

Whose opinion matters when insiders disagree with short sellers?*

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ABSTRACT

This study investigates the credibility of conflicting trading signals from two well-informed and sophisticated parties, corporate insiders and short sellers. Our results suggest that insiders' information plays a dominant role when short sellers trade in the opposite direction. Insiders have better access to superior information than short sellers, such as firms' future earnings and forthcoming acquisition activities. The higher credibility of insider buying accelerates when the level of information asymmetry is high. We find that the *ex ante* high level of information asymmetry increases the likelihood of disagreement, which further supports the idea that short sellers may experience a glass ceiling in accessing private information.

Keywords: Short selling, Insider buying, Disagreements, Information asymmetry

JEL Classification: G14, G30, G34

1. Introduction

Short sellers are sophisticated investors whose trades can generate excess returns, while insider trading is mostly profitable when corporate insiders purchase shares in their own firms. Evidence suggests that both insider trading and shorting selling send out credible signals to the markets, especially when the information environment is opaque (see, *inter alia*, Aboody and Lev, 2000; Veenman, 2011; Khan and Lu, 2013). The existing literature shows that short sellers are either skilled public information processors (Engelberg, Reed, and Ringgenberg, 2012), or can detect information leakage from other informed parties (Christophe, Ferri, and Hsieh, 2010; Khan and Lu, 2013; Massa, Qian, Xu, and Zhang, 2015). On the other hand, insiders are able to detect stock mispricing based on available information (Seyhun, 1992; Jenter, 2005), or due to superior private knowledge about future cashflows (Ke, Huddart, and Petroni, 2003), or both (Piotroski and Roulstone, 2005). Given their relative information advantage and profit incentives, it is not surprising to see that insider buying and short selling may beat opposite signals from other informed parties, such as analysts and institutional investors (see, *inter alia*, Sivakumar and Vijayakumar, 2001; Sias and Whidbee, 2010; Drake, Rees, and Swanson, 2011).

In this paper, we point to a nontrivial instance where corporate insiders and short sellers disagree with each other. Such a scenario should raise immense market concerns as uninformed investors face a disagreement between two of the most informed parties. The disagreement will inevitably lead to uncertainty among uninformed investors about whose information is more credible. While an increase in short selling is typically associated with negative stock returns in the future (Boehmer and Wu, 2013; Purnanadam and Seyhun, 2018), uninformed investors cannot rule out the possibility that short sellers can act on speculation (Blau and Wade, 2012), hedging (Boehmer et al., 2008), or even false information (Brunnermeier and Pehmke, 2013). On the other hand, insider trading could be less-informative when the buying is “routine” after managers receive a bonus (Cohen, Malloy, and Pomorski, 2012), or when the selling is for

liquidity and personal portfolio rebalance, such as the sales after an option exercise (Lakonishok and Lee, 2001). Alternative trading incentives from the informed parties will raise uncertainties in the market, especially when the firm's information environment is opaque.

Specifically, we ask two questions in this study. First, when insiders and short sellers trade in the opposite direction, e.g., insider buying versus short selling, whose signal is more credible to the future stock returns? Second, how does the information asymmetry moderate the answer to the first question? We answer the first question by examining the stock return after the market observes the conflicting signals. Short sellers do not have equivalent access to private information as corporate insiders, even if they are skilled public information processors and are "well-informed and sophisticated" investors. Therefore, insider buying is more likely to be superior to short selling such that the post-disagreement stock return will be positive.¹

We define the disagreement between insiders and short sellers when we observe (1) an increase of short interests by more than 0.5% and (2) an open-market purchase of the firm's common shares by corporate executives and directors within the same month. Based on the firm-month panel data over 30 years from U.S. public firms, we document a positive and significant stock return within the next three months following the disagreement. Specifically, our regression, which controls for risk factors of stock returns, firm-level characteristics, and firm and calendar month fixed effects, shows that the three-month buy-and-hold abnormal return is on average 0.952% higher following a disagreement between inside buyers and short sellers. Our results are robust across multiple insider trading measures and after excluding routine insider trading (Cohen et al., 2012) which is less likely to be driven by information. Therefore, our results are indicative of the view that insider buying is based on positive private information that has not been perceived by short sellers.

¹ We do not exclude the possibility that insider buying could be less informative due to routine purchases (Cohen et al., 2012). In the robustness tests, we exclude the routine trades and retain the opportunistic trades following Cohen et al. (2012). Our results are robust.

We then seek to an answer to the second question by examining whether the valuation effect of the conflicting signals is conditional on information asymmetry. Again, uninformed investors face uncertainty about the trading incentives of both informed parties, and information asymmetry will exacerbate such uncertainty. Similarly, we argue that the answer to the second question lies in whether the buying reflects insiders' private information about their firm's prospects. If so, then insiders' information set is more likely superior to the short sellers', and the information asymmetry will amplify the insider's advantage of holding private information against short sellers. Therefore, we expect positive stock returns after the disagreement will be higher in firms with a more opaque information environment. However, such a return pattern may not appear if insider buying is not motivated by private information.

We derive three information asymmetry proxies. The first proxy is a composite measure of information opacity, combining stock trading volume, bid-ask spread, analyst following, and analyst forecast dispersion (Anderson, Duru, and Reeb, 2009). The second proxy measures the probability of informed trading from the daily buy and sell orders, following Brown and Hillegeist (2007) and David, Hvidkjaer, and O'Hara (2002). The final proxy considers industry-wide information asymmetry, which measures the "speed of industry information transfer into prices" (Wang, 2019). First, we examine the determinants of the disagreement between short sellers and inside buyers and confirm that the likelihood of the disagreement significantly increases with the degree of information asymmetry between insiders and outsiders. Then, we document that the positive stock return after the disagreement is more pronounced in firms with a higher degree of information asymmetry. Our findings again support the view that information asymmetry amplifies insiders' information advantage against short sellers.

In addition, we test whether the positive stock returns after the disagreement are due to the private information that is known by insiders and not known by short sellers. We first examine quarterly earnings announcements subsequent to the disagreement and document

significantly higher positive earnings surprises by the firms with a disagreement. Further, firms with a disagreement are associated with higher subsequent earnings surprises than firms with insider buying but no short selling spike, which shows that managers possess real good news when they purchase shares against short sellers. We also show that firms with a disagreement are less likely to engage in equity-based acquisition within the next 12 months, which is widely regarded as a signal of stock overpricing (Ge and Lennox, 2011). Overall, our additional tests confirm that insider buying conveys positive private information that may not be perceived by short sellers. All findings hold after a battery of robustness tests.

Our contribution is twofold. First, we show that even when opposed by the short selling, insider buying is a credible information channel about a firm's prospects for outside investors, and that insider buying is particularly useful for investors in firms with an opaque information environment. Our finding adds to the insider trading literature, which shows that insider trading, especially buying, is more credible under information asymmetry (see, *inter alia*, Aboody and Lev, 2000; Frankel and Li, 2004; Gu and Li, 2007; Babenko, Tserlukevich, and Vedrashko, 2012). Second, our finding also adds to the literature of short selling by showing a potential ceiling of short selling in a concrete context. We do not aim to downplay the positive role of short sellers in identifying overpriced stocks and promoting market efficiency; however, we show that short sellers may have a limitation in capturing private information that is important to outside investors.

The rest of the paper is organized as follows. Section 2 summarizes the literature and derives the hypotheses. Section 3 introduces the data and methodology. Section 4 depicts the results and Section 5 concludes.

2. Literature Review and Hypotheses Development

While global policymakers are still concerned about the threatening role of short sellers in destabilizing financial markets, the literature has provided overwhelming evidence that short

selling generally improves market efficiency by successfully identifying overpriced stocks. Short selling is generally associated with negative stock returns in the short and long run (Jones and Lamont, 2002; Boehmer et al., 2008; Saffi and Sigurdsson, 2010; Boehmer and Wu, 2013). Consistent with the price discovery, short selling is informative about negative corporate news, such as earnings fraud, analyst recommendation downgrades, and credit rating downgrades (Christophe et al., 2010; Karpoff and Lou, 2010; Henry, Kisgen, and Wu, 2015). The negative relation between short interest and stock return stems from the market friction and widespread short selling constraints, which enhances the credibility of short selling (Miller, 1977; Diamond and Verrecchia, 1987).

Regarding how short sellers are informative, the literature points to short sellers' sophisticated skills in analyzing public information (Drake et al., 2011; Engelberg et al., 2012). Short sellers may get tips or "leaks" from other informed parties, such as corporate executives (Khan and Lu, 2013; Massa et al., 2015) and analysts (Christophe et al., 2010), which may in part explain why short selling can bring additional information, not embedded in public information, to the market.

While short selling generally reflects negative information regarding firms' prospects, there may be alternative motivations for short selling. Boehmer et al. (2008) show that institutional program trading is less likely information driven because the program trading is typically used to hedge against a convertible bond repurchase (Bargeron and Bonaime, 2017). In addition, some studies raise the concern that short sellers mislead uninformed investors by releasing misinformation and rumors (Allen and Gale, 1992; Brunnermeier and Oehmke, 2014). While there is not much direct evidence supporting such a concern, Blau and Wade (2012) find that short sellers tend to bet equivalently on the eve of both equity analyst upgrades and downgrades, suggesting that some short sellers are simply speculating.

The literature shows that insider trading, particularly purchases, provides valuable information about future stock returns (Lakonishok and Lee, 2001; Ravina and Sapienza, 2009). Insider trading reflects corporate insiders' opinion that shares of their firms are mispriced based on the available information (Seyhun, 1992; Jenter, 2005), or superior insider knowledge about future cashflows (Ke et al., 2003), or both (Piotroski and Roulstone, 2005). Given insiders' information advantage, the market relies on their trading to interpret other price-sensitive signals, such as dividend payout (John and Lang, 1991), stock repurchase (Babenko et al., 2012; Bonaime and Ryngaert, 2013), and seasonal equity offerings (Cziraki, Lyandres, and Michaely, 2019). Empirical findings show that insider buying can magnify market reactions to positive signals, such as cash dividend payouts and share repurchases, and even mitigate market reactions to negative signals, such as accounting restatements (Badertscher, Hribar, and Jenkins, 2011).

However, there are different motivations underlying an insider's decision to trade in a firm's shares, other than private information regarding the future. Compared with buying, insider selling is generally not indicative of negative stock returns (Lakonishok and Lee, 2001; Jeng, Metrick and Zeckhauser, 2003). The literature shows that insiders may sell shares next to the exercise of stock options (Ofek and Yermack, 2000), or to rebalance portfolios that are not optimally diversified (Kallunki, Nilsson, and Hellström, 2009), or for liquidity reasons. For insider buying, one cannot rule out the possibility that insiders are overconfident and acquire shares in the mistaken belief they are undervalued (Kolasinski and Li, 2013). Moreover, events that may negatively affect the stock price, such as short selling and financial misstatements, may create pressure on corporate managers, especially when their personal benefits are bundled to the stock price. Those threats can exacerbate insiders' incentive to maintain the stock price (Badertscher et al., 2011; Lamont, 2012; Barger and Bonaime, 2017). Therefore, insiders

may buy to dissimulate outsiders, even though the insiders do not possess private information not available to outsiders.

We then focus on the scenario where insiders are against short sellers. A stream of literature discusses the disagreements among various informed parties;² however, the disagreement between insiders and short sellers has received less attention.³ This non trivial phenomenon would no doubt raise outside investors' concern, as they face a situation where two of the most informed parties disagree with each other. Some questions arise immediately: is this just a coincidence? If not, which signal is more credible?

We posit that the post-agreement stock return will be positive if insider buying reflects positive private information about the future. Two reasons support this statement. First, short sellers do not have equivalent access to private information as corporate insiders. Therefore, short sellers may not be able to perceive some private information about the future, albeit they are skilled public information processors and are “well-informed and sophisticated” investors. For instance, Barger and Bonaime (2017) document significantly positive stock returns after corporate managers use share repurchase to disagree with short sellers and attribute the positive stock return to private information not captured by short sellers. One may argue that short sellers can also possess private information by detecting the leakage from some smart orders from insiders (Khan and Lu, 2013; Massa et al., 2015). However, those findings are from a different scenario where insiders and short sellers trade in the same direction, such that informed traders face the competition of realizing their private information ahead of others (Holden

² For disagreements among equity analyst forecasts, see Diether, Malloy, and Scherbina (2002). For disagreements between hedge funds and short sellers, see Jiao, Massa, and Zhang (2016). For disagreements between short sellers and equity analysts, see Drake et al. (2011). For disagreements between insiders and equity analysts, see Sivakumar and Vijayakumar (2001). For disagreements between insiders and institutional investors, see Sias and Whidbee (2010).

³ We are aware of two contemporaneous studies that work on the interaction between insider buying and short selling by Zhang and Zhong (2016) and Wu (2018). But they mainly focus on insiders' trading reactions following high short selling pressures, in which the incentive of insider trading might be distorted consequently.

and Subrahmanya, 1992). We do not anticipate such competition occurring when insiders and short sellers trade in the opposite direction.

Second, the regulation in the United States enhances the credibility of insider buying. Section 16 (b) of the Securities Exchange Act 1934 prohibits short-swing profits (profits realized in any period less than 6 months) by corporate insiders in their own corporation's stock, except in very limited circumstances. Insider trading is associated with the personal wealth of corporate insiders, and this regulation adds credibility to the long-term signaling effect of insider trading because insiders are prohibited from trading for short-term profits. A large body of literature suggests that reported insider trading around price-sensitive events indicates mispricing of share prices to the market, and the stock prices do not reverse after insider trading (Seyhun, 1992; Kahle, 2000; Lakonishok and Lee, 2001; Babenko et al., 2012).

Based on the arguments above, if we believe insider buying carries more credible information, we expect the following hypothesis to hold:

H1: There is a positive stock return after a disagreement between insiders and short sellers.

Alternatively, we may not observe such positive stock returns. If short selling contains more credible information than insider buying, we may observe negative stock returns. If none of the trades are informative, we may not observe any significant price reaction patterns.

Our second hypothesis focuses on how information asymmetry affects post-disagreement returns. On the one hand, short selling is indicative of negative stock returns in small firms and firms with less analyst following, confirming that short sellers' information detecting and processing skills are particularly important for outside investors within an opaque information environment (Boehmer et al., 2008; Engelberg et al., 2012; Purnanadam and Seyhun, 2018). On the other hand, in the presence of information asymmetry, insider trading is likely to be a more important tool for mitigating any communication impediments between insiders and outsiders (Gu and Li, 2007; Huddart, Ke, and Shi, 2007; Badertscher et al., 2011).

Empirical evidence indicates that the relationship between insider trading and stock returns is stronger in the presence of information asymmetry (*inter alia*, Gu and Li, 2007; Frankel and Li, 2004; Babenko et al., 2012).

To figure out how information asymmetry affects stock returns when insiders and short sellers disagree with each other, we point to the argument that short sellers do not have equivalent access to private information as corporate insiders. In the presence of information asymmetry, it is more difficult for outside investors to determine a firm's prospects because less publicly available information is available (for example, fewer equity analysts' opinions about the prospects of the firm). For firms associated with a greater degree of information asymmetry, insider trading will constitute a larger proportion of available information about the firm. For short sellers, information asymmetry will enhance the difficulty of retrieving public and private information, which also increases the difficulty of analyzing the information. Therefore, information asymmetry will enlarge the insiders' information advantage. Based on the arguments above, we have the following hypothesis:

H2: The positive stock return after a disagreement between insiders and short sellers is more pronounced in the presence of information asymmetry.

3. Data

3.1 Sample Construction

In this section, we explain the procedure of data collection, cleaning, and variable construction. We collect short selling data from the supplemental short interest file of Compustat, which includes the monthly short interest level of all NYSE/NASDAQ/AMEX firms since 1973. We retrieve insider trading data from Thomson Reuter's Insider Filing Feed, which started collecting insider filings in 1986. We obtain firms' stock returns from the Center for Research in Security Prices (CRSP) and limit the stocks to common shares (CRSP share code = 10 or 11). To construct controlling variables, we retrieve financial data from Compustat

and analyst coverage from the Institutional Brokers' Estimate System (IBES). Finally, we construct a firm-month panel data of 873,143 observations with complete returns, insider trading, short selling, and other controlling variables. Our sample period is from 1986 to 2016.

3.2 Short Selling

Compustat aggregates each firm's short interest as the total number of uncovered shares sold short in each month. We focus on the month-to-month change of the short interests and standardize the monthly change of short interests by the firm's outstanding shares at the end of the prior month. To capture short selling "spikes" which most likely raise investors' concerns, we define a short selling spike as the change of monthly short interests by more than 0.5%. We confirm that using alternative thresholds, such as 1%, will not change our inferences throughout the paper.

3.3 Insider Trading

Consistent with insider trading literature, we first collect open-market purchases and sales from Thomson Reuters but exclude the sales that are related to prior option exercises. Ofek and Yermack (2000) show that the option-related sales are primarily for the purpose of personal portfolio rebalance and are less related to insiders' private information. To capture the most informative trades, we include the trades of directors and officers but exclude transactions of the blockholders (Ravina and Sapienza, 2009). Then, we aggregate insider-trading shares, transactions, and value by transaction types (buy and sell) and firms.

We follow Dargenidou, Tonks, and Tsohligkas (2018) to construct monthly insider trading ratios. First, the net purchase ratio (*NPR*) is the value of monthly purchases minus the value of monthly sales scaled by the total value of purchases and sales. Therefore, a positive *NPR* means net insider buying, while a negative *NPR* indicates net insider selling. A zero *NPR* results from either no insider trading or an equivalent value of buying and selling (which is an extremely rare case), and we regard a zero *NPR* as a neutral case where aggregated insider

trading does not convey any information. Second, because *NPR* is value related and insider trading value is constrained by insiders' personal wealth, we calculate a weighted *NPR*, where the weights are estimated as the ratio of the relative trade size to the shares owned by the director (Dargenidou et al., 2018). Therefore, the weighted *NPR* takes account of the relative personal wealth of each insider when there are multiple insiders trading in a month. Third, we use a dummy, *NetTrade*, to identify the general direction of the insiders' trading. Therefore, *NetTrade* equals one if the number of buying insiders is greater than the number of selling insiders in a month. Finally, to capture a stronger insider signal, we define the last measure, *ConsisTrade*, as the situation where all insiders trade in the same direction in a month, which eliminates the scenarios where conflicting insider transactions exist.

3.4 Returns

We calculate monthly abnormal stock returns controlling for size and book-to-market ratio because insiders' trading predictability is significantly associated with both factors (Lakonishok and Lee, 2001). We assign all CRSP firms into appropriate benchmark portfolios and calculate the value-weighted benchmark return. Specifically, from January 1986, we construct 2 x3 monthly portfolios based on the breakpoints of firm size and book-to-market ratio⁴. The size and book-to-market breakpoints are rebalanced monthly. The size breakpoints are calculated by sorting NYSE firms based on market capitalization at the end of last month. The book-to-market breakpoints are calculated by sorting NYSE firms based on the ratio of book equity to market capitalization. We require the book value to be available at least six months prior to the underlying month. We assign a matched portfolio to each of our sample firms after comparing each firm's characteristics to the breakpoints. The monthly abnormal stock return of the sample firms equals the monthly raw return of the sample firm minus the value-weighted return of the corresponding matched portfolio.

⁴ We do not tabulate these, but results are robust if we use 5x5 portfolios to prepare benchmark returns.

The monthly abnormal stock return of the sample firms equals the monthly raw return of the sample firm minus the value-weighted return of the corresponding matched portfolio.

3.5 Information Asymmetry Proxies

To examine how information asymmetry is related to the post-agreement stock returns we prepare several variables. First, we follow Anderson et al. (2009) to construct a measure of corporate opacity by summing four individual proxies: trading volume, bid-ask spread, number of equity analysts following, and analyst forecast dispersion. We calculate firms' trading volumes by taking the natural log of the average daily trading volume of a firm's stock in a fiscal year. We calculate firms' bid-ask spread by taking the average daily bid-ask spread of a firm's stock in a given fiscal year. We calculate the log of the average number of analysts following over three quarters before each fiscal year end. Finally, we calculate the forecast dispersion as the square of the difference between the mean analysts' earnings forecast and actual firm earnings scaled by the firm's stock price. Again, the annual measure of forecast dispersion is taken over three quarters before the fiscal year end. We then sort all sample firms into four decile portfolios based on the four calculations and assign 10 to the most opaque firms and 1 to the least opaque firms. The four rankings are aggregated and scaled by 40 to reach the final measure of *Opacity*, ranging from 0.1 (least opaque) to 1 (most opaque).

While the opacity serves as a reliable measure of information asymmetry by taking advantage of combining various individual proxies from the literature, we also prepare alternative measures of information asymmetry. Following Brown and Hillegeist (2007) and David et al (2002), our second measure, *PIN*, captures the stock price informativeness by taking the propensity of informed trading from the daily buy and sell order flows. The level of information revealed by insider trading will be significantly higher when the information environment is opaque. Therefore, a higher level of *PIN* is indicative of a higher level of information asymmetry (Wang, 2019).

Finally, while both *Opacity* and *PIN* are firm-level information asymmetry proxies, we take account of the fact that industry-level characteristics also contribute to the information environment. Our third measure, *IDELAY*, estimates how much of the lagged industry-level information is still reflected in a firm's current stock price, which is consistent with Hou (2007) and Wang (2019). Specifically, we regress firms' monthly stock returns on weighted average industry stock returns of the past two months using a rolling sample of the past 36 months. *IDELAY* is the coefficient of past industry returns. The use of *IDELAY* follows Wang (2019), who proposes that the market can be viewed as less reflective of information if lagged industry-level information is still indicative of future stock return. Therefore, the higher the *IDELAY*, the more sluggish the industry-level information transfer, and the higher the information asymmetry.

3.6 Empirical Strategies

We use the following model to test H1:

$$\begin{aligned} BHAR_{(t+1, t+3)} = & \beta_0 + \beta_1 \text{Disagreement}_t + \beta_2 \text{Conditional Spike}_t + \beta_3 \text{Conditional ItBuy}_t \\ & + \beta_4 \text{Size}_{t-1} + \beta_5 \text{BM}_{t-1} + \beta_6 \text{MOM}_{(t-6, t-1)} + \text{Error} \end{aligned} \quad (1)$$

The dependent variable, $BHAR_{(t+1, t+3)}$, is the three-month buy-and-hold abnormal stock returns after the disagreement between inside buyers and short sellers. A longer window may be beyond short sellers' concern as the average holding period of a short position is 37 trading days (Boehmer et al., 2008). We choose the horizon of three months consistent with Barger and Bonaime (2017)⁵.

Spike is a dummy variable equal to one if the firm's monthly change of the short interest from $t-1$ to t is more than 0.5% and zero otherwise. In the model, we capture conditional *Spike* where there is no insider buying in the month of t . *ItBuy* is a dummy variable equaling one for the following scenarios: $NPR > 0$; Weighted $NPR > 0$; $NetTrade = 1$; $ConsisTrade = 1$. In the

⁵ We also extend post-disagreement window up to six months and our results are qualitatively similar.

model, we capture conditional *ItBuy* where there is no simultaneous short selling in the month of t . We anticipate a negative coefficient of *Conditional Spike* and a positive coefficient of *Conditional ItBuy*, which is commensurate with the prior literature that without opposite signals, short selling (insider buying) is informative of negative (positive) stock return in the future.

Our primary concern is *Disagreement*, which is a dummy variable equaling one if both *ItBuy* and *Spike* equal one at the month of t . There could be another situation of disagreement where insider selling is confronted with reversed short selling spikes (i.e., short sellers reduce their short position). We do not consider this situation for two reasons. First, as we discussed before, insider selling is not informative compared with buying. Second, the monthly reduction of short positions may be due to short constraints that are beyond the control of short sellers, which is not information driven. Based on H1, we anticipate a positive coefficient of *Disagreement*, indicating that the insiders' information set dominates the market when insiders convey positive private information.

We control for firm size (*Size*), book-to-market ratio (*BM*), and past stock return (*MOM*) because they are common risk factors in asset pricing models. *Size* is the natural log of total assets at $t-1$. *BM* is the book value of equity scaled by the market value of the outstanding shares, measured at $t-1$. *MOM* is the aggregated monthly returns from $t-6$ to $t-1$. We also control for firm and month fixed effects to take account of the unobservable variants.

To test H2 we rerun the Model (1) by employing the subsamples of high and low asymmetry firms, where we use three information asymmetry proxies: *Opacity*, *PIN*, and *IDELAY*.

4. Results

4.1 Sample Characteristics

Table 1 presents the sample characteristics of the firm-month observations with disagreements (Panel A) and without disagreements (Panel B). The average three-month BHAR

is 79.8 basis points for the firm-months with disagreements, while the average is -6 basis points for the firm-months without disagreements. The difference between the mean BHAR is 86 basis points, which is consistent with H1. Compared with the firm-months without disagreements, insiders and short sellers tend to disagree with each other when the firm size is larger, and the momentum return is lower. It is also noted that disagreement cases are clustered in a more asymmetric information environment: the disagreement sample is associated with higher *Opacity*, compared with the subsample without disagreements. The sample characteristics, therefore, warrant the importance of information asymmetry when we discuss the credibility of insider buying and short selling.

(Insert Table 1 here)

4.2 Likelihood of Disagreements: Cross-sectional Test

To discuss further whether the disagreement between insider buying and short selling is centered around a more opaque information environment, we examine the determinants of the disagreement by employing the following panel logit model, after controlling for firm fixed effects:

$$\text{Logit}(\text{Disagreement}_t = 1) = \beta_1 \text{Market Divergence}_{t-1} + \beta_2 \text{Size}_{t-1} + \beta_3 \text{BM}_{t-1} + \beta_4 \text{MOM}_{(t-6, t-1)} + \text{Error} \quad (2)$$

To measure the level of market divergence toward the firm value, we employ seven measures. *High_Opacity* is a dummy equaling one if a firm's value of *Opacity* is higher than the sample median. Because *Opacity* consists of four individual measures, we also separately regard each as a potential determinant of the disagreement. *High_Dispersion* is a dummy equaling one if a firm's analyst forecast dispersion is higher than the sample median. *Low_Analyst_Following* is a dummy equaling one if a firm's analyst following is lower than the sample median. *High_Spread* is a dummy equaling one if the firm stock's bid-ask spread is higher than the sample median. *Low_Volume* is a dummy equaling one if the trading volume of the firm's stock is lower than the sample median. We further employ two extra measures:

High_Absolute_Surprises is a dummy equaling one if a firm's earnings surprises, measured by quarterly earnings-per-share minus the median forecast from IBES's equity analysts scaled by stock price, is higher than the sample median. *High_Volatility* is a dummy equaling one if a firm's standard deviation of daily stock return over the past 12 months is higher than the sample median. All the proxies are measured by the most recent period prior to the disagreement between insiders and short sellers. Consistent with Model (1), we also control for firm size, book-to-market ratio, and momentum stock return.

We expect that the disagreement between insiders and short sellers is more likely to occur when the information environment between insiders and outsiders is more opaque, such that the market opinions are also divergent. Therefore, we anticipate the likelihood of disagreement is high when *Opacity* is high, forecast dispersion is large, the number of analysts following is low, the bid-ask spread is high, trading volume is low, earnings surprise is high, and stock volatility is high. The choice of the proxies for market divergence is consistent with prior studies (Anderson et al., 2009; Boehme, Danielsen, and Sorescu, 2006; Garfinkel and Sokobin, 2006).

Table 2 presents the results. Consistent with Table 1, the disagreement is positively associated with higher firm values but lower prior momentum returns. The likelihood of disagreement is also positively associated with book-to-market ratio, indicating that insiders and short sellers disagree upon whether the current stock value is already overvalued. More importantly, consistent with our expectation, the likelihood of the disagreement increases with the overall measure of *Opacity*, analyst forecast dispersion, bid ask spread, earnings surprises, and stock price volatility, confirming the importance of the information environment when discussing the impact of disagreements on the stock price. The relation between the occurrence of disagreement and analyst following is insignificant. Finally, the likelihood of the disagreement is lower if the trading volume is lower than the sample median, which is contrary

to our prediction. A potential explanation is that the low trading volume not only indicates an opaque information environment but also indicates that the stock is illiquid, which constrains short selling activities among the markets, and reduces the chance of disagreement.

(Insert Table 2 here)

4.3 Test of H1: Univariate and Multivariate Results

We test H1 in Table 3. Panel A presents the univariate results of the firm-months with short selling spikes. We partition the sample by the presence/absence of insider buying. Without insider buying, a “pure” short selling spike is associated with a negative stock return of around -0.527%, which is consistent with the short selling literature. However, the pattern is different if insiders buy against short sellers: the average BHAR is 80 basis points (0.798%) when the insider buying signal is measured by a positive *NPR*. Using the other three insider trading measures yields qualitatively and quantitatively similar results. Put together, when the insider buying signal is proxied by *NPR*, the difference of the three-month BHAR between the cases with and without insider buying is 1.325%, which is highly significant (t-value = 4.49). Therefore, insider buying overturns the future stock return, despite the existence of short selling spikes.

(Insert Table 3 here)

We formally test H1 in Panel B by employing Model (1). First, we show that without a conflicting signal, “pure” insider buying is associated with a higher return of 1.245% in Column 1, compared with the benchmark without insider buying/short selling. Similarly, without simultaneous insider buying, short sellers earn, on average, 88 basis points (-0.881%) in the next quarter. The coefficients of *ItBuy* and *Spike* are consistent with insider trading and short selling literature. The coefficient of *Disagreement* is 0.952 (t-value = 3.144), indicating that the portfolio of insider buying/short selling spike earns a quarterly abnormal return of 95 basis points above the benchmark portfolio of no insider buying/no short selling spike. This finding

is not sensitive to the choice of insider trading measures. Furthermore, we conduct an F-test to compare the coefficients between *Disagreement* and conditional *Spike* without insider buying, confirming a highly significant difference up to 197 basis points (1.969%) when we use *NetTrade* as the insider buying signal. To summarize, Panel B shows that when insiders actively disagree with short sellers by investing personal wealth into their firms' shares, the market is generally associated with positive stock returns, after controlling for risk factors and fixed effects.

Next, we further test whether any cross-sectional variation affects the relation between stock return and the disagreement. Specifically, we examine whether the timing of the disagreement is close to the next scheduled corporate news announcement that is recognized by the outside investors. The insider trading literature shows that on the one hand, insiders tend to trade on their private information, which will be embedded in the subsequent public news announcement. On the other hand, insiders need to consider the potential litigation and reputational cost when they trade on the eve of the corporate news announcements (Billings and Cedergrén, 2015; Hong and Li, 2019). Therefore, *ex post* insider trading prior to the public news announcement indicates that the benefits outweigh the costs of insider trading (Karpoff and Lee, 1991).

Based on the argument above, in Table 4, we examine whether the relation between the disagreement and stock return is conditional on whether the next corporate news announcement is upcoming. We choose quarterly earnings announcements (QEAs) because they are scheduled events that outsider investors can roughly anticipate the timing of the announcement. We argue that if the next QEA is within one month after the disagreement, then the stock return post-disagreement should be higher, considering the inference that insider buying shortly before corporate news announcements more likely conveys positive private information.

(Insert Table 4 here)

Table 4 confirms our argument: when the disagreement occurs less than one month before the next QEA, the average three-month BHAR is on average 2.212% higher than the benchmark portfolio with neither insider buying nor a short selling spike (t-value = 3.19). By contrast, the three-month BHAR is moderately higher than the benchmark portfolio by 57 basis points (t-value = 1.75) if the next QEA occurs much later than the disagreement. Further, the F-test shows that the difference of coefficients of *Disagreement* between a sooner or later QEA is 1.642%, which is significant (t-value = 2.14). Using the other three insider trading measures yields qualitatively and quantitatively similar results, after controlling for risk factors and fixed effects.

4.4 Test of H2

To test H2, we estimate Model (1) by dividing our sample into high and low asymmetry firms. Panel A uses *Opacity* as the proxy of information asymmetry, and the sample is separated by the median of *Opacity*. For firms associated with a higher level of information opacity, the abnormal stock return is 1.784% (t-value = 3.417) if there are simultaneous insiders buying ($NPR > 0$) and short selling spikes. For firms associated with lower *Opacity*, the post-disagreement stock return is much lower, equaling an insignificant yield of 10.6 basis points. We also employ the F-test to compare the coefficients of *Disagreement* between high and low information asymmetry firms, and the difference is highly significant (the coefficient difference between high and low opacity firms = 1.678 and Z-value = 2.615), supporting the H2. Using the other three insider trading measures yields qualitatively and quantitatively similar results, after controlling for risk factors and fixed effects.

Panel B uses *PIN* as the proxy of information asymmetry, and the sample is separated by the median of *PIN*. *PIN* measures the probability of informed trading from the daily buy and sell orders. A higher value of *PIN* is indicative of a more asymmetric information environment in which the propensity for informed trading is higher (Brown and Hillegeist, 2007; David et

al., 2002; Wang, 2019). We obtain the data of *PIN* from two sources: (1). *PIN* data of the U.S. public firms from 1993 to 2010, which is available from Steven Brown's personal website⁶. (2) *PIN* data of the U.S. public firms from 1983 to 2001, which is available from Soeren Hvidkjaer's website⁷. We employ the data of Steven Brown in Panel B because it covers the most recent periods up to 2010. Our inferences are robust when we employ the *PIN* data from Soeren Hvidkjaer to cover the early period from 1986 to 1992. Those results are untabulated but available upon request.

Consistent with H2, Panel B shows that the coefficients of *Disagreement* remain highly significant within firms of high *PIN*, regardless of the choice of insider trading measures. For instance, Column 1 shows that after the disagreement between net insider buying ($NPR > 0$) and short selling spikes, the next-quarter abnormal stock return is, on average, 205 basis points higher than the benchmark portfolio without insider buying and short selling spike, if the firm's *PIN* is higher than the sample median. By contrast, given a lower-than-median *PIN*, firms are associated with a negative next-quarter abnormal return of -0.247% for the case of disagreement, albeit it is insignificant. The F-test shows that the difference of coefficients of *Disagreement* between high and low *PIN* firms is 229.8 basis points, significant at 1% (Z -score = 2.754). Again, the difference of coefficients of *Disagreement* between high and low *PIN* firms remains significant for the choice of any other insider trading measure.

Finally, in Panel C, we employ *IDELAY*, which measures the efficiency of transferring industry-level information to a firm's stock price (Wang, 2019). A higher *IDELAY* is indicative of a lower speed of transferring industry-wide information to specific firms, and therefore indicative of a higher extent of information asymmetry. Regardless of the choice of insider trading measures, the coefficient of *Disagreement* is only significant for firms with higher

⁶ <http://scholar.rhsmith.umd.edu/sbrown/pin-data>

⁷ <https://sites.google.com/site/hvidkjaer/data>

IDELAY. The difference of the coefficient of *Disagreement* between high and low *IDELAY* firms is constantly significant, regardless of the choice of insider trading measures.

To summarize, the results presented in Table 5 consistently support H2, in that the post-disagreement stock return is higher in firms facing greater information asymmetry.

(Insert Table 5 here)

4.5 What Do We Know from Insider Buying?

Our results indicate that the opinion divergence between insiders and short sellers is accompanied by positive stock returns, and such a pattern is more pronounced in firms suffering from a higher degree of information asymmetry. However, we are still not clear whether the positive stock return is the result of insiders possessing positive private information. To validate, we conduct five tests to figure out what information is gradually revealed. The results of these tests are presented in Table 6.

(Insert Table 6 here)

In Column 1, we regress three-day buy-and-hold abnormal stock returns surrounding subsequent QEAs following the disagreements, controlling for other variables and firm fixed effects. The positive coefficient of *Disagreement* is indicative of more positive information associated with the subsequent QEAs, and therefore supportive of the view that insider buying conveys positive private information otherwise unavailable to outsiders. In Column 2, we employ a logit model to regress the likelihood of beating analyst forecasts following the disagreements. Consistent with our thoughts, the disagreement is associated with a higher likelihood of beating earnings forecast in the future.

In Column 3-5 we focus on another category of information disclosure: M&A announcements. First, we show that, *ceteris paribus*, the disagreement is associated with less chance of engaging in an acquisition in the next 12 months. However, we are not aware of whether those upcoming acquisitions are value-creation or not. Then, we further separate the

acquisitions by equity-financed and others. Prior literature (e.g., Lennox and Ge, 2011) shows that equity-financed acquisitions are regarded by outside investors as value-destroyed. Consistent with this view, in Column 4, we show that after the disagreement firms are less likely to engage in an equity-financed acquisition. Therefore, Table 6 indicates that, when insiders buy against short sellers, the insider trading is not dissimulating but indicative of positive information that is gradually disseminated to the market.

4.6 Robustness Test 1: Excluding Routine Insider Trading

In Sections 4.6 and 4.7, we conduct two robustness tests by excluding less informative insider trading and short selling, respectively.

Cohen et al. (2012) argue that even insider buying can be less informative if “routine” insiders conduct it. Routine insiders are inclined to time their transactions on regular intervals e.g., in the same calendar months of consecutive years, resulting in less litigation risk. Cohen et al. show that compared with routine trading, opportunistic trading is more informative.

Therefore, we conduct a robustness test by excluding routine insiders and their transactions. To execute the refinement, we define an insider as a routine insider if he or she has conducted consecutive trading in the same direction and the same month of the past three years. Table 7 presents the results of Model (1) by excluding routine trading. The results remain highly significant. For instance, Column 1 shows that the disagreement is associated with 93 basis points higher on the next-quarter return, compared with the benchmark portfolio of no insider buying/no short selling spike, and such coefficient is highly significant (t-value = 2.944).

(Insert Table 7 here)

4.7 Robustness Test 2: Does the Beginning Level of Shorting Interests Matter?

Finally, we follow Barger and Bonaime (2017) by taking the beginning level of shorting interests into account and examine whether the findings are robust across the beginning level of the shorting interests. We focus on two subsamples where (1) the beginning level of

the shorting interest is higher than 2.5% of the outstanding shares before the spike and (2) the beginning level of the shorting interest is higher than 5% of the outstanding shares before the spike and repeat the tests of H1 in Table 8.

(Insert Table 8 here)

First, we show that the results of H1 are not affected by the beginning level of shorting interests because the disagreement is still associated with significantly positive stock returns. Second, in lieu with Barger and Bonaime (2017), we show that the information content of the insider buying against short selling is even greater when the beginning level of shorting interests increases from 2.5% to 5%. Therefore, our findings are not affected by the beginning level of shorting interests.

5. Conclusion

Short sellers are well-informed and sophisticated investors who aim to identify overpriced stocks and profit from a drop in the stock price. A spike of short selling generally sends out an easy-to-interpret message of declining price. However, the credibility of such a message should be challenged if corporate insiders, who assume to have access to superior information, disagree and trade in the opposite direction. Our study shows that negative signals from short selling are overwhelmed by positive signals from insider buying. A positive relationship between the subsequent three-month buy-and-hold abnormal returns and the disagreement suggests that insider buying has a better price forecasting power. Such a positive relationship is more significant when the level of information asymmetry is high, which supports the expectation of insiders buying on unrevealed superior information.

We further observe that the high credibility of insider buying comes from insiders' better knowledge of a firm's unreported earnings performance and forthcoming acquisition plans, while such information may not always be revealed to or uncovered by short sellers. From an investment perception, our results suggest that insider buying is more credible and

reliable when conflicting signals appear, especially when the information environment is opaque.

References

- Aboudy, D. and Lev, B., 2000. Information asymmetry, R&D, and insider gains. *The Journal of Finance*, 55(6), pp.2747-2766.
- Allen, F. and Gale, D., 1992. Stock-price manipulation. *The Review of Financial Studies*, 5(3), pp.503-529.
- Anderson, R.C., Duru, A. and Reeb, D.M., 2009. Founders, heirs, and corporate opacity in the United States. *Journal of Financial Economics*, 92(2), pp.205-222.
- Babenko, I., Tserlukevich, Y. and Vedrashko, A., 2012. The credibility of open market share repurchase signaling. *Journal of Financial and Quantitative Analysis*, 47(5), pp.1059-1088.
- Badertscher, B.A., Hribar, S.P. and Jenkins, N.T., 2011. Informed trading and the market reaction to accounting restatements. *The Accounting Review*, 86(5), pp.1519-1547.
- Bargeron, L. and Bonaime, A., 2017. What is revealed when firms disagree with short sellers?. *Working paper*.
- Billings, M.B. and Cedergren, M.C., 2015. Strategic silence, insider selling and litigation risk. *Journal of Accounting and Economics*, 59(2-3), pp.119-142.
- Blau, B.M. and Wade, C., 2012. Informed or speculative: Short selling analyst recommendations. *Journal of Banking & Finance*, 36(1), pp.14-25.
- Boehme, R.D., Danielsen, B.R. and Sorescu, S.M., 2006. Short-sale constraints, differences of opinion, and overvaluation. *Journal of Financial and Quantitative Analysis*, 41(2), pp.455-487.
- Boehmer, E., Fong, K.Y. and Wu, J., 2013. Algorithmic trading and changes in firms' equity capital. *Working paper*, Available at SSRN 2348730.
- Boehmer, E., Jones, C.M. and Zhang, X., 2008. Which shorts are informed?. *The Journal of Finance*, 63(2), pp.491-527.
- Bonaime, A.A. and Ryngaert, M.D., 2013. Insider trading and share repurchases: Do insiders and firms trade in the same direction?. *Journal of Corporate Finance*, 22, pp.35-53.
- Brown, S. and Hillegeist, S.A., 2007. How disclosure quality affects the level of information asymmetry. *Review of Accounting Studies*, 12(2-3), pp.443-477.
- Brunnermeier, M.K. and Oehmke, M., 2013. Predatory short selling. *Review of Finance*, 18(6), pp.2153-2195.
- Christophe, S.E., Ferri, M.G. and Hsieh, J., 2010. Informed trading before analyst downgrades: Evidence from short sellers. *Journal of Financial Economics*, 95(1), pp.85-106.
- Cohen, L., Malloy, C. and Pomorski, L., 2012. Decoding inside information. *The Journal of Finance*, 67(3), pp.1009-1043.

- Cziraki, P., Lyandres, E. and Michaely, R., 2019, November. What do insiders know? Evidence from insider trading around share repurchases and seos. *Journal of Corporate Finance*, forthcoming.
- Dargenidou, C., Tonks, I. and Tsoligkas, F., 2018. Insider trading and the post-earnings announcement drift. *Journal of Business Finance & Accounting*, 45(3-4), pp.482-508.
- Diamond, D.W. and Verrecchia, R.E., 1987. Constraints on short-selling and asset price adjustment to private information. *Journal of Financial Economics*, 18(2), pp.277-311.
- Diether, K.B., Malloy, C.J. and Scherbina, A., 2002. Differences of opinion and the cross section of stock returns. *The Journal of Finance*, 57(5), pp.2113-2141.
- Drake, M.S., Rees, L. and Swanson, E.P., 2011. Should investors follow the prophets or the bears? Evidence on the use of public information by analysts and short sellers. *The Accounting Review*, 86(1), pp.101-130.
- Easley, D., Hvidkjaer, S. and O'hara, M., 2002. Is information risk a determinant of asset returns?. *The journal of finance*, 57(5), pp.2185-2221.
- Engelberg, J.E., Reed, A.V. and Ringgenberg, M.C., 2012. How are shorts informed?: Short sellers, news, and information processing. *Journal of Financial Economics*, 105(2), pp.260-278.
- Frankel, R. and Li, X., 2004. Characteristics of a firm's information environment and the information asymmetry between insiders and outsiders. *Journal of Accounting and Economics*, 37(2), pp.229-259.
- Garfinkel, J.A. and Sokobin, J., 2006. Volume, opinion divergence, and returns: A study of post-earnings announcement drift. *Journal of Accounting Research*, 44(1), pp.85-112.
- Ge, R. and Lennox, C., 2011. Do acquirers disclose good news or withhold bad news when they finance their acquisitions using equity?. *Review of Accounting Studies*, 16(1), pp.183-217.
- Gu, F. and Li, J.Q., 2007. The credibility of voluntary disclosure and insider stock transactions. *Journal of Accounting Research*, 45(4), pp.771-810.
- Henry, T.R., Kisgen, D.J. and Wu, J.J., 2015. Equity short selling and bond rating downgrades. *Journal of Financial Intermediation*, 24(1), pp.89-111.
- Holden, C.W. and Subrahmanyam, A., 1992. Long-lived private information and imperfect competition. *The Journal of Finance*, 47(1), pp.247-270.
- Hong, C.Y. and Li, F.W., 2019. The information content of sudden insider silence. *Journal of Financial and Quantitative Analysis*, 54(4), pp.1499-1538.
- Huddart, S., Ke, B. and Shi, C., 2007. Jeopardy, non-public information, and insider trading around SEC 10-K and 10-Q filings. *Journal of Accounting and Economics*, 43(1), pp.3-36.
- Jeng, L.A., Metrick, A. and Zeckhauser, R., 2003. Estimating the returns to insider trading: A performance-evaluation perspective. *Review of Economics and Statistics*, 85(2), pp.453-471.
- Jenter, D., 2005. Market timing and managerial portfolio decisions. *The Journal of Finance*, 60(4), pp.1903-1949.

- Jiao, Y., Massa, M. and Zhang, H., 2016. Short selling meets hedge fund 13F: An anatomy of informed demand. *Journal of Financial Economics*, 122(3), pp.544-567.
- John, K. and Lang, L.H., 1991. Insider trading around dividend announcements: Theory and evidence. *The Journal of Finance*, 46(4), pp.1361-1389.
- Jones, C.M. and Lamont, O.A., 2002. Short-sale constraints and stock returns. *Journal of Financial Economics*, 66(2-3), pp.207-239.
- Kahle, K.M., 2000. Insider trading and the long-run performance of new security issues. *Journal of Corporate Finance*, 6(1), pp.25-53.
- Kallunki, J.P., Nilsson, H. and Hellström, J., 2009. Why do insiders trade? Evidence based on unique data on Swedish insiders. *Journal of Accounting and Economics*, 48(1), pp.37-53.
- Karpoff, J.M. and Lee, D., 1991. Insider trading before new issue announcements. *Financial Management*, pp.18-26.
- Karpoff, J.M. and Lou, X., 2010. Short sellers and financial misconduct. *The Journal of Finance*, 65(5), pp.1879-1913.
- Ke, B., Huddart, S. and Petroni, K., 2003. What insiders know about future earnings and how they use it: Evidence from insider trades. *Journal of Accounting and Economics*, 35(3), pp.315-346.
- Khan, M. and Lu, H., 2013. Do short sellers front-run insider sales?. *The Accounting Review*, 88(5), pp.1743-1768.
- Kolasinski, A.C. and Li, X., 2013. Can strong boards and trading their own firm's stock help CEOs make better decisions? Evidence from acquisitions by overconfident CEOs. *Journal of Financial and Quantitative Analysis*, 48(4), pp.1173-1206.
- Lakonishok, J. and Lee, I., 2001. Are insider trades informative?. *The Review of Financial Studies*, 14(1), pp.79-111.
- Lamont, O.A., 2012. Go down fighting: Short sellers vs. firms. *The Review of Asset Pricing Studies*, 2(1), pp.1-30.
- Massa, M., Qian, W., Xu, W. and Zhang, H., 2015. Competition of the informed: Does the presence of short sellers affect insider selling?. *Journal of Financial Economics*, 118(2), pp.268-288.
- Miller, E.M., 1977. Risk, uncertainty, and divergence of opinion. *The Journal of finance*, 32(4), pp.1151-1168.
- Ofek, E. and Yermack, D., 2000. Taking stock: Equity-based compensation and the evolution of managerial ownership. *The Journal of Finance*, 55(3), pp.1367-1384.
- Piotroski, J.D. and Roulstone, D.T., 2005. Do insider trades reflect both contrarian beliefs and superior knowledge about future cash flow realizations?. *Journal of Accounting and Economics*, 39(1), pp.55-81.
- Purnanandam, A. and Seyhun, H.N., 2018. Do short sellers trade on private information or false information?. *Journal of Financial and Quantitative Analysis*, 53(3), pp.997-1023.

- Ravina, E. and Sapienza, P., 2009. What do independent directors know? Evidence from their trading. *The Review of Financial Studies*, 23(3), pp.962-1003.
- Saffi, P.A. and Sigurdsson, K., 2010. Price efficiency and short selling. *The Review of Financial Studies*, 24(3), pp.821-852.
- Seyhun, H.N., 1992. Why does aggregate insider trading predict future stock returns?. *The Quarterly Journal of Economics*, 107(4), pp.1303-1331.
- Sias, R.W. and Whidbee, D.A., 2010. Insider trades and demand by institutional and individual investors. *The Review of Financial Studies*, 23(4), pp.1544-1595.
- Sivakumar, K. and Vijayakumar, J., 2001. Insider trading, analysts' forecast revisions, and earnings changes. *Journal of Accounting, Auditing & Finance*, 16(2), pp.167-187.
- Veenman, D., 2011. Disclosures of insider purchases and the valuation implications of past earnings signals. *The Accounting Review*, 87(1), pp.313-342.
- Wang, S., 2019. Informational environments and the relative information content of analyst recommendations and insider trades. *Accounting, Organizations and Society*, 72, pp.61-73.
- Wu, W., 2018. Insider Purchases after Short Interest Spikes: A False Signaling Device?. *Fama-Miller Working Paper*, Chicago Booth Research Paper No. 14-04.
- Zhang, C. and Zhong, X., Insider Trading under Short Selling Pressure: An Incentive Based Story. *Working paper*.

Tables

Table 1: Summary Statistics of Firm Characteristics

Table 1 presents the summary of firm characteristics from 873143 firm-month observations starting from 1986 to 2016. There are 8077 firm-months associated with the disagreement between insider buying and short selling (Panel A), and 865066 firm-months do not have conflicting signals (Panel B). $BHAR_{(t+1, t+3)}$ is 100 times the risk-adjusted abnormal stock returns from $t+1$ to $t+3$, where t is the month of disagreement. $Size$ is the natural log of market capitalization at the month prior to disagreement. BM is the book-to-market ratio. $MOM_{(t-6, t-1)}$ is the 6-month abnormal stock return prior to the disagreement. $Opacity$ is the composite measure of information asymmetry following Anderson et al. (2009). $IDELAY$ is the measure of industry-level information efficiency, defined by the extent to which current stock price reflects prior industry-level information (Wang, 2019). PIN is the probability of informed trading, which follows Brown and Hillegeist (2007).

	N	mean	sd	p25	p50	p75
<i>Panel A: with disagreement</i>						
$BHAR_{(t+1, t+3)}$	8077	0.798	25.649	-12.098	-0.332	11.633
$Size_{t-1}$	8077	6.560	1.474	5.597	6.511	7.489
BM_{t-1}	8077	-0.670	0.919	-1.166	-0.609	-0.122
$MOM_{(t-6, t-1)}$	8077	-0.031	0.394	-0.257	-0.027	0.174
$Opacity$	7234	0.482	0.169	0.350	0.475	0.600
$IDELAY$	7469	0.115	1.272	-0.444	0.057	0.609
PIN	5168	0.148	0.069	0.104	0.134	0.177
<i>Panel B: without disagreement</i>						
$BHAR_{(t+1, t+3)}$	865066	-0.058	25.350	-11.633	-1.351	9.142
$Size_{t-1}$	865066	6.113	1.999	4.648	6.081	7.487
BM_{t-1}	865066	-0.677	0.872	-1.175	-0.624	-0.143
$MOM_{(t-6, t-1)}$	865066	0.079	0.345	-0.096	0.075	0.247
$Opacity$	664597	0.459	0.190	0.300	0.450	0.600
$IDELAY$	802712	0.118	1.285	-0.412	0.064	0.601
PIN	522125	0.201	0.118	0.115	0.170	0.259

Table 2: Which Factors Are Related to the Disagreement?

This table presents the results of the following model:

$$\text{Logit}(\text{Disagreement}_i = 1) = \beta_1 \text{Market Divergence}_{i,t-1} + \beta_2 \text{Size}_{i,t-1} + \beta_3 \text{BM}_{i,t-1} + \beta_4 \text{MOM}_{(i,t-6, t-1)} + \text{Error};$$

To measure the level of market divergence over the firm valuation we employ five measures. *High Opacity* is a dummy equaling one if a firm's value of *Opacity* is higher than the sample median. *High Dispersion* is a dummy equaling one if a firm's analyst forecast dispersion is higher than the sample median. *Low Analyst Following* is a dummy equaling one if a firm's analyst coverage is lower than the sample median. *High Spread* is a dummy equaling one if a firm's bid-ask spread is higher than the sample median. *Low Volume* is a dummy equaling one if a firm's trading volume is lower than the sample median. *High Absolute Surprises* is a dummy equaling one if a firm's quarterly earnings-per-share scaled by stock price is higher than the median forecast from equity analysts. *High Volatility* is a dummy equaling one if a firm's standard deviation of daily stock return is higher than the median of all sample firms. All market divergent proxies are measured by the most recent period prior to the disagreement between insiders and short sellers. We control for firm fixed effects within the panel logic model. Other variables are defined in Table 1. *t-values* are reported in parentheses and ***, **, * indicate statistical significance at the 0.01, 0.05, 0.1 levels, respectively, using two-tailed tests.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
High Opacity	0.067* (1.774)						
High Dispersion		0.143*** (4.873)					
Low Analyst Following			-0.003 (-0.070)				
High Spread				0.195*** (6.277)			
Low Volume					-0.284*** (-6.607)		
High Absolute Surprises						0.105*** (3.637)	
High Volatility							0.149*** (4.588)
Size	0.324*** (14.867)	0.316*** (15.198)	0.314*** (14.546)	0.390*** (19.962)	0.313*** (15.080)	0.281*** (12.941)	0.392*** (19.816)
BM	0.078*** (2.936)	0.065** (2.441)	0.075*** (2.815)	0.107*** (4.410)	0.085*** (3.509)	0.070*** (2.598)	0.116*** (4.681)
MOM	-1.181*** (-27.296)	-1.178*** (-27.398)	-1.162*** (-26.977)	-1.079*** (-27.452)	-1.032*** (-25.956)	-1.187*** (-27.017)	-1.103*** (-27.660)
Firm fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo R2	0.018	0.018	0.017	0.018	0.018	0.018	0.019
N	382756	382768	385678	453938	454256	350223	447590

Table 3: Test of H1: Univariate and Multivariate Tests

Table 3 presents the univariate and multivariate tests of H1. Panel A presents the mean three-month buy-and-hold abnormal stock return (multiplied by 100) for the sub-sample with short selling spikes. We further separate the sub-sample the cases of with and without insider buying. Panel B presents the results of Model (1), where $Disagreement_t$ is defined as the appearance of short selling spike and insider buying in the month of t . We use four insider trading measures to define $ItBuy$ following Dargenidou et al. (2018). We control for firm and month fixed effects within the panel logic model. Other variables are defined in Table 1. t -values are reported in parentheses and ***, **, * indicate statistical significance at the 0.01, 0.05, 0.1 levels, respectively, using two-tailed tests.

Panel A: Univariate Test of $BHAR_{(t+1, t+3)}$ within the Sub-sample of Short Selling Spikes				
Mean $BHAR_{(t+1, t+3)}$	<i>NPR</i>	Weighted <i>NPR</i>	<i>NetTrade</i>	<i>ConsisTrade</i>
(1) Short Spike * Insider Buy	0.798***	0.727***	0.897***	0.808***
(2) Short Spike * No Insider Buy	-0.527***	-0.523***	-0.533***	-0.523***
(3) No Short Spike * Insider Buy	0.782***	0.768***	0.762***	0.792***
(4) No Short Spike * No Insider Buy	-0.046	-0.046	-0.044	-0.044
<i>Difference = (1) - (2)</i>	1.325***	1.250***	1.430***	1.331***
Panel B: The Relation between $BHAR_{(t+1, t+3)}$ and Disagreement: Multivariate Test				
	<i>NPR</i>	Weighted <i>NPR</i>	<i>NetTrade</i>	<i>ConsisTrade</i>
$Disagreement_t$	0.952***	0.866***	1.079***	0.965***
	(3.144)	(2.919)	(3.517)	(3.133)
Conditional $Spike_t$: no $ItBuy$	-0.881***	-0.876***	-0.890***	-0.879***
	(-8.886)	(-8.837)	(-8.979)	(-8.881)
Conditional $ItBuy_t$: no Spike	1.245***	1.223***	1.241***	1.245***
	(8.787)	(8.749)	(8.714)	(8.658)
$Size_{t-1}$	-5.860***	-5.861***	-5.860***	-5.859***
	(-38.040)	(-38.043)	(-38.038)	(-38.033)
BM_{t-1}	-0.026	-0.026	-0.026	-0.026
	(-0.168)	(-0.164)	(-0.166)	(-0.166)
$MOM_{(t+6, t-1)}$	0.165	0.164	0.166	0.164
	(0.764)	(0.757)	(0.768)	(0.759)
Constant	26.662***	26.665***	26.661***	26.659***
	(29.696)	(29.699)	(29.694)	(29.691)
$Disagreement_t$ – Conditional $Spike_t$: no $ItBuy$	1.833***	1.742***	1.969***	1.844***
Z-score:	(5.750)	(5.564)	(6.104)	(5.700)
Firm and month fixed effect	Yes	Yes	Yes	Yes
Adj R ²	0.025	0.025	0.025	0.025
N	873143	873143	873143	873143

Table 4: Disagreement and Stock Return: Does the Timing of Next Scheduled Event Matters?

Table 4 presents the results of Model (1) by two sub-samples, depending on whether the next quarterly earnings announcement (QEA), a scheduled corporate news announcement, occurs within the subsequent month (t+1). *Disagreement_t* is defined as the appearance of short selling spike and insider buying in the month of t. We use four insider trading measures to define *ItBuy* following Dargenidou et al. (2018). We control for firm and month fixed effects within the panel logic model. Other variables are defined in Table 1. *t-values* are reported in parentheses and ***, **, * indicate statistical significance at the 0.01, 0.05, 0.1 levels, respectively, using two-tailed tests.

	NPR		Weighted NPR		NetTrade		ConsisTrade	
	QEA at t+1	Later QEA	QEA at t+1	Later QEA	QEA at t+1	Later QEA	QEA at t+1	Later QEA
<i>Disagreement_t</i>	2.212*** (3.185)	0.570* (1.749)	1.948*** (2.856)	0.536* (1.663)	2.112*** (3.036)	0.736** (2.224)	1.944*** (2.757)	0.656* (1.952)
Conditional <i>Spike_t</i> ; no <i>ItBuy</i>	-0.910*** (-6.086)	-0.880*** (-7.504)	-0.899*** (-6.013)	-0.878*** (-7.485)	-0.904*** (-6.052)	-0.894*** (-7.632)	-0.896*** (-6.005)	-0.884*** (-7.549)
Conditional <i>ItBuy_t</i> ; no <i>Spike</i>	1.588*** (6.207)	1.105*** (6.810)	1.579*** (6.232)	1.091*** (6.825)	1.593*** (6.216)	1.101*** (6.740)	1.566*** (6.036)	1.117*** (6.772)
<i>Size_{t-1}</i>	-5.762*** (-36.159)	-6.495*** (-36.876)	-5.763*** (-36.161)	-6.495*** (-36.880)	-5.763*** (-36.159)	-6.494*** (-36.872)	-5.762*** (-36.152)	-6.494*** (-36.868)
<i>BM_{t-1}</i>	-0.193 (-1.184)	-0.154 (-0.897)	-0.192 (-1.180)	-0.153 (-0.895)	-0.192 (-1.180)	-0.153 (-0.897)	-0.192 (-1.180)	-0.154 (-0.897)
<i>MOM_(t-6, t-1)</i>	0.314 (1.301)	0.134 (0.545)	0.312 (1.293)	0.133 (0.540)	0.314 (1.300)	0.135 (0.550)	0.312 (1.291)	0.134 (0.544)
Constant	27.280*** (23.610)	30.183*** (27.843)	27.282*** (23.611)	30.186*** (27.846)	27.281*** (23.610)	30.181*** (27.840)	27.279*** (23.607)	30.179*** (27.838)
Disagreement - Conditional <i>Spike_t</i> ; no <i>ItBuy</i>	3.122*** (4.398)	1.450*** (4.186)	2.847*** (4.078)	1.414*** (4.127)	3.016*** (4.243)	1.630*** (4.643)	2.840*** (3.941)	1.540*** (4.328)
Disagreement: QEA at t+1 - Later QEA	1.642** (2.141)		1.412* (1.872)		1.376* (1.787)		1.288* (1.649)	
Firm and month fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adj R ²	0.031	0.029	0.031	0.029	0.031	0.029	0.031	0.029
N	262266	569462	262266	569462	262266	569462	262266	569462

Table 5: The Effect of Information Asymmetry on the Relation Between Disagreements and Stock Returns

Table 5 presents the results of Model (1) conditional on information asymmetry. Panel A employs *Opacity* as the proxy of information asymmetry and separates firms by the sample median of *Opacity*. We follow Anderson et al. (2009) to construct *Opacity*. Panel B employs *PIN* as the proxy of information asymmetry and separates firms by the sample median of *PIN*. *PIN* is the probability of informed trading, which follows Brown and Hillegeist (2007). Panel C employs *IDELAY* as the proxy of information asymmetry and separates firms by the sample median of *IDELAY*. We follow Wang (2019) to construct *IDELAY*. *Disagreement_t* is defined as the appearance of short selling spike and insider buying in the month of *t*. We use four insider trading measures to define *ItBuy* following Dargenidou et al. (2018). We control for firm and month fixed effects within the panel logic model. Other variables are defined in Table 1. *t-values* are reported in parentheses and ***, **, * indicate statistical significance at the 0.01, 0.05, 0.1 levels, respectively, using two-tailed tests.

Panel A: Information Asymmetry Proxy = <i>Opacity</i>								
	<i>NPR</i>		Weighted <i>NPR</i>		<i>NetTrade</i>		<i>ConsisTrade</i>	
	High <i>Opacity</i>	Low <i>Opacity</i>	High <i>Opacity</i>	Low <i>Opacity</i>	High <i>Opacity</i>	Low <i>Opacity</i>	High <i>Opacity</i>	Low <i>Opacity</i>
<i>Disagreement_t</i>	1.784*** (3.417)	0.106 (0.284)	1.650*** (3.240)	0.110 (0.299)	1.881*** (3.531)	0.232 (0.614)	1.780*** (3.391)	0.152 (0.390)
Conditional <i>Spike_t</i> : no <i>ItBuy</i>	-1.048*** (-5.217)	-0.487*** (-5.230)	-1.039*** (-5.173)	-0.489*** (-5.250)	-1.058*** (-5.269)	-0.494*** (-5.305)	-1.041*** (-5.191)	-0.491*** (-5.279)
Conditional <i>ItBuy_t</i> : no <i>Spike</i>	1.422*** (5.967)	0.745*** (4.551)	1.404*** (5.961)	0.711*** (4.439)	1.393*** (5.828)	0.766*** (4.640)	1.436*** (5.951)	0.734*** (4.380)
<i>Size_{t-1}</i>	-7.783*** (-24.367)	-5.257*** (-24.293)	-7.784*** (-24.370)	-5.257*** (-24.293)	-7.783*** (-24.366)	-5.257*** (-24.289)	-7.783*** (-24.365)	-5.256*** (-24.289)
<i>BM_{t-1}</i>	-0.809*** (-2.719)	-0.048 (-0.261)	-0.809*** (-2.718)	-0.048 (-0.260)	-0.809*** (-2.719)	-0.048 (-0.261)	-0.809*** (-2.719)	-0.048 (-0.261)
<i>MOM_(t-6, t-1)</i>	-0.519 (-1.532)	-1.454*** (-4.762)	-0.521 (-1.539)	-1.455*** (-4.765)	-0.520 (-1.535)	-1.451*** (-4.752)	-0.521 (-1.537)	-1.454*** (-4.762)
Constant	30.032*** (17.441)	32.466*** (22.460)	30.035*** (17.444)	32.469*** (22.460)	30.032*** (17.441)	32.464*** (22.456)	30.031*** (17.441)	32.465*** (22.457)
<i>Disagreement - Conditional Spike</i>	2.832*** (5.063)	0.593 (1.543)	2.689*** (4.914)	0.599 (1.578)	2.939*** (5.159)	0.726* (1.760)	2.821*** (5.018)	0.643 (1.608)
Disagreement: High <i>Opacity</i> - Low <i>opacity</i>	1.678*** (2.615)		1.540** (2.452)		1.649** (2.524)		1.628** (2.492)	
Adj R ²	0.033	0.045	0.033	0.045	0.033	0.045	0.033	0.045
N	319361	352470	319361	352470	319361	352470	319361	352470

Panel B: Information Asymmetry Proxy = PIN								
	NPR		Weighted NPR		NetTrade		ConsisTrade	
	High PIN	Low PIN	High PIN	Low PIN	High PIN	Low PIN	High PIN	Low PIN
<i>Disagreement_t</i>	2.051***	-0.247	1.908***	-0.234	2.043***	-0.035	1.886***	-0.237
	(2.902)	(-0.559)	(2.717)	(-0.535)	(2.897)	(-0.077)	(2.578)	(-0.521)
Conditional <i>Spike_t</i> ; no <i>ItBuy</i>	-2.062***	-1.269***	-2.052***	-1.274***	-2.064***	-1.284***	-2.040***	-1.271***
	(-8.337)	(-8.763)	(-8.303)	(-8.784)	(-8.350)	(-8.871)	(-8.271)	(-8.791)
Conditional <i>ItBuy_t</i> ; no <i>Spike</i>	2.202***	0.855***	2.178***	0.806***	2.178***	0.863***	2.187***	0.830***
	(8.777)	(3.734)	(8.809)	(3.584)	(8.698)	(3.712)	(8.647)	(3.536)
<i>Size_{t-1}</i>	-9.939***	-10.467***	-9.940***	-10.467***	-9.938***	-10.466***	-9.936***	-10.466***
	(-24.390)	(-24.079)	(-24.390)	(-24.079)	(-24.387)	(-24.077)	(-24.381)	(-24.075)
<i>BM_{t-1}</i>	-0.188	-0.051	-0.187	-0.051	-0.186	-0.052	-0.186	-0.051
	(-0.488)	(-0.144)	(-0.486)	(-0.142)	(-0.484)	(-0.145)	(-0.484)	(-0.142)
<i>MOM_(t-6, t-1)</i>	-0.383	-0.853**	-0.384	-0.854**	-0.383	-0.850**	-0.386	-0.853**
	(-0.945)	(-2.101)	(-0.948)	(-2.105)	(-0.945)	(-2.094)	(-0.952)	(-2.103)
Constant	39.929***	70.609***	39.933***	70.611***	39.926***	70.604***	39.921***	70.604***
	(22.032)	(25.310)	(22.033)	(25.310)	(22.029)	(25.307)	(22.025)	(25.305)
<i>Disagreement - Conditional Spike</i>	4.113***	1.022**	3.960***	1.040**	4.107***	1.249***	3.926***	1.034**
Z-score	(5.492)	(2.193)	(5.321)	(2.259)	(5.498)	(2.636)	(5.088)	(2.165)
Disagreement: High PIN – Low PIN	2.298***		2.142***		2.078**		2.123**	
Z-score	(2.754)		(2.590)		(2.483)		(2.466)	
Adj R ²	0.036	0.057	0.036	0.057	0.036	0.057	0.036	0.057
N	263543	263750	263543	263750	263543	263750	263543	263750

Panel C: Information Asymmetry Proxy = IDELAY								
	NPR		Weighted NPR		NetTrade		ConsisTrade	
	High IDELAY	Low IDELAY	High IDELAY	Low IDELAY	High IDELAY	Low IDELAY	High IDELAY	Low IDELAY
<i>Disagreement_t</i>	1.721***	0.375	1.567***	0.415	1.872***	0.533	1.759***	0.369
	(3.919)	(0.879)	(3.624)	(0.983)	(4.217)	(1.237)	(3.931)	(0.839)
Conditional <i>Spike_t</i> ; no <i>ItBuy</i>	-0.928***	-0.714***	-0.919***	-0.718***	-0.941***	-0.724***	-0.929***	-0.714***

	(-6.845)	(-5.245)	(-6.778)	(-5.264)	(-6.944)	(-5.309)	(-6.862)	(-5.241)
Conditional <i>ItBuy</i> : no <i>Spike</i>	1.545***	0.978***	1.517***	0.973***	1.506***	1.007***	1.519***	0.967***
	(7.591)	(5.101)	(7.522)	(5.153)	(7.379)	(5.170)	(7.305)	(4.961)
<i>Size</i> _{<i>t-1</i>}	-6.107***	-6.174***	-6.108***	-6.174***	-6.107***	-6.173***	-6.106***	-6.173***
	(-27.075)	(-28.345)	(-27.078)	(-28.347)	(-27.077)	(-28.341)	(-27.072)	(-28.339)
<i>BM</i> _{<i>t-1</i>}	0.246	0.285	0.246	0.285	0.246	0.285	0.246	0.285
	(1.060)	(1.228)	(1.063)	(1.228)	(1.060)	(1.228)	(1.061)	(1.228)
<i>MOM</i> _(<i>t-6, t-1</i>)	-0.446	-0.593*	-0.448	-0.593*	-0.446	-0.591*	-0.448	-0.594*
	(-1.453)	(-1.806)	(-1.461)	(-1.807)	(-1.454)	(-1.800)	(-1.460)	(-1.810)
Constant	30.187***	33.276***	30.191***	33.278***	30.189***	33.273***	30.185***	33.274***
	(24.265)	(27.146)	(24.268)	(27.148)	(24.266)	(27.142)	(24.263)	(27.141)
<i>Disagreement - Conditional Spike</i>	2.649***	1.089**	2.486***	1.133**	2.813***	1.257***	2.688***	1.083**
Z-score	(5.768)	(2.435)	(5.478)	(2.555)	(6.058)	(2.781)	(5.757)	(2.352)
Disagreement: High <i>IDELAY</i> - Low <i>IDELAY</i>	1.346**		1.152*		1.339**		1.390**	
Z-score	(2.200)		(1.905)		(2.164)		(2.216)	
Adj R ²	0.029	0.027	0.029	0.027	0.029	0.027	0.029	0.027
N	405084	405097	405084	405097	405084	405097	405084	405097

Table 6: What Do Insiders know?

This Table presents the information revealed after the disagreement between insider buying and short selling. In Column (1) we first regress the three-day buy-and-hold abnormal stock returns surrounding the subsequent quarterly earnings announcements within next 12 months on disagreements, controlling other variables. From column (2) to (5) we employ logit regression to examine the possibility of beating earnings forecast and announcing an M&A plan within the next 12 months. Specifically, we further partition equity-financed M&As and others. We collect the information of M&As from SDC, which is available via Thomson Reuters. *Disagreement_t* is defined as the appearance of short selling spike and insider buying in the month of t. We use four insider trading measures to define *ItBuy* following Dargenidou et al. (2018). Other variables are defined in Table 1. We control for firm fixed effects within all estimation. *t-values* are reported in parentheses and ***, **, * indicate statistical significance at the 0.01, 0.05, 0.1 levels, respectively, using two-tailed tests.

	(1)	(2)	(3)	(4)	(5)
	Earnings Surprises: 3-Day BHARs	Earnings Surprises: Beating Forecasts	M&A [t+1, t+12]	M&A Equity-financed	M&A Non-equity-financed
<i>Disagreement_t</i>	0.342*** (2.810)	0.199*** (6.165)	-0.124** (-2.205)	-0.289** (-2.330)	-0.078 (-1.285)
Conditional <i>Spike_t</i> ; no <i>ItBuy</i>	-0.113*** (-3.090)	0.035*** (3.422)	-0.056*** (-3.457)	-0.016 (-0.408)	-0.061*** (-3.547)
Conditional <i>ItBuy_t</i> ; no <i>Spike</i>	0.280*** (5.610)	0.152*** (9.352)	0.021 (0.828)	0.054 (1.062)	0.021 (0.748)
<i>Size_{t-1}</i>	-0.879*** (-17.755)	-0.508*** (-82.084)	0.120*** (13.549)	-0.174*** (-9.647)	0.177*** (18.319)
<i>BM_{t-1}</i>	-0.069 (-1.309)	0.191*** (24.086)	-0.458*** (-40.859)	-0.752*** (-29.623)	-0.407*** (-33.723)
<i>MOM_(t-6, t-1)</i>	0.155* (1.949)	0.213*** (18.533)	0.154*** (9.075)	0.246*** (6.241)	0.144*** (7.833)
Constant	4.156*** (14.494)	-	-	-	-
<i>Disagreement - Conditional Spike</i>	0.455***	0.164***	-0.068	-0.305**	-0.017
Z-score:	(3.577)	(4.892)	(-1.168)	(-2.352)	(-0.268)
Firm fixed effect	Yes	Yes	Yes	Yes	Yes
Adj R ² (Pseudo R ²)	0.004	0.026	0.018	0.029	0.018
N	831728	536692	240272	68317	215837

Table 7: Robustness Test of H1 Using Opportunistic Insider Trading

Table 7 examines the H1 by employing opportunistic and excluding routine insider trading, which follows Cohen et al. (2012). $Disagreement_t$ is defined as the appearance of short selling spike and insider buying in the month of t . We use four insider trading measures to define $ItBuy$ following Dargenidou et al. (2018). Other variables are defined in Table 1. We control for firm and month fixed effects within all estimation. t -values are reported in parentheses and ***, **, * indicate statistical significance at the 0.01, 0.05, 0.1 levels, respectively, using two-tailed tests.

	<i>NPR</i>	Weighted <i>NPR</i>	<i>NetTrade</i>	<i>ConsisTrade</i>
<i>Disagreement_t</i>	0.930*** (2.944)	0.868*** (2.805)	1.062*** (3.307)	0.779*** (2.999)
Conditional <i>Spike_t</i> : no <i>ItBuy</i>	-0.872*** (-8.820)	-0.870*** (-8.794)	-0.880*** (-8.906)	-0.880*** (-8.763)
Conditional <i>ItBuy_t</i> : no <i>Spike</i>	1.308*** (9.066)	1.285*** (9.008)	1.314*** (9.051)	1.162*** (9.094)
<i>Size_{t-1}</i>	-5.861*** (-38.042)	-5.861*** (-38.046)	-5.861*** (-38.040)	-5.866*** (-38.088)
<i>BM_{t-1}</i>	-0.026 (-0.170)	-0.026 (-0.168)	-0.026 (-0.168)	-0.025 (-0.160)
<i>MOM_(t-6, t-1)</i>	0.167 (0.771)	0.166 (0.765)	0.168 (0.777)	0.161 (0.742)
Constant	26.665*** (29.699)	26.668*** (29.703)	26.663*** (29.697)	26.690*** (29.734)
<i>Disagreement_t</i> – Conditional <i>Spike_t</i>: no <i>ItBuy</i>	1.802*** (5.442)	1.738*** (5.356)	1.942*** (5.781)	1.659*** (5.955)
Z-score:				
Firm and month fixed effect	Yes	Yes	Yes	Yes
Adj R ²	0.025	0.025	0.025	0.025
N	873143	873143	873143	873143

Table 8: Robustness Test of H1 on Beginning Short Interest Level

Table 8 examines the H1 by focusing on sample firms with high level of beginning short interests. The first four columns show results based on the sample where the beginning level of short interests is greater than 2.5%, the last four columns show results based on the sample where the beginning level of short interests is greater than 5%. *Disagreement_t* is defined as the appearance of short selling spike and insider buying in the month of t. We use four insider trading measures to define *ItBuy* following Dargenidou et al. (2018). Other variables are defined in Table 1. We control for firm and month fixed effects within all estimation. *t-values* are reported in parentheses and ***, **, * indicate statistical significance at the 0.01, 0.05, 0.1 levels, respectively, using two-tailed tests.

	Short interests >2.5%				Short interests > 5%			
	NPR	weighted NPR	Net trades	Consistent trades	NPR	weighted NPR	Net trades	Consistent trades
<i>Disagreement_t</i>	1.409*** (3.817)	1.338*** (3.717)	1.524*** (4.078)	1.455*** (3.873)	1.740*** (3.596)	1.651*** (3.527)	1.899*** (3.849)	1.753*** (3.582)
Conditional <i>Spike_t</i> : no <i>ItBuy</i>	-0.541*** (-4.591)	-0.539*** (-4.565)	-0.550*** (-4.664)	-0.540*** (-4.588)	-0.308** (-2.038)	-0.302** (-1.998)	-0.320** (-2.121)	-0.308** (-2.039)
Conditional <i>ItBuy_t</i> : no <i>Spike</i>	1.155*** (4.901)	1.122*** (4.843)	1.141*** (4.781)	1.173*** (4.839)	1.377*** (4.005)	1.364*** (4.036)	1.351*** (3.891)	1.350*** (3.812)
<i>Size_{t-1}</i>	-7.157*** (-26.151)	-7.157*** (-26.153)	-7.157*** (-26.149)	-7.157*** (-26.150)	-7.589*** (-18.899)	-7.588*** (-18.897)	-7.588*** (-18.895)	-7.588*** (-18.895)
<i>BM_{t-1}</i>	-0.685*** (-2.991)	-0.684*** (-2.988)	-0.685*** (-2.989)	-0.685*** (-2.991)	-0.612* (-1.960)	-0.611* (-1.955)	-0.611* (-1.957)	-0.611* (-1.956)
<i>MOM_(t-6, t-1)</i>	-0.758** (-2.552)	-0.760** (-2.559)	-0.757** (-2.548)	-0.758** (-2.551)	-0.976*** (-2.577)	-0.978*** (-2.583)	-0.975** (-2.574)	-0.978*** (-2.583)
Constant	30.638*** (9.604)	30.639*** (9.604)	30.639*** (9.604)	30.636*** (9.604)	31.839*** (6.928)	31.839*** (6.928)	31.839*** (6.928)	31.840*** (6.929)
<i>Disagreement_t</i> – Conditional <i>Spike_t</i> : no <i>ItBuy</i>	1.950*** (5.033)	1.877*** (4.955)	2.074*** (5.288)	1.995*** (5.062)	2.048*** (4.039)	1.953*** (3.971)	2.219*** (4.304)	2.061*** (4.027)
Firm and month fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adj R ²	0.031	0.031	0.031	0.031	0.035	0.035	0.035	0.035
N	328743	328743	328743	328743	184711	184711	184711	184711