintile.

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Table 3
Abnormal Stock Returns During Quarterly Earnings Announcement Windows by SUE Quintile and Prior Insider Trading

	$BHAR_{[-2,0]}$			
	All	Prior Insider Trading	No Prior Insider Trading	**No Prior Trading – Prior Trading**
	(1)	(2)	(3)	(4)
SUE5	1.532	1.334	1.699	**0.364**
	(64.12)	*(40.80)*	*(49.50)*	***(8.62)***
SUE4	0.820	0.738	0.886	**0.148**
	(37.59)	*(24.16)*	*(28.81)*	***(3.89)***
SUE3	0.328	0.333	0.324	**-0.009**
	(15.08)	*(10.72)*	*(10.75)*	***(-0.24)***
SUE2	-0.172	-0.060	-0.257	**-0.198**
	(-7.94)	*(-1.90)*	*(-8.64)*	***(-5.13)***
SUE1	-0.878	-0.705	-1.014	**-0.310**
	(-38.27)	*(-21.41)*	*(-31.94)*	***(-7.58)***
SUE5 – SUE1	**2.409**	**2.039**	**2.713**	**0.674**
	(76.58)	***(45.92)***	***(59.40)***	***(12.24)***

Notes: This table presents buy-and-hold abnormal stock returns around quarterly earnings announcements for the window [-2, 0], where day zero is the quarterly earnings announcement date. *t*-statistics are reported in parenthesis. For hedge returns (SUE5 – SUE1 and No Prior Trading – Prior Trading), bootstrap *t*-statistics are calculated by simulating 500 long-short return differences and contrasting the realized hedge returns against the empirical distributions of these return differences. Firm-quarter observations are independently sorted and classified based on *SUE* and insider trading during pre-earnings announcement period. We classify firm-quarter observations into quintiles from highest *SUE* (SUE5) to lowest *SUE* (SUE1) using cut-off points based on the prior quarter's *SUE* distribution. We partition firm-quarters into two portfolios, Prior Insider Trading and No Prior Insider Trading, based on whether or not there is at least one insider trading transaction during the pre-earnings announcement period. $BHAR_{[-2,0]}$ is buy-and-hold abnormal stock returns around quarterly earnings announcements for the window [-2, 0], where day zero is the quarterly earnings announcements date. *SUE* is standardized unexpected quarterly earnings. All continuous variables are winsorized at 1% and 99% within each *SUE* quintile.

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Table 4
PEAD by SUE Quintile and Prior Insider Trading

	$BHAR_{[1,120]}$			
	All	Prior Insider Trading	No Prior Insider Trading	**No Prior Trading – Prior Trading**
	(1)	(2)	(3)	(4)
SUE5	3.380	2.795	3.875	**1.081**
	(24.86)	*(15.17)*	*(19.71)*	***(5.79)***
SUE4	1.695	1.466	1.879	**0.413**
	(13.15)	*(8.31)*	*(10.20)*	***(2.38)***
SUE3	0.612	0.416	0.761	**0.345**
	(4.70)	*(2.28)*	*(4.17)*	***(2.05)***
SUE2	-0.360	0.192	-0.777	**-0.969**
	(-2.79)	*(1.05)*	*(-4.32)*	***(-5.65)***
SUE1	-1.814	-1.463	-2.091	**-0.629**
	(-13.85)	*(-7.96)*	*(-11.36)*	***(-3.54)***
SUE5 – SUE1	**5.194**	**4.257**	**5.967**	**1.709**
	(31.57)	***(18.58)***	***(26.10)***	***(5.53)***

Notes: This table presents buy-and-hold abnormal stock returns following quarterly earnings announcements for the window [1, 120], where day zero is the quarterly earnings announcement date. *t*-statistics are reported in parenthesis. For hedge returns (SUE5 – SUE1 and No Prior Trading – Prior Trading), bootstrap *t*-statistics are calculated by simulating 500 long-short return differences and contrasting the realized hedge returns against the empirical distributions of these return differences. Firm-quarter observations are independently sorted and classified based on *SUE* and insider trading during the pre-earnings announcement period. We classify firm-quarter observations into quintiles from highest *SUE* (SUE5) to lowest *SUE* (SUE1) using cut-off points based on the prior quarter's *SUE* distribution. We partition firm-quarters into two portfolios, Prior Insider Trading and No Prior Insider Trading, based on whether or not there is at least one insider trading transaction during the pre-earnings announcement period. $BHAR_{[1,120]}$ is buy-and-hold abnormal stock returns following quarterly earnings announcements for the window [1, 120], where day zero is the quarterly earnings announcements date. *SUE* is standardized unexpected quarterly earnings. All continuous variables are winsorized at 1% and 99% within each *SUE* quintile.

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Table 5
Association between Prior Insider Trading and PEAD

Panel A: Main Results

	Dependent Variable = $BHAR_{[1,120]}$		
	(1)	(2)	(3)
$PriorInsiderTrading_q$	0.009***	0.006**	0.004*
	(2.71)	*(2.33)*	*(1.67)*
$QSUE_q$	0.059***	0.074***	0.064***
	(17.06)	*(8.61)*	*(7.88)*
$QSUE_q$*$PriorInsiderTrading_q$	-0.019***	-0.007**	-0.009**
	(-4.99)	*(-1.99)*	*(-2.46)*
$QInstOwn_q$		0.025***	-0.027**
		(3.27)	*(-2.18)*
$QSUE_q$*$QInstOwn_q$		-0.032***	-0.023***
		(-4.17)	*(-3.43)*
$QSpread_q$		-0.025*	-0.016
		(-1.83)	*(-1.43)*
$QSUE_q$*$QSpread_q$		0.029***	0.020***
		(3.84)	*(2.66)*
$Bundle_q$		0.020***	0.007
		(4.00)	*(1.40)*
$QSUE_q$*$Bundle_q$		-0.016***	-0.012***
		(-3.29)	*(-2.59)*
$QEarnVol_{q-1}$		0.012**	0.003
		(2.06)	*(0.61)*
$QSUE_q$*$QEarnVol_{q-1}$		-0.034***	-0.031***
		(-5.28)	*(-5.40)*
$Beta_q$		-0.031***	-0.035***
		(-3.29)	*(-3.60)*
$Size_q$		-0.001	-0.086***
		(-0.35)	*(-17.40)*
B/M_q		0.023***	0.025***
		(5.00)	*(4.03)*
$Momentum_q$		0.024**	-0.071***
		(2.36)	*(-7.29)*
$BadNews_q$		-0.001	-0.001
		(-0.33)	*(-0.23)*
$4thQ_q$		0.019***	0.019***
		(6.35)	*(6.73)*
Quarter Fixed Effects	Included	Included	Included
Firm Fixed Effects	Excluded	Excluded	Included
Nb. of Observations	458,712	395,067	395,067
Nb. of *PriorInsiderTrading* = 1	202,732	180,285	180,285
Adjusted R^2 (in %)	0.96	1.70	4.13

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Table 5 (Cont'd)

Panel B: Results by Cross-Sectional Variation in Trade Informativeness

	Dependent Variable = $BHAR_{[1,120]}$		
	(1)	(2)	(3)
$PIT_Contradictory_q$	0.012**		
	(2.42)		
PIT_Other_q	-0.001		
	(-0.09)		
PIT_Multi_q		0.004	
		(1.32)	
PIT_Single_q		0.003	
		(1.15)	
$PIT_Opportunistic_q$			0.006**
			(2.05)
$PIT_Routine_q$			0.005
			(0.94)
$QSUE_q$	0.066***	0.064***	0.060***
	(7.98)	*(7.88)*	*(7.39)*
$QSUE_q$*$PIT_Contradictory_q$	-0.022***		
	(-3.63)		
$QSUE_q$*PIT_Other_q	-0.001		
	(-0.04)		
$QSUE_q$*PIT_Multi_q		-0.012***	
		(-2.58)	
$QSUE_q$*PIT_Single_q		-0.005	
		(-1.01)	
$QSUE_q$*$PIT_Opportunistic_q$			-0.013***
			(-2.75)
$QSUE_q$*$PIT_Routine_q$			-0.008
			(-1.01)
Additional Control Variables	Included	Included	Included
Quarter & Firm Fixed Effects	Included	Included	Included
Nb. of Observations	391,364	395,067	278,583
Nb. of *PIT_Contradictory* = 1	38,142		
Nb. of *PIT_Other* = 1	142,143		
Nb. of *PIT_Multi* = 1		107,484	
Nb. of *PIT_Single* = 1		72,801	
Nb. of *PIT_Opportunistic* = 1			58,112
Nb. of *PIT_Routine* = 1			13,958
Adjusted R^2 (in %)	4.13	4.13	4.21

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Table 5 (Cont'd)

Panel C: Results by the Sophistication of Market Participants

	Dependent Variable = $BHAR_{[1,120]}$		
	(1)	(2)	(3)
PIT_HighIO_q	0.010***		
	(3.01)		
PIT_LowIO_q	-0.001		
	(-0.09)		
$PIT_High\#A_q$		0.014***	
		(4.03)	
$PIT_Low\#A_q$		-0.003	
		(-0.93)	
$PIT_HiInformedComp_q$			0.013***
			(3.66)
$PIT_LoInformedComp_q$			0.001
			(0.38)
$QSUE_q$	0.059***	0.061***	0.097***
	(7.36)	*(7.62)*	*(8.66)*
$QSUE_q$*PIT_HighIO_q	-0.027***		
	(-5.14)		
$QSUE_q$*PIT_LowIO_q	0.003		
	(0.72)		
$QSUE_q$*$PIT_High\#A_q$		-0.030***	
		(-5.40)	
$QSUE_q$*$PIT_Low\#A_q$		0.004	
		(0.95)	
$QSUE_q$*$PIT_HiInformedComp_q$			-0.027***
			(-4.75)
$QSUE_q$*$PIT_LoInformedComp_q$			-0.005
			(-1.12)
Additional Control Variables	Included	Included	Included
Quarter & Firm Fixed Effects	Included	Included	Included
Nb. of Observations	395,067	395,067	340,521
Nb. of *PIT_HighIO* = 1	84,112		
Nb. of *PIT_LowIO* = 1	96,173		
Nb. of *PIT_High#A* = 1		74,022	
Nb. of *PIT_Low#A* = 1		106,263	
Nb. of $PIT_HiInformedComp_q$ = 1			73,367
Nb. of $PIT_LoInformedComp_q$ = 1			94,797
Adjusted R^2 (in %)	4.13	4.14	4.13

Notes: This table presents the results from regressions of buy-and-hold abnormal stock returns following quarterly earnings announcements for the window [1, 120], where day zero is the quarterly earnings announcement date, on insider trading during the pre-earnings announcement period. Standard errors are clustered at the firm and calendar

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quarter levels. *t*-statistics are reported in parenthesis. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Quarter fixed effects are included in Panel A, Columns (1) and (2), and quarter and firm fixed effects are included in Panel A, Column (3), and Panels B and C, but not reported for brevity. In Panels B and C, the control variables from Equation (1) are included but not reported. $BHAR_{[1,120]}$ is buy-and-hold abnormal stock returns following quarterly earnings announcements for the window [1, 120], where day zero is the quarterly earnings announcements date. *QSUE* is the quintile ranking of standardized unexpected quarterly earnings. *PriorInsiderTrading* is an indicator variable equal to one if the firm has insider trading transactions in the pre-earnings announcement period, zero otherwise. *QInstOwn* is the quintile ranking of the percentage of institutional ownership at the beginning of the quarter. *QSpread* is the quintile ranking of the average daily bid-ask spread during the quarter. *Bundle* is an indicator variable equal to one if the firm's earnings announcement is bundled with a management forecast of next quarter's earnings, zero otherwise. *QEarnVol* is the quintile ranking of the standard deviation of quarterly earnings per share. *Beta* is estimated from a market model regression for each firm prior to the earnings announcement date. *Size* is the natural logarithm of the market value of equity at the beginning of the quarter. *B/M* is the ratio of the book value of equity to the market value of equity, at the beginning of the quarter. *Momentum* is the three-month raw stock returns ending three trading days prior to the earnings announcement date. *BadNews* is an indicator variable equal to one if *SUE* for the quarter is negative, zero otherwise. *4thQ* is an indicator variable equal to one if the quarter is the fourth fiscal quarter of the year, zero otherwise. *PIT_Contradictory* (*PIT_Other*) is an indicator variable equal to one if the firm-quarter is (not) classified into SUE5 & NetSell or SUE1 & NetBuy, zero otherwise. *PIT_Multi* (*PIT_Single*) is an indicator variable equal to one if *PriorInsiderTrading* equals to one and there are multiple insiders (is a single insider) trading in the pre-earnings announcement period, zero otherwise. *PIT_Opportunistic* (*PIT_Routine*) is an indicator variable equal to one if *PriorInsiderTrading* equals to one and there is at least one opportunistic (routine) trade in the pre-earnings announcement period, zero otherwise. *PIT_HighIO* (*PIT_LowIO*) is an indicator variable equal to one if *PriorInsiderTrading* equals to one and the percentage of institutional ownership is (not) in the highest tercile at the beginning of the quarter, zero otherwise. *PIT_High#A* (*PIT_Low#A*) is an indicator variable equal to one if *PriorInsiderTrading* equals to one and the number of analysts who issued earnings forecasts during the quarter is (not) in the highest tercile during the quarter, zero otherwise. *PIT_HiInformedComp* (*PIT_LoInformedComp*) is an indicator variable equal to one if *PriorInsiderTrading* equals to one and the concentration of institutional owners is (not) in the lowest tercile, zero otherwise. All continuous variables are winsorized at 1% and 99% within each *SUE* quintile.

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Table 6
Future Earnings News on Current Earnings News and Prior Insider Trading

Panel A: Main Results

	Dependent Variable = $QSUE_{q+n}$			
	q+1	q+2	q+3	q+4
$PriorInsiderTrading_q$	-0.011***	-0.014***	-0.014***	-0.017***
	(-4.52)	*(-6.19)*	*(-5.51)*	*(-6.53)*
$QSUE_q$	0.241***	0.105***	-0.011*	-0.288***
	(33.08)	*(16.61)*	*(-1.79)*	*(-38.71)*
$QSUE_q$*$PriorInsiderTrading_q$	0.022***	0.016***	0.006*	0.013***
	(5.86)	*(4.34)*	*(1.66)*	*(3.33)*
$Beta_q$	-0.001	-0.003***	-0.007***	-0.005***
	(-1.42)	*(-2.91)*	*(-6.05)*	*(-4.16)*
$Size_q$	-0.028***	-0.034***	-0.032***	-0.025***
	(-15.63)	*(-15.25)*	*(-13.02)*	*(-10.68)*
B/M_q	0.027***	0.061***	0.065***	0.087***
	(9.04)	*(17.95)*	*(17.32)*	*(22.64)*
$Momentum_q$	0.053***	0.025***	-0.064***	-0.093***
	(12.79)	*(5.44)*	*(-11.75)*	*(-17.96)*
$QSpread_q$	0.004	0.014***	0.034***	0.034***
	(0.94)	*(2.70)*	*(5.10)*	*(5.49)*
$QInstOwn_q$	-0.011**	-0.015**	-0.016**	-0.012*
	(-2.46)	*(-2.49)*	*(-2.52)*	*(-1.81)*
$BadNews_q$	-0.086***	-0.050***	-0.023***	-0.011***
	(-30.68)	*(-18.14)*	*(-6.75)*	*(-3.00)*
$4thQ_q$	-0.001	0.002	0.002	-0.004*
	(-0.04)	*(1.08)*	*(0.95)*	*(-1.66)*
Quarter and Firm Fixed Effects	Included	Included	Included	Included
Nb. of Observations	435,097	416,383	401,989	388,693
Nb. of *PriorInsiderTrading* = 1	195,941	189,866	184,621	179,167
Adjusted R^2 (in %)	14.71	5.31	2.08	9.73

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Table 6 (Cont'd)

Panel B: Results by Trade Conformity

	Dependent Variable = $QSUE_{q+n}$			
	q+1	q+2	q+3	q+4
$PIT_Contradictory_q$	0.012**	0.016***	0.025***	0.036***
	(2.38)	*(3.88)*	*(6.06)*	*(8.24)*
PIT_Other_q	-0.018***	-0.024***	-0.027***	-0.028***
	(-7.38)	*(-9.23)*	*(-9.36)*	*(-9.15)*
$QSUE_q$	0.243***	0.108***	-0.007	-0.287***
	(33.78)	*(17.21)*	*(-1.16)*	*(-39.12)*
$QSUE_q$*$PIT_Contradictory_q$	-0.004	-0.019***	-0.037***	-0.029***
	(-0.73)	*(-3.56)*	*(-6.94)*	*(-4.98)*
$QSUE_q$*PIT_Other_q	0.034***	0.032***	0.026***	0.020***
	(8.52)	*(7.88)*	*(5.67)*	*(4.30)*
Additional Control Variables	Included	Included	Included	Included
Quarter and Firm Fixed Effects	Included	Included	Included	Included
Nb. of Observations	435,097	416,383	401,989	388,693
Nb. of *PIT_Contradictory* = 1	41,116	39,917	38,931	37,743
Nb. of *PIT_Other* = 1	154,825	149,949	145,690	141,424
Adjusted R^2 (in %)	14.72	5.34	2.14	9.85

Notes: This table presents the results from regressions of future quarterly earnings news on current quarterly earnings news and insider trading during the pre-announcement period. Standard errors clustered at the firm and calendar quarter levels. *t*-statistics are reported in parenthesis. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Quarter and firm fixed effects are included in all panels but not reported for brevity. In Panel B, the control variables from Equation (2) are included but not reported. *QSUE* is the quintile ranking of standardized unexpected quarterly earnings. *PriorInsiderTrading* is an indicator variable equal to one if the firm has insider trading transactions in the pre-earnings announcement period, zero otherwise. *Beta* is estimated from a market model regression for each firm prior to the earnings announcement date. *Size* is the natural logarithm of the market value of equity at the beginning of the quarter. *B/M* is the ratio of the book value of equity to the market value of equity, at the beginning of the quarter. *Momentum* is the three-month raw stock returns ending three trading days prior to the earnings announcement date. *QSpread* is the quintile ranking of the average daily bid-ask spread during the quarter. *QInstOwn* is the quintile ranking of the percentage of institutional ownership at the beginning of the quarter. *BadNews* is an indicator variable equal to one if *SUE* for the quarter is negative, zero otherwise. *4thQ* is an indicator variable equal to one if the quarter is the fourth fiscal quarter of the year, zero otherwise. *PIT_Contradictory* (*PIT_Other*) is an indicator variable equal to one if the firm-quarter is (not) classified into SUE5 & NetSell or SUE1 & NetBuy, zero otherwise. All continuous variables are winsorized at 1% and 99% within each *SUE* quintile.

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Table 7
Abnormal Stock Returns Around Future Quarterly Earnings Announcements on Future Earnings News and Prior Insider Trading

Panel A: Main Results

	Dependent Variable = $BHAR_{[-2,0],q+n}$			
	q+1	q+2	q+3	q+4
$PriorInsiderTrading_q$	0.003***	0.003***	0.004***	0.003***
	(6.99)	*(8.29)*	*(9.30)*	*(5.83)*
$QSUE_{q+n}$	0.024***	0.025***	0.024***	0.024***
	(24.27)	*(24.06)*	*(24.69)*	*(23.77)*
$QSUE_{q+n}$*$PriorInsiderTrading_q$	-0.005***	-0.006***	-0.006***	-0.005***
	(-7.66)	*(-9.19)*	*(-8.45)*	*(-6.26)*
$Beta_{q+n}$	-0.001	-0.001	-0.001	-0.001
	(-1.10)	*(-0.98)*	*(-1.22)*	*(-1.07)*
$Size_{q+n}$	-0.006***	-0.006***	-0.006***	-0.006***
	(-16.72)	*(-16.51)*	*(-17.17)*	*(-16.70)*
B/M_{q+n}	-0.001***	-0.001***	-0.001***	-0.001***
	(-2.91)	*(-2.68)*	*(-2.80)*	*(-2.84)*
$Momentum_{q+n}$	-0.013***	-0.013***	-0.013***	-0.013***
	(-11.98)	*(-11.94)*	*(-11.91)*	*(-11.32)*
$QSpread_{q+n}$	0.001	0.001	0.001	0.001
	(0.41)	*(0.25)*	*(0.48)*	*(0.89)*
$QInstOwn_{q+n}$	-0.005***	-0.005***	-0.004***	-0.004***
	(-5.46)	*(-5.16)*	*(-4.70)*	*(-4.61)*
$BadNews_{q+n}$	-0.001**	-0.001**	-0.001***	-0.001***
	(-2.43)	*(-2.37)*	*(-2.71)*	*(-2.97)*
$4thQ_{q+n}$	0.002***	0.002***	0.002***	0.002***
	(4.13)	*(3.99)*	*(4.04)*	*(3.82)*
Quarter and Firm Fixed Effects	Included	Included	Included	Included
Nb. of Observations	435,388	416,669	402,256	388,939
Nb. of $PriorInsiderTrading_q$ = 1	196,001	189,925	184,676	179,220
Adjusted R^2 (in %)	2.09	2.11	2.13	2.11

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Table 7 (Cont'd)

Panel B: Results by Trade Conformity

	Dependent Variable = $BHAR_{[-2,0],q+n}$			
	q+1	q+2	q+3	q+4
$PIT_Contradictory_q$	0.002**	0.002***	0.003***	0.004***
	(2.27)	*(2.61)*	*(4.47)*	*(5.06)*
PIT_Other_q	0.003***	0.004***	0.004***	0.002***
	(6.94)	*(8.67)*	*(9.08)*	*(5.06)*
$QSUE_{q+n}$	0.024***	0.025***	0.024***	0.024***
	(24.24)	*(24.01)*	*(24.61)*	*(23.72)*
$QSUE_{q+n}$*$PIT_Contradictory_q$	-0.005***	-0.005***	-0.005***	-0.006***
	(-4.51)	*(-4.24)*	*(-5.38)*	*(-4.34)*
$QSUE_{q+n}$*PIT_Other_q	-0.005***	-0.007***	-0.006***	-0.005***
	(-7.12)	*(-9.12)*	*(-7.89)*	*(-5.95)*
Additional Control Variables	Included	Included	Included	Included
Quarter and Firm Fixed Effects	Included	Included	Included	Included
Nb. of Observations	435,388	416,669	402,256	388,939
Nb. of *PIT_Contradictory* = 1	41,130	39,932	38,947	37,762
Nb. of *PIT_Other* = 1	154,871	149,993	145,729	141,458
Adjusted R^2 (in %)	2.09	2.11	2.13	2.11

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Table 7 (Cont'd)

Panel C: Results by the Sophistication of Market Participants

	Dependent Variable = $BHAR_{[-2,0],q+n}$											
	HighIO & LowIO				*High#A & Low#A*				*HiInformedComp & LoInformedComp*			
	q+1	*q*+2	*q*+3	*q*+4	*q*+1	*q*+2	*q*+3	*q*+4	*q*+1	*q*+2	*q*+3	*q*+4
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
PIT_High$_q$	0.004***	0.005***	0.005***	0.004***	0.006***	0.007***	0.007***	0.006***	0.007***	0.008***	0.008***	0.007***
	(6.74)	*(8.97)*	*(9.71)*	*(6.94)*	*(10.84)*	*(11.79)*	*(13.23)*	*(11.14)*	*(11.13)*	*(12.58)*	*(13.57)*	*(10.32)*
PIT_Low$_q$	0.001***	0.002***	0.002***	0.001*	0.001	0.001**	0.001**	-0.001	0.001	0.001**	0.001***	0.001
	(2.68)	*(3.78)*	*(3.80)*	*(1.79)*	*(0.49)*	*(1.97)*	*(2.06)*	*(-0.31)*	*(1.10)*	*(2.19)*	*(2.65)*	*(0.42)*
QSUE$_q$	0.024***	0.025***	0.024***	0.024***	0.024***	0.025***	0.025***	0.024***	0.026***	0.027***	0.026***	0.026***
	(24.29)	*(24.06)*	*(24.70)*	*(23.78)*	*(24.29)*	*(24.06)*	*(24.68)*	*(23.79)*	*(24.62)*	*(24.41)*	*(25.27)*	*(24.08)*
QSUE$_q$**PIT_High*$_q$	-0.009***	-0.010***	-0.009***	-0.008***	-0.011***	-0.012***	-0.011***	-0.011***	-0.014***	-0.015***	-0.014***	-0.014***
	(-9.69)	*(-10.65)*	*(-11.01)*	*(-8.71)*	*(-12.49)*	*(-13.20)*	*(-12.45)*	*(-10.96)*	*(-14.03)*	*(-14.84)*	*(-14.52)*	*(-12.35)*
QSUE$_q$**PIT_Low*$_q$	-0.002*	-0.003***	-0.002***	-0.002*	-0.001	-0.002**	-0.002*	-0.001	-0.001	-0.002**	-0.002	-0.001
	(-1.71)	*(-3.46)*	*(-2.58)*	*(-1.83)*	*(-0.91)*	*(-2.32)*	*(-1.80)*	*(-0.46)*	*(-0.87)*	*(-1.96)*	*(-1.61)*	*(-0.54)*
Addl Control Variables	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.
Quarter and Firm F.E.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.
Nb. of Observations	435,388	416,669	402,256	388,939	435,388	416,669	402,256	388,939	379,843	364,209	352,162	340,975
Nb. of *PIT_High* = 1	98,518	95,719	93,166	90,522	81,968	79,962	78,514	76,196	80,750	78,854	77,024	75,206
Nb. of *PIT_Low* = 1	97,483	94,206	91,510	88,698	114,033	109,963	106,162	103,024	102,701	98,974	95,975	92,754
Adjusted R^2 (in %)	2.10	2.12	2.14	2.12	2.12	2.14	2.16	2.15	2.26	2.30	2.31	2.30

Notes: This table presents the results from regressions of buy-and-hold abnormal stock returns around quarterly earnings announcements of quarter *q*+*n* (*n* = 1, 2, 3, 4) for the window [-2, 0], where day zero is the quarterly earnings announcement date of quarter *q*+*n* on future quarterly earnings news and insider trading during the pre-announcement period of quarter *q*. Standard errors are clustered at the firm and calendar quarter levels. *t*-statistics are reported in parenthesis. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Quarter and firm fixed effects are included in all panels but not reported for brevity. In Panels B and C, the control variables from Equation (3) are included but not reported. $BHAR_{[-2,0]}$ is buy-and-hold abnormal stock returns around quarterly earnings announcements for the window [-2, 0], where day zero is the quarterly earnings announcements date. *QSUE* is the quintile ranking of standardized unexpected quarterly earnings. *PriorInsiderTrading* is an indicator variable equal to one if the firm has insider trading transactions in the pre-earnings announcement period, zero otherwise. *Beta* is estimated from a market model regression for each firm prior to the earnings announcement date. *Size* is the natural logarithm of the market value of equity at the beginning of the quarter. *B/M* is the ratio of the book value of equity to the market value of equity, at the beginning of the quarter. *Momentum* is the three-month raw stock returns ending three trading days prior to the earnings announcement date. *QSpread* is the quintile ranking of the average daily bid-ask spread during the quarter. *QInstOwn* is the quintile ranking of the percentage of institutional ownership at the beginning of the quarter. *BadNews* is an indicator variable equal to one if *SUE* for the quarter is negative, zero otherwise. *4thQ* is an indicator variable equal to one if the quarter is the fourth fiscal quarter of the year, zero otherwise. *PIT_Contradictory* (*PIT_Other*) is an indicator variable equal to one if the firm-quarter is (not) classified into SUE5 & NetSell or SUE1 & NetBuy, zero otherwise. *PIT_HighIO* (*PIT_LowIO*) is an indicator variable equal to one if *PriorInsiderTrading* equals to one and the percentage of institutional ownership is (not) in the highest tercile at the beginning of the quarter, zero otherwise. *PIT_High#A* (*PIT_Low#A*) is an indicator variable equal to one if *PriorInsiderTrading* equals to one and the number of analysts who issued earnings forecasts during the quarter is (not) in the highest tercile during the quarter, zero otherwise. *PIT_HiInformedComp* (*PIT_LoInformedComp*) is an indicator variable equal to one if *PriorInsiderTrading* equals to one and the concentration of institutional owners is (not) in the lowest tercile, zero otherwise. All continuous variables are winsorized at 1% and 99% within each *SUE* quintile.

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