DO INSIDERS CLUSTER TRADES WITH COLLEAGUES? EVIDENCE FROM DAILY INSIDER TRADING

Dallin M. Alldredge

Florida International University

Brian Blank

Mississippi State University

Abstract

We explore similarities in insider trading as a proxy for information flows. We observe that corporate insiders cluster trades around those of other insiders at their firm, especially around trades of insiders with whom they work closely. Clustering is greater when informational advantages are larger: during periods of low investor attention, high uncertainty, and high information asymmetry. We also document that clustered insider purchases are followed by abnormal returns in excess of 2% during the subsequent month. Our results are consistent with informed trading, which could result from information sharing among corporate insiders.

JEL Classification: G14, G30, K22

Dallin M. Alldredge (corresponding author), College of Business, Florida International University, Miami, FL 33174; Email: Dalldred@fiu.edu. Phone: (305) 348-6649. Brian Blank, College of Business, Mississippi State University, Mississippi State, MS 39762; Email: Brian.blank@msstate.edu. Phone: (662) 325-5910. We are grateful for comments and suggestions from David Whidbee, Brandon Cline, David Cicero, Eric Kelley and Lee Biggerstaff, as well as seminar participants at Washington State University and Mississippi State University. Errors are our own.

Electronic copy available at: https://ssrn.com/abstract=2781761

I. Introduction

Do corporate insiders cluster together when they trade? Answering this question may provide information about the relation between corporate insiders' information sets and the resulting flow of information between corporate insiders, as evidenced by trades and subsequent performance. Studies document that corporate insider trades exhibit superior stock performance (Jaffe 1974; Seyhun 1986, 1998; Lin and Howe 1990; Lakonishok and Lee 2001). Although aggregating all insider trades often masks the extent to which insiders are informed, Lorie and Niederhoffer (1968), Cohen, Malloy, and Pomorski (2012), and Biggerstaff et al. (2015) use patterns of insider trading to identify abnormalities in trading behavior and uncover informed trading within time-series patterns. In this study, we explore similarities in insiders' trading behavior at the daily level to learn about the profitable information insiders hold and the subsequent transfer of that information.

We offer evidence of daily trade clustering by investors with information pertaining to a firm's internal operations: corporate insiders (Lakonishok and Lee 2001; Cohen, Malloy, and Pomorski 2012). We also offer both informed and uninformed explanations for why insiders could exhibit behavior similar to herding. If insiders' trades are completely independent from one another, we expect that they do not bunch together any more than expected by chance, with an average day containing a similar number of insider trades. However, if informed insiders do trade in clusters, they may do so either intentionally or unintentionally. As Holden and Subrahmanyam (1992) suggest, herd behavior can result unintentionally because related information sets are revealed to individual traders at varying rates, depending on information flow and trader networks. Although this could induce informed investigative herding (Lakonishok, Shleifer, and Vishny 1992), insiders might also cluster their trades because of other private information channels.

Electronic copy available at: https://ssrn.com/abstract=2781761

Specifically, relatively more informed insiders privately share information by tipping other less informed insiders, and both sets of insiders coordinate trading to mutually benefit from the shared information. Economic theory suggests that agents behave rationally and incorporate relevant information into decision-making processes. Scharfstein and Stein (1990) show that this results in herding when agents consider the decisions of others. Furthermore, when managers are asked where they get information, nearly universally people are cited as the source, especially those they perceive as informed and to whom they can gain access in a timely fashion (Cross et al. 2003). Similar behaviors and decision making could lead to herding behavior among an array of manager decisions, including trading of the firm's stock. Some early theoretical models suggest that insiders with shared private information should not cooperate to mutually benefit from shared information but rather should compete aggressively to profit from their tradable information without benefiting other insiders (Holden and Subrahmanyam 1992; Back, Cao, and Willard 2000). However, Indjejikian, Lu, and Yang (2014) and Ahern (2017) find rational explanations for why insiders share tradable information (i.e., rational information leakage to other informed participants) to jointly profit from private information. These factors could result in informed trade clustering among insiders, either through coordinated information sharing or independently obtained information.

Alternatively, insider trade clustering could result from uninformed trading related to restrictions in trading or information. For example, firm trading restrictions in the form of blackout dates or restrictions around earnings announcements could limit insider trading opportunities and lead to the clustering of trades. Similarly, insiders selling stock might trade in groups to avoid costly litigation risk, especially where media and regulatory scrutiny is higher (Alldredge and Cicero 2015; Chen, Martin, Wang 2012; Brochet 2010). Finally, limitations and differences

Electronic copy available at: https://ssrn.com/abstract=2781761

between insiders' information sets could result in information cascades, which are settings in which traders follow other trades because they perceive those trades to be informed (Bikhchandani, Hirshleifer, and Welch 1992). In particular, uninformed clustering could be the result of insiders viewing the Form 4 insider trade disclosures of insider peers and following their trades. In a related setting, Scharfstein and Stein (1990) show that managers sometimes mimic the decisions of other managers when considering investment opportunities. Likewise, Keynes (1936) suggests that investors will herd if they are concerned about how others assess their abilities to make sound judgments. In the same way, insiders may disregard their own noisy information sets and trade in groups based on information deduced from the public disclosure of other insider trades. With these explanations in mind, we seek to determine if and how corporate insiders cluster their trades.

To understand insider trades and identify possible clusters, we isolate trades more likely to be deliberate and discern the relative timing of insider trades.[1] Despite the sparseness of insider trading, we find that 23% of insider purchases occur on the same day of at least one other insider purchase at the same firm, and likewise, 21% of insider sales occur on the day of another insider sale at the same firm. Furthermore, when we compare the conditional probability of insiders trading around other insider trades, we observe that insiders are nearly four times more likely to purchase shares of stock when other insiders at their firm also purchase shares on the same day. Additionally, the volume of shares purchased on days when there is another peer insider purchase is nearly seven times greater than the quantity purchased during the entire two weeks before the peer purchase. These results suggest that not only are insiders more likely to purchase around peer purchases, but also the quantity of shares purchased is substantively higher around peer purchases.

[1]We focus on insider trades that are not routine in nature, following the Cohen, Malloy, and Pomorski (2012) routine insider classification. However, our conclusions are similar when including routine insider trades. We limit our sample to nonroutine trades to isolate intentional insider trade clustering.

Electronic copy available at: https://ssrn.com/abstract=2781761

However, insider sales do not predict insider purchases, suggesting that the clustering of insider trading may not be the result of restrictive corporate insider trading policies. In addition to limiting our sample to trades that are not routine in nature (Cohen, Malloy, and Pomorski 2012), we control for the timing of trading relative to earnings announcements, where corporations often restrict insider trading. Overall, our results show recent trading by a peer insider is an economically and statistically significant determinant of insider trading, suggesting that significant insider trade clustering is not explained by the timing of trading restrictions relative to earnings announcements.

We also explore the timing of trading relative to Form 4 filings to determine whether insiders are publicly observing and following other insider trades to capitalize on perceived information superiority (Bikhchandani, Hirshleifer, and Welch 1992). We show that insider purchases are three times more likely to precede Form 4 filings of stock purchases by peer insiders and that insider sales are nearly three times more likely to precede Form 4 filings of stock sales by peer insiders than to follow them. Therefore, the intrafirm insider trade clustering we observe is not the result of information cascades, where insiders follow public information from Form 4 filings. Instead, clustering takes place before trade information is disclosed and is therefore still private.

Next, we explore the market response to insider trades to determine whether insider trade clustering represents informed trading activities. We observe that insider purchases that occur within two days of a peer insider purchase obtain monthly abnormal returns of 2.1%, which is 0.9% higher than the abnormal returns following solitary insider purchases (i.e., insider purchases not timed with peers' purchases). Cohen, Malloy, and Pomorski (2012) find opportunistic insider trade months are followed by approximately 1% monthly abnormal returns, similar to the magnitude of the abnormal returns following solitary insider purchases in our study. In contrast to

Electronic copy available at: https://ssrn.com/abstract=2781761

the results for insider purchase clusters, the market response to insider sale clusters is not significantly different from the market response to solitary sales, except during the five days after insider filings. Although insider purchase clusters represent informed trading, insider sale clusters may instead be seeking to limit scrutiny (Alldredge and Cicero 2015; Chen, Martin, and Wang 2012; Brochet 2010).

We also investigate the timing of insider trade clusters and find that they are more common when investor attention is low, firm uncertainty is high, and information asymmetry is high, which is consistent with informed insider trade clustering. Furthermore, we attempt to identify the flow of information within the firm by investigating which insiders purchase stock in groups. Chief executive officers (CEOs) and chief financial officers (CFOs) are each more than four times as likely to purchase stock if the other has purchased stock within the past two days, whereas other officers are more than three times as likely to purchase stock within two days of a purchase by the CEO, CFO, or other officer. Directors are more likely to follow fellow directors and the CEO, suggesting that insiders trade with colleagues with whom they work more closely. Furthermore, insider trade clusters led by the CEO, CFO, and directors exhibit the most information, as measured by subsequent stock performance.

Finally, we seek to identify the mechanism that results in informed insider trade clusters by exploiting a shock to the timing of insider trading disclosure. Although we cannot directly test whether insider trade clusters are coordinated, we use changes in trading restrictions to test whether insider trade clustering is likely the result of investigative herding or private information sharing. Specifically, we explore insider trading before and after the Sarbanes–Oxley Act of 2002 (SOX), which requires more timely disclosure of insider trades to the U.S. Securities and Exchange Commission (SEC).

Electronic copy available at: https://ssrn.com/abstract=2781761

If insiders independently trade, we do not expect clustering to be influenced by disclosure changes in the post-SOX period, whereas coordination by traders could change following SOX disclosure requirements. In fact, in the post-SOX period, we observe a significant tightening of insider trading clusters within the disclosure deadline, which indicates that insiders are clustering more before information is public. These results suggest that insiders may be sharing information with peers before disclosing trades. Although we cannot directly test for independent investigative herding (Lakonishok, Shleifer, and Vishny 1992), we do not expect investigative herding to be affected by changes in insider trading disclosure rules, because insider trading decisions are independent. As a result, trading should not change with disclosure requirements. Instead, our results are consistent with the intentional exchange of information through nonpublic channels.

Our study contributes to the informed insider trading literature by providing insight into the clustering of trades among some informed traders by observing daily corporate executive trades. We add to the growing evidence of informed insider trading patterns (Cohen, Martin, and Wang 2012; Biggerstaff, Cicero, and Wintoki 2015). Within the context of the opportunistic insider trading pattern documented by Cohen, Martin, and Wang (2012), we find more granular variation in the information content of insider trades based on the daily clustering of insider trades. Importantly, daily insider trade clustering appears to be the impetus behind the monthly intensive insider trading introduced by Lorie and Niederhoffer (1968) and followed by Jaffe (1974). Finally, we complement the research of Ahern (2017) and Hvide and Östberg (2015) by documenting that relationships within the firm lead to correlated insider trading activity. Although our work has similarities with Ahern, one important distinction is that our study broadly explores insider trading by corporate executives. As a result, we provide a new perspective into the flow of profitable information between corporate executives through insider trade clusters, improving our

Electronic copy available at: https://ssrn.com/abstract=2781761

understanding of knowledge transfer within firms and resulting information signaled to market participants. Although insider trade volume is smaller than some groups of traders, the information content of insider trades is critical to understanding firm information diffusion.

II. Data and Results

Our analysis incorporates data from several sources. We collect data from Table I of the Thomson Reuters insider database, which contains stock transactions by insiders at publicly traded U.S. firms. We exclude insider trades related to option transactions and include only Thompson Reuters verified accurate open market sale and purchase transactions from January 1986 to December 2014.[2] To evaluate the abnormal returns for insider trades, we gather stock market returns and firm characteristics, including balance sheet and income statement data from the Center for Research in Security Prices (CRSP) and Compustat. We drop illiquid stocks with prices below $5. Moreover, we winsorize accounting variables at the 1% and 99% levels to eliminate the effect of outliers. We also limit the sample to insiders at the firm with trades spanning at least 12 months. From this sample, we identify all New York Stock Exchange (NYSE) trading days starting 1 month after the first trade by the insider until 1 month before the last trade by the insider to determine potential insider trade days.

Sample Construction

For our analysis, we summarize our sample in two ways. In Tables 1 and 2, we summarize our sample at the monthly level. Then, for the remainder of our analysis, we focus on trading at the daily level to identify clustering at a more granular level. We make several efforts to control for the effects of corporate policies that restrict trading. Firms with tight trading restrictions might

[2]We rely on Thompson Reuters transactions with a cleanse code of R, H, L, C, or Y.

Electronic copy available at: https://ssrn.com/abstract=2781761

have clustered insider trading that results from limited trading opportunities rather than from information flow. Bettis, Coles, and Lemmon (2000) find that 30% of companies restrict trading to 3 to 12 days after quarterly earnings announcements and 43% of companies allow trading windows based on earnings announcements. Firms that have strict trading windows following regularly occurring earnings announcements likely have crowded insider trading unrelated to information flows during these narrow trading windows. We control for differences in trading 3 to 12 days following earnings announcements throughout our analyses, in addition to controlling for the commonly implemented blackout window of 30 days preceding earnings announcements until 2 days following earnings announcements. Finally, we limit our sample to nonroutine trades, because removing routine traders allows for a more direct test of intentional insider trade clustering. Following Cohen, Malloy, and Pomorski (2012), we characterize insider trading as routine if the insider trades in the same calendar month in three consecutive years, which is by definition habitual.

Summary Statistics

Table 1 summarizes firm size, book-to-market, trades per month, and shares traded in each insider trade month for our sample by the frequency of sellers and buyers. Our sample consists of 52,532 corporate insiders from 8,789 firms during January 1986 to December 2014. Sellers tend to trade within the same month at larger firms, with average market capitalization over $3 billion and relatively lower book-to-market ratios, 0.50 or less on average. However, purchasers trade together at smaller firms, with market capitalization averaging less than $2.3 billion, which may not be expected as smaller firms are likely to have fewer insiders, and higher book-to-market firms, 0.64 or more on average. Because insider sales of an overvalued stock could be evidence in a shareholder suit claiming fraud, insiders selling might cluster trades to avoid costly litigation risk,

Electronic copy available at: https://ssrn.com/abstract=2781761

especially at large firms where media and regulatory scrutiny is higher (Alldredge and Cicero 2015; Chen, Martin, and Wang 2012; Brochet 2010). Insiders purchasing in small firms might cluster their trades around timely privately held information. According to Lakonishok and Lee (2001), insiders at smaller firms are more likely to have valuable information about their companies and more freedom to exploit that information. As a result, clustered insider purchases are more likely than clustered insider sales to reflect information flow within the firm. The median number of shares traded per insider is 84% higher during firm-months with multiple purchasers than during firm-months with only one buyer, and 78% higher during firm-months with multiple sellers than during firm-months with only one seller. If increased trade volume proxies for informed trading activity, the insiders trading in months with multiple insiders trading in the same direction are more likely to be informed.

[INSERT TABLE 1 HERE]

We report the distribution of insider firm-month observations by roles in Panel A of Table 2. The insider is considered a buyer if the number of shares purchased in the month is greater than the number of shares sold, and vice versa for sellers. We identify roles by the primary role code classification in the Thomson Reuters Insider Filing Database. We classify insiders into five categories: CEO, CFO, other officers, directors, and other. Of these groups, directors trade in the most trade months. However, directors and other officers make up a lower percentage of all insiders trading during months with multiple sellers (directors = 33% and officers = 39%) or multiple purchasers (directors = 46% and officers = 23%), compared to trade months with a single seller (directors = 33% and officers = 48%) or single purchaser (directors = 58% and officers = 25%). Conversely, CEOs make up a higher percentage of all insiders trading during months with multiple purchasers (10%) and multiple sellers (11%) than during months with a single purchaser

Electronic copy available at: https://ssrn.com/abstract=2781761

(8%) or multiple sellers (7%). Moreover, CFOs make up about the same percentage of all insiders trading during months with multiple insiders as during months with a lone trader (5% and 4%).

[INSERT TABLE 2 HERE]

In Panel B of Table 2, we present the frequency of months in which insiders trade by the number of purchasers (vertically) and sellers (horizontally), similar to Lorie and Niederhoffer (1968). The results show that 81% (672,534 of 829,572) of months do not contain insider trades. Furthermore, when multiple insiders trade, they typically trade in the same direction. For example, among the 17,674 months with four or more sellers, 16,664 (94%) have zero purchasers, suggesting that the economic magnitude of insider trading clusters is substantive. The pattern of insider trading is consistent with the intensive insider trading identified by Lorie and Niederhoffer. Throughout the remainder of this article, we attempt to identify whether insiders exhibit herding behavior at the daily level and whether insider trade clustering reflects a sharing of information among corporate insiders.

Identifying Insider Trade Clusters

We analyze the similarities in insiders' trading behavior to identify the information flows between insiders. We summarize insider transactions at the daily level. When an insider trades multiple times in the same day, we aggregate their trading to the daily level by subtracting the number of shares sold from the number of shares purchased throughout the day. If on a given day an insider sells more shares than he or she purchases at the firm, the insider firm-day observation is recorded as an insider sale day, and vice versa.

We first explore the propensity for an insider to trade around other insider trades. To do so, we analyze two measures for insider demand, similar to prior methodologies (Lakonishok,

Electronic copy available at: https://ssrn.com/abstract=2781761

Shleifer, and Vishny 1992; Wermers 1999; Sias 2004). The first measure, net number of purchasers, is the mean difference between the number of other insider purchasers and the number of other insider sellers trading at the same firm over the specified window around an insider purchase or sale on day *t*. The second measure, net number of shares purchased, is the mean difference between the number of shares purchased and the number of shares sold as a percentage of the number of shares outstanding (in thousands) across other insiders at the firm over the specified window around an insider purchase or sale on day *t*.

Table 3 provides univariate analysis of insider demand around insider purchases and sales. In Panel A, we use the net number of purchasers trading at the same firm around peer insider purchases and sales to assess insider demand. We observe an average of 0.49 additional insiders purchasing stock on the day an insider purchases stock at the same firm and 0.37 additional insiders selling stock on the day an insider sells stock at the same firm. The difference between the net number of purchasers on the day of an insider purchase and the net number of purchasers on the day of an insider sale is 0.86, which is both economically and statistically meaningful (*t*-statistic = 223.29), relative to standard insider trade likelihood. The net number of purchasers on the day of an insider purchase is larger than the net number of purchasers in the previous 10 days combined. The net number of purchasers in the 10 days leading up to an insider purchase on day *t* is 0.32, and the net number of purchasers in the 10 days leading up to an insider sale on day *t* is −0.53. The results indicate that insiders are more likely to trade on the same day and in the same direction as other insiders, and insider demand tapers off in the days or weeks before or after the insider trade day. Purchases are more likely to occur when other insiders are purchasing, and sales are more likely to occur when other insiders are selling, resulting in a negative sign for the difference between net insider purchases and sales around an insider's sale at the firm.

Electronic copy available at: https://ssrn.com/abstract=2781761

[INSERT TABLE 3 HERE]

In Panel B of Table 3, we calculate the net number of shares purchased and sold by insiders as a secondary measure of insider demand. Consistent with the results from Panel A, we find that the net number of shares purchased and sold by other insiders at the firm increases in the days leading up to and peaks on the day of an insider purchase or sale. The percentage of outstanding stock purchased, net of sales, by insiders on the day a peer insider purchases stock is nearly seven times larger than the percentage of outstanding stock net purchased by insiders in the 10 days leading up to a peer insider purchase. These results indicate that not only do insider trades usually occur near the same time as the trades of other insiders at their firm, but insiders trade a larger magnitude of shares when their trades occur near the same time as peer insider transactions. Compared to other equity traders, corporate executives have a uniquely high level of information about firm value, and as a group, they share information on a regular basis. Therefore, the high concentration of insider trading could be indirect evidence of the information flow within the firm. Next, we document this distributional effect graphically.

In Figure I, we show the relative timing of insider trades. For each insider trade on day *t*, we identify the probability that another insider at the same firm also traded on each day from *t*−10 to *t*+10. The probability of an insider trading is far higher on days when other insiders trade. In fact, Panel A shows the probability that an insider purchasing is concentrated, centering on days other insiders purchase. The probability spikes on day *t* to more than 20%, whereas the days before and after symmetrically decline in probability, as other insider trade is further away. However, insider trade clusters are predominantly uniform in trading position. The likelihood of an insider sale on day *t* is less than 2% and remains less than 2% for the entire 21-day window shown in Panel A. Furthermore, Panel B shows insiders are more likely to sell when another insider sells on

Electronic copy available at: https://ssrn.com/abstract=2781761

the same day. The probability of an insider sale spikes to more than 20% on the same day of another insider sale and declines as the trade moves further away from day *t*. In our sample, insiders purchase stock on only 0.11% of potential trading days and sell stock on 0.36% of potential trading days. Despite this, more than one of every five insider trades occurs on the same day as a trade of a peer insider at the same firm.

[INSERT FIGURE I HERE]

Probability of Insider Trades

Next, we perform multivariate analysis of insider trade clusters. We begin by constructing a sample of potential insider trade days. Because insider trading is sparse compared to institutional trading, we do not limit our study to the imbalance measures from the herding literature. On average, we observe that 4 of every 12 firm-months contain nonzero insider trading. Although Sias (2004) uses a standardized lead–lag measure to identify whether institutional buying the previous period explains institutional buying in the current period, insider trading differs from institutional trading in frequency and volume. As a result, the standardized lead–lag measure used by Sias may not offer the same benefits for our setting. Furthermore, the sparse nature of insider trades makes the Lakonishok, Shleifer, and Vishny (1992) herding measure imperfect as well. In addition to these measures, we use analyses accounting for the nature of insider trading data.

Our primary empirical analysis uses limited dependent variable regressions, where we predict insider trading as a function of contemporaneous and lagged insider trading at the firm. In this framework, we identify the propensity for traders to cluster trades, controlling for blackout periods and determinants of insider returns. The starting date of employment for each insider is not identifiable from the Form 4 filings, so the first and last trades of the insider are the best approximation of the initiation and termination of employment at the firm. Because trading around

Electronic copy available at: https://ssrn.com/abstract=2781761

the commencement and termination of employment at the firm might include unusual trading behavior, we exclude the first and last months of trading in our analysis to ensure that our results are not affected by these periods. However, robustness tests confirm that our conclusions are unchanged for various sample restrictions. The remaining sample consists of every potential insider trade day observation for all insiders, yielding 52,734,073 insider firm-day observations.

In column 1 of Table 4, the dependent variable of the probit regression equals 1 for a purchase on day *t* by insider *i* at firm *j*, and 0 for all other possible trading days when insider *i* does not purchase stock. In column 2, the dependent variable of the Tobit regression is the number of shares purchased by insider *i* at firm *j* on day *t*, scaled by shares outstanding in thousands of shares. In column 3, the dependent variable of the probit regression equals 1 for an insider sale on day *t* by insider *i* at firm *j*, and 0 for all other possible trading days when the insider does not sell stock. In column 4, the dependent variable of the Tobit regression is the number of shares sold by insider *i* at firm *j* on day *t*, in thousands of shares. The independent variables of the regressions are defined as follows: *Peer Sale* (*Peer Purchase*) is an indicator variable equal to 1 if there is at least one sale (purchase) by an insider peer to (from) insider *i* at firm *j* during the specified window ($t-5$ to $t-3$ and $t-2$ to t), and 0 otherwise. *Own Sale* (*Own Purchase*) is an indicator variable equal to 1 if there is at least one sale (purchase) by insider *i* at firm *j* from days $t-20$ to $t-6$, before the relevant clustering windows. *Size* is the log of the previous year-end market value. *B/M* is the log of the previous year-end book-to-market ratio. *Momentum* is the cumulative market-adjusted return from days $t-20$ to $t-1$, which accounts for the effect of insider trading likelihood based on historical stock performance or recent firm-specific news. *Safe* is equal to 1 if the trading day is within the (3, 12) window following the firm's earnings announcement, and *Blackout* is equal to 1 if the

Electronic copy available at: https://ssrn.com/abstract=2781761

trading day is within the (−30, 2) window around the firm's earnings announcement. *Log Insiders* is the log of the number of insiders trading in the firm-month.[3]

[INSERT TABLE 4 HERE]

The results in Table 4 indicate that insiders are likely to trade following other insiders that trade in the same direction. Column 3 shows that an insider is 184% more likely to sell if another insider sells within the past two days. We compute the conditional probability by using the marginal effects from the probit regression model (0.00665), divided by the probability of an insider trade (0.00362). Specifically, the marginal probability of an insider selling stock within two days of another insider sale is 0.665%, and the probability of an insider selling on any given potential insider trade day is 0.362%. Therefore, the conditional probability of an insider trading within two days before another insider sale is 0.00665/0.00362 = 184%. This is the interpretation of the probit regression models used throughout this article.

Furthermore, an insider is 298% more likely to purchase if another insider purchases within the past two days. Not only are insiders more likely to purchase when other insiders are also purchasing, but insiders are likely to purchase more stock if they are following the trade of another insider. An insider purchases 0.042% more of outstanding stock if a fellow insider trades within the past two days. These results are consistent with insiders holding similar tradable information and timing their trades to profit on their jointly held information. If insiders were inferring

[3]Although controlling for cross-sectional and time-series variation by incorporating fixed effects into the probit regression model is appealing, it is not computationally feasible. Adding fixed effects to the model nearly eliminates the potential for convergence, because of the large number of observations and the sparseness of the dependent variable.

Electronic copy available at: https://ssrn.com/abstract=2781761

information from others' trading activity, past trading activity would be a larger predictor of insider trading activity than would contemporaneous trading activity.

Another important predictor of insider trade clustering is whether the same trader traded in the same direction over the past month. We show that insiders not only follow other individuals' trades but also their own trades over a substantive period. Although the literature documents that insiders often break up their trades throughout a day or several days (Cornell and Sirri 1992), we show that insiders' trades exhibit momentum for at least one month. If an insider purchased over the past month, the insider is more than four times as likely to purchase again. Additionally, if an insider sold in the past month, the insider is twice as likely to sell again.[4] Insiders' information sets appear to be persistent, and insider trades are not susceptible to daily and weekly changes in stock market performance.

We document that the clustering behavior of insiders is evident when using traditional herding measures, univariate probabilities, and more complex multivariate logistic models. However, we have not addressed the motivation for the trade clustering behavior. In subsequent tests, we attempt to uncover the motivation for insiders trading in groups.

Explanations for Insider Trade Clusters

We first analyze the possibility that insiders trade together because of tight restrictions and mandated blackout periods. If insiders are allowed to trade on only a few days per quarter, we should observe clustering of insider trades. We limit this possibility in several ways. First, we eliminate all routine trades following the Cohen, Malloy, and Pomorski (2012) trading

[4]In untabulated results, we incorporate an ordinal logistic regression model that assigns +1 to a purchase, −1 to a sale, and 0 to all other trade days. The results from using the ordinal logistic regression framework are consistent with the results we present.

Electronic copy available at: https://ssrn.com/abstract=2781761

classification. If firms restrict insider trading to a limited window following earnings announcements, these trades may occur in the same month each year. In this case, we classify the trades as routine and exclude them from our analysis. Even still, Figure II shows that insiders are more likely to trade following earnings announcements, which may be due to limitations imposed on insider trades in the form of blackout periods. As a result, in our multivariate regression analysis, we control for the period following the earnings announcement (3 to 12 days following earnings announcements) that is most likely to be the trading window for insiders at firms with the most restrictive trading policies, according to Bettis, Coles, and Lemmon (2000). Next, we construct a test to identify whether the multivariate clustering results are largely a function of the trading window following earnings announcements by 3 to 12 days. From the regression analysis documented in columns 2 and 5 of Table 5, we find that the clustering identified in previous tests is not simply the result of restrictive trading windows following earnings announcements. The economic significance and statistical significance both appear to be muted during this period, as evidenced by negative coefficients on the interaction of *Peer Purchase* (*Sale*) and *Safe.* Finally, we restrict the sample to the window 3 to 12 trade days following the earnings announcements. If insiders are allowed to trade only during this time, insider purchases would predict insider sales and insider sales would predict insider purchases. In columns 3 and 6, we present the regression analysis isolated to the restricted sample and find that insider purchases do not predict insider sales and insider sales do not predict insider purchases. Our results are also consistent with Tables 3 and 4, so it appears that trade clustering by corporate insiders does not result from individual firm governance policies.

[INSERT TABLE 5 HERE]

Electronic copy available at: https://ssrn.com/abstract=2781761

We further examine the timing of insiders clustering trades by exploring whether clustering is more likely in periods of low investor attention, high uncertainty, and high information asymmetry. In Table 6, we use the same regression framework as in Tables 4 and 5 to predict the likelihood of insider trade clustering during periods of low outside investor attention, high uncertainty, and high information asymmetry. If outside investor attention allows for opportunities of conspicuous insider trade clustering, we expect more clustering when investor attention is low (Alldredge and Cicero 2015). We proxy for investor attention with the number of analysts following the firm, where *Attention* equals 1 if analyst following is above the median, and 0 otherwise. Consistent with our hypothesis, we find that insider trade clustering is more likely to occur in firms that have lower outside investor attention, consistent with informed intrafirm insider trade clustering.

[INSERT TABLE 6 HERE]

During periods of uncertainty, insiders may underweight their own information sets and look to other insiders' information, resulting in information cascades (Bikhchandani, Hirshleifer, and Welch 1992; Banerjee 1992; Lakonishok, Shleifer, and Vishny 1992; Wermers 1999; Sias 2004). We examine periods of above-average uncertainty and proxy for uncertainty with stock return volatility, where *Uncertainty* equals 1 if the volatility of monthly stock return over the past 24 months is above the median. The positive and significant coefficient on the interaction term $Peer\ Purchase_{i,j,t-2,t} \times Uncertainty$ in Panel A of Table 6 indicates that insider trade clustering is more likely to occur when there is more uncertainty about the stock.

Although information cascades may take place during times of high uncertainty, this could be consistent with informed trade clustering as well. To this end, Table 6 explores whether insider

Electronic copy available at: https://ssrn.com/abstract=2781761

trade clustering is more likely to occur when there is more information asymmetry. The value relevance of private information is likely higher during periods of high information asymmetry; therefore, we expect that insiders are more likely to seek the benefits from clustering at these times. We measure information asymmetry using subsequent earnings surprises, where *Information* is equal to 1 if the firm has no earnings surprise in the subsequent quarter, and 0 otherwise. The positive and significant coefficient on the interaction term $Peer\ Purchase_{i,j,t-2,t} \times Information$ in Panel A shows that insiders are more likely to cluster during periods of high information asymmetry. Our results show that peer insider trades are more likely to bunch together during periods of low attention, high uncertainty, and high information asymmetry, suggesting insiders are informed and take advantage of informational advantages when other market participants may be less aware.[5] Overall, each of these results is consistent with informed insider trade clustering.

We perform another test to determine whether the clustering we observe is the result of information cascades. If insiders follow the publicly observed trades of other insiders and trade in an effort to follow information they perceive as informed, they could create an information cascade. However, if they follow the trades of other insiders before they are publicly available, they are more likely to be involved in informed trading that results from private sharing of information or investigative herding. To determine whether insider trade clustering is the result of information cascades, we examine trading around SEC Form 4 filings. We look at the dates of Form 4 filings by insiders and compare insider trading by other insiders at the firm before and after the filing date. Using probit regression models, we predict the date of an insider Form 4 filing that

[5]We find similar results when using above-median firm size as a proxy for investor attention, a continuous measure of stock return volatility as a proxy for uncertainty, and above-median earnings surprise as a proxy for information, which can be found in the Online Appendix.

Electronic copy available at: https://ssrn.com/abstract=2781761

contains open market purchases (column 1 of Table 7) and open market sales (column 2) on day *t*, by insider trading on the days before (*t*−1) and after (*t*+1) the filing date, as well as other control variables.[6] In Table 7, we present the regression output from this test. We find that insider purchases on day *t*−1 are 315% more likely to predict a peer insider Form 4 filing that contains an open market purchase on day *t* than insider purchases on day *t*+1 from the same firm. Insider sales on day *t*−1 are 249% more likely to predict a peer insider Form 4 filing that contains an open market sale on day *t* than insider sales on day *t*+1 from the same firm. Overall, we observe that insiders are more likely to trade before the Form 4 filing of a peer insider than afterward. These results suggest that insider trade clustering is not the result of an information cascade following public information from Form 4 filings. Having examined uninformed explanations for insider trade clustering, we now examine whether insider trade clusters exhibit information about future stock performance.

[INSERT TABLE 7 HERE]

We explore whether the market response to insider trading is different if the insider trading occurs in isolation or in a cluster. We aggregate all potential insider trading days up to the firm level to eliminate any redundancy in our dependent variable.[7] We use daily abnormal returns for all firm trading days and observe whether insider trade clusters inform the market. Daily abnormal returns are calculated by subtracting the daily equally weighted NYSE/AMEX/NASDAQ CRSP market return from the daily stock return of each firm. We present ordinary least squares (OLS)

[6]We exclude insider Form 4 filing observations where the filing date and stock transaction date are the same to ensure we are isolating the effect of insider trading on the Form 4 filing of peer insiders from the effect of insider trading on stock transactions of peer insiders.

[7]We cluster our standard errors at the firm-quarter level to correct for any error dependence within firm quarters, and we control for time-series and cross-sectional effects by including year and industry fixed effects.

Electronic copy available at: https://ssrn.com/abstract=2781761

regression output in Table 8 where the dependent variable is 5-, 20-, 60-, and 120-day abnormal returns for all trading days. For the 5-day abnormal return window, we accumulate abnormal returns over days *t* to *t*+4.[8] For the 20-, 60-, and 120-day abnormal return windows, we calculate buy-and-hold abnormal returns. The variables of interest are *Purchase*, *Purchase Cluster*, *Sale*, and *Sale Cluster*. *Purchase* (*Sale*) is an indicator variable equal to 1 if there is at least one insider purchasing (selling) within the *t*−2 to *t* trading window. *Purchase Cluster* (*Sale Cluster*) is an indicator variable equal to 1 if there are at least two insiders purchasing (selling) within the *t*−2 to *t* trading window, such that the incremental market response to insider herding beyond solitary insider trading is captured by the *Purchase Cluster* and *Sale Cluster* variables. We also include firm and insider controls in the OLS regressions with industry and firm fixed effects to account for, among other information, time-varying economic factors or industry-specific information or effects.

[INSERT TABLE 8 HERE]

The results in Table 8 indicate that purchase clusters are more informative than isolated purchases. In column 1 of Panel A, we find that if insiders purchase within two days of a fellow insider purchase, there is a five-day abnormal return of 1.1%, 0.5% (*t*-statistic = 4.68) higher than the market reaction to insiders that do not purchase within two days following a peer insider purchase. The market response over the 20-, 60-, and 120-day windows show that the abnormal returns following purchase clusters exceed those of solitary insider purchases over the short and long run. For comparison, Cohen, Malloy, and Pomorski (2012) find opportunistic insider trade

[8]The five-day trading window used to measure the market reaction to insider trading follows Lakonishok and Lee (2001). However, we find significant market reactions in untabulated results using a (*t*+1, *t*+4) window, which reduces concerns that our results are a function of pricing pressure.

Electronic copy available at: https://ssrn.com/abstract=2781761

months are followed by approximately 1% monthly abnormal returns, similar to the solitary insider purchases in our study (1.2%) and less than the 2.1% abnormal returns over the subsequent month from column 3. These findings suggest that the market views insider trades within the context of other insider trading at the firm and values trades more when they confirm the signal provided by recent insider trading activity at the firm. Moreover, the elevated abnormal returns following purchase clusters suggest that insiders are more likely to be informed when they trade with their insider peers than when they trade in isolation.

Unlike purchase clusters, sale clusters do not appear to be more informative than isolated insider sales. In column 2 of Panel A in Table 8, we find that if insiders sell within two days of a peer insider sale, the five-day abnormal return is −0.09%, which is insignificantly different (*t*-statistic = 0.25) from the five-day abnormal return of −0.10% following insiders who do not sell within two days of a fellow insider sell. Abnormal returns over the longer horizon following sale clusters are also insignificantly different from abnormal returns following solitary insider trades. Sale clusters appear to be less informative for market prices than purchase clusters. However, we also perform a similar analysis in Panel B, replacing the transaction date with the date the insider Form 4 is filed, disclosing the trade. Although our results are similar for purchase clusters, one notable difference exists for sale clusters. We find some evidence of informed sale clusters, with five-day abnormal returns 0.1% higher than solitary insider sales. Although purchase clusters are more informed, we find some evidence of information in sale clusters as well.

One explanation for these differences between clusters may be litigation risk. Because of litigation risk, insiders are less likely to sell on private material information (Alldredge and Cicero 2015; Chen, Martin, and Wang 2012; Brochet 2010). The fear of litigation or class action lawsuits may lead to insiders clustering their sales during periods with a lower likelihood of being identified

Electronic copy available at: https://ssrn.com/abstract=2781761

as a suspect of illegal activity. Consistent with this hypothesis, we find that insider sale clusters are less likely to follow short-term negative abnormal returns than solitary insider sales. Moreover, we find that insider sale clusters are less informative for market prices than insider purchase clusters.

Informed Purchase Clusters

Finally, we analyze the timing of insider purchases in an attempt to detect similarities in insiders' trading behavior as a proxy for information flows. Identifying the timing of insider purchases by insiders with different positions within the firm shows how information spreads through the firm. We attempt to identify corporate insiders leading and following within clusters. Although CEO and CFO trades are highly studied, information flow among high-level insiders is unknown. Information flow within the firm is important because people overwhelmingly gather information from other people (Cross et al. 2003). Furthermore, Ahern (2017) investigates insider trading and shows that coworkers are frequently involved in information sharing. Similarly, Hvide and Östberg (2015) show that private investing is often the same as coworkers.

Table 9 presents results from probit regressions analyzing determinants of insider purchases by role code as a function of insider purchases within the past two days by other insiders at the firm, also by role code. We create indicator variables for insider purchases by role at the firm. Specifically, we examine insider trades by CEOs, CFOs, other officers, and directors in four mutually exclusive groups. In particular, officers are not considered directors for the purposes of this analysis, even if they hold board seats. The dependent variables are the purchase indicators for CEOs, CFOs, other officers, and directors. Each indicator variable is equal to 1 if an insider in the group trades on day *t*, and 0 otherwise. The variables of interest are the purchase indicators for CEOs, CFOs, other officers, and directors, which are equal to 1 if an insider in the group trades in

Electronic copy available at: https://ssrn.com/abstract=2781761

the *t*–2 to *t* window. Using conditional probabilities similar to those used in Tables 4 and 5, we find that CFOs are nearly four times as likely to purchase stock if the CEO purchased stock within the past two days. We document that officers cluster with other officers, whereas directors not only cluster with other directors but also follow CEO purchases. Other officers are three times as likely to purchase stock if the CEO or CFO recently purchased stock, and they are four times as likely to purchase stock if a fellow officer purchased stock in the past two days. On the other hand, director trades follow trades by other directors and the CEO more than those of other officers. Directors are three times more likely to follow the trade of fellow directors, and trade after a recent trade by the CEO. If investigative herding were the explanation for observed insider trade clusters, we would find that directors do not herd because they are uninformed about future returns. However, we observe that nearly half of director purchases occur within two days of a fellow insider purchase.

[INSERT TABLE 9 HERE]

Our results are consistent with those documented in the literature (Ahern 2017; Hvide and Östberg 2015). Ahern (2017) examines insider trading networks and documents that coworkers share information, mostly originating from executives. Similarly, we find firm management is more likely to cluster together. Whereas Ahern finds that subordinates often tip supervisors to impress them, we observe that employees often herd with those with whom they work closely. Similarly, Hvide and Östberg (2015) observe that coworkers make correlated investments because of social interactions, consistent with our conclusions. Overall, our findings are consistent with insiders intentionally timing their trades.

Electronic copy available at: https://ssrn.com/abstract=2781761

In Table 10, we investigate the performance of insider clusters by which insiders compose the group. Similar to column 1 of Panel A in Table 8, our dependent variable is five-day cumulative abnormal returns from day t to day t+4 for each firm j. $Purchase_{j,t}$ is equal to 1 if an insider purchases stock at firm j on day t. $Peer\ Purchase_{j,t-2,t}$ is equal to 1 if another insider at firm j purchases stock between days $t-2$ and t. The interaction of $Purchase_{j,t}$ and $Peer\ Purchase_{j,t-2,t}$ represents an indicator for an insider cluster (i.e., $Purchase\ Cluster_{j,t-2,t}$ is the synonymous variable used in column 1 of Panel A in Table 9). We further break down $Peer\ Purchase_{j,t-2,t}$ based on the four insider roles in Table 9 (i.e., CEO, CFO, other officer, and director). These interaction variables are used to evaluate the relative performance of insider clusters led by insiders with various roles over solitary insider purchases on day t represented by $Purchase_{j,t}$. Our results in column 1 of Table 10 identify whether five-day future stock returns are significantly higher following an insider purchase cluster. Consistent with our prior analysis, we find insiders who purchase stock within two days after another insider attain 0.6% higher abnormal returns over the next week, which is double the abnormal return of insiders who do not trade within two days after another insider. Next, we break down the insider trade clusters to explore which insiders are likely to lead the most informed trade clusters. We split insider trades into four groups: CEOs, CFOs, other officers, and directors. All officers who do not have a Thomson Reuters role code of CEO or CFO are labeled as other officers. The directors group contains all directors who do not have a contemporaneous role as officer at the firm. In columns 2–5 , we identify which insider type is most likely to lead a profitable insider trade cluster. The clusters led by CEOs, CFOs, and directors realize 0.32%, 0.42%, and 0.45% larger abnormal returns over the subsequent week, respectively,

Electronic copy available at: https://ssrn.com/abstract=2781761

whereas clusters led by other officers realize insignificantly larger abnormal returns.[9] According to these results, clusters led by CFOs and directors attain higher profits than solitary insider trades, similar to Wang, Shin, and Francis's (2012) findings that CFOs hold the most profitable information about the firm.

[INSERT TABLE 10 HERE]

Our findings are consistent with private insider information sharing or insiders tipping other insiders about their trading decisions, though we are unable to directly test investigative herding as an explanation for insider trading clusters. We know that herding behavior occurs through social connections, influencing a wide range of behaviors (Glaeser, Sacerdote, and Scheinkman 1996; Bikhchandani, Hirshleifer, and Welch 1992). Our results suggest that insiders trade with other insiders with whom they are socially connected at the firm, consistent with Ahern (2017) and Bikhchandani, Hirshleifer, and Welch (1992). Because data limitations make social connections difficult to explore among our insider networks, we examine the role of information disclosure on clustering.

To understand whether insiders may be independently trading on similar information, we take advantage of a semi-natural experiment. We seek to distinguish between informed clustering explanations by considering the impact of public information. Specifically, we use the passage of SOX in 2002, which requires more timely disclosure of insider trading as an exogenous shock. Before SOX, insiders were required to disclose trades by the 10th day of the month after the trade, whereas SOX requires insiders to disclose trades within 2 days. Figure III shows the decline in

[9]We further explore the cluster composition and subsequent returns in our Online Appendix, which draws similar conclusions and shows that clusters with directors and CFOs exhibit the most favorable performance.

Electronic copy available at: https://ssrn.com/abstract=2781761

disclosure timing around SOX. We observe that before SOX, the average disclosure took place 3 weeks after trades. However, after SOX, the average disclosure time drops to 1 day. If insiders trade independently, we do not expect disclosure to affect insider trade clustering. However, if insiders are sharing private information, disclosure of that information could affect insider clustering.

[INSER FIGURE III HERE]

In Table 11, we use multivariate analysis of insider purchases to determine the effect SOX has on the decision of insiders to trade. To balance our panel around SOX, we limit the sample to the 10 years before and 10 years after SOX (August 1992 to August 2012). In the post-SOX period, we observe an increase in insider purchasing clusters, especially within two days of purchases by insider peers, which is the window before Form 4 filings are due. Our results suggest insiders may be sharing information with insider peers before publicly disclosing purchases, which is consistent with insider clustering resulting from information flowing between insiders. This suggests insiders intentionally coordinate purchases to jointly profit from shared information.[10]

[INSERT TABLE 11 HERE]

III. Conclusion

Few traces of closed-door communications between insiders are observable. However, the shared profit motive for insiders that share access to the same information leads to similarities in trading behavior. We explore similarities in insiders' trading behavior as a proxy for information flows.

[10]To the extent that 10b5-1 plans are incorporated into our data set, we believe that the implications of our results hold, as substantively the same process still takes place. If information sharing occurs earlier in anticipation of trading, that only indicates that the information content is even more important. Furthermore, Jagolinzer (2009) documents that insider trades using 10b5-1 disclose plans, which became available in late 2000 and permit an insider to precommit to trades, are also strategic. He shows that insiders initiate sales before bad news and cancel sales before good performance. Our results are not limited to the period before 10b5-1 plans.

Electronic copy available at: https://ssrn.com/abstract=2781761

We find that corporate insiders trade in clusters. Furthermore, insider purchases are more profitable when corporate insiders cluster their trades, suggesting insider purchase clusters are informed. Information disclosure also appears to affect insider trade clustering, suggesting it is likely due to insiders privately sharing information, which is consistent with observations by Ahern (2017). Moreover, insiders trade more with other insiders with whom they work closely. For example, CEOs and CFOs trade together, and other officers follow the trades of CEOs and CFOs. Directors trade with each other and occasionally follow the CEO. Our results indicate that insider trade clusters are a reasonable proxy for information flow within the firm.

Our findings provide indirect evidence of information flows within the firm and how insiders trade collectively. As the first in-depth empirical exploration of the daily herding behavior of corporate executives, we offer an innovative understanding of the market response and stock return performance of clustered informed trading. By documenting significant clustering among corporate insiders, we suggest that some informed market participants exhibit herding behavior. We also find that purchase clusters are more informed than isolated purchases, suggesting clustering signals information to the market. We provide future researchers with a potential proxy for information flow within the firm to use in future research. Regulators should benefit from using the clustering of insider trades at the daily level to understand trading patterns and information sources. The observance of insider trade clusters provides new insight into the transfer of profitable information among corporate executives.

Electronic copy available at: https://ssrn.com/abstract=2781761

References

Ahern, K. R., 2017, Information networks: Evidence from illegal insider trading tips, *Journal of Financial Economics*125, 26–47.

Alldredge, D. M., and D. C. Cicero, 2015, Attentive insider trading, *Journal of Financial Economics* 115, 84–101.

Back, K., C. H. Cao, and G. A. Willard, 2000, Imperfect competition among informed traders, *Journal of Finance* 55, 2117–55.

Banerjee, Abhijit V., 1992, A simple model of herd behavior, *Quarterly Journal of Economics* 107, 797-817.

Bettis, J. C., J. L. Coles, and M. L. Lemmon, 2000, Corporate policies restricting trading by insiders, *Journal of Financial Economics* 57, 191–220.

Biggerstaff, L., D. C. Cicero, and M. B. Wintoki, 2015, Insider trading patterns, Presented at the annual meeting of the American Finance Association, Boston.

Bikhchandani, S., D. Hirshleifer, and I. Welch, 1992, A theory of fads, fashion, custom, and cultural change as informational cascades, *Journal of Political Economy* 100, 992–1026.

Brochet, F., 2010. Information content of insider trades before and after the Sarbanes-Oxley Act, *The Accounting Review* 85, 419–46

Chen, C., X. Martin, and X. Wang, 2012, Insider trading, litigation concerns, and auditor going-concern opinions, *The Accounting Review* 88, 365–93.

Cohen, L., C. Malloy, and L. Pomorski, 2012, Decoding inside information, *Journal of Finance* 67, 1009–43.

Cornell, B., and E. R. Sirri, 1992, The reaction of investors and stock prices to insider trading, *Journal of Finance* 47, 1031–59.

Electronic copy available at: https://ssrn.com/abstract=2781761

Cross, R., A. Parker, L. Prusak, and S. P. Borgatti, 2003, *Networks in the Knowledge Economy* (Oxford University Press, New York, NY).

Glaeser, E. L., B. Sacerdote, and J. A. Scheinkman, 1996, Crime and social interactions, *Quarterly Journal of Economics* 111, 507–48.

Holden, C. W., and A. Subrahmanyam, 1992, Long-lived private information and imperfect competition, *Journal of Finance* 47, 247–70.

Hvide, H. K., and P. Östberg, 2015, Social interaction at work, *Journal of Financial Economics* 117, 628–52.

Indjejikian, R., H. Lu, and L. Yang, 2014, Rational information leakage, *Management Science* 60, 2762–75.

Jaffe, J. F., 1974, Special information and insider trading, *Journal of Business* 47, 410–28.

Jagolinzer, A. D., 2009, SEC Rule 10b5-1 and insiders' strategic trade, *Management Science* 55, 224–39.

Keynes, J. M., 1936, *The General Theory of Interest, Employment and Money* (Macmillan, London).

Lakonishok, J., and I. Lee, 2001, Are insider trades informative? *Review of Financial Studies* 14, 79–111.

Lakonishok, J., A. Shleifer, and R. W. Vishny, 1992, The impact of institutional trading on stock-prices, *Journal of Financial Economics* 32, 23–43.

Lin, J. C., and J. S. Howe, 1990, Insider trading in the OTC market, *Journal of Finance* 45, 1273–84.

Lorie, J. H., and V. Niederhoffer, 1968, Predictive and statistical properties of insider trading, *Journal of Law & Economics* 11, 35–53.

Electronic copy available at: https://ssrn.com/abstract=2781761

Scharfstein, D. S., and J. C. Stein, 1990, Herd behavior and investment, *American Economic Review* 80, 465–479.

Seyhun, H., 1986, Insiders' profits, costs of trading, and market efficiency, *Journal of Financial Economics* 16, 189–212.

Seyhun, H., 1998, *Investment Intelligence from Insider Trading* (MIT Press, Cambridge, MA).

Sias, R. W., 2004, Institutional herding, *Review of Financial Studies* 17, 165–206.

Wang, W., Y. C. Shin, and B. B. Francis, 2012, Are CFOs' trades more informative than CEOs' trades? *Journal of Financial and Quantitative Analysis* 47, 743–62.

Wermers, R., 1999, Mutual fund herding and the impact on stock prices, *Journal of Finance* 54, 581–622.

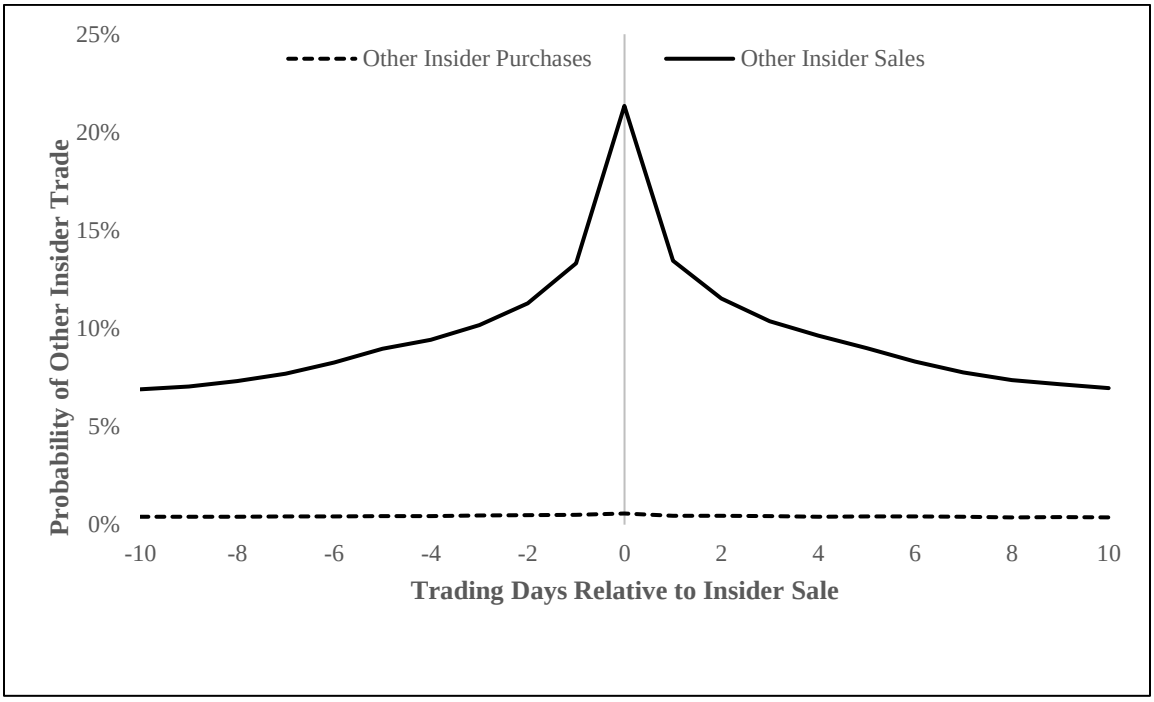
Supporting Information

Additional Supporting Information may be found online in the supporting information tab for this article.

Electronic copy available at: https://ssrn.com/abstract=2781761

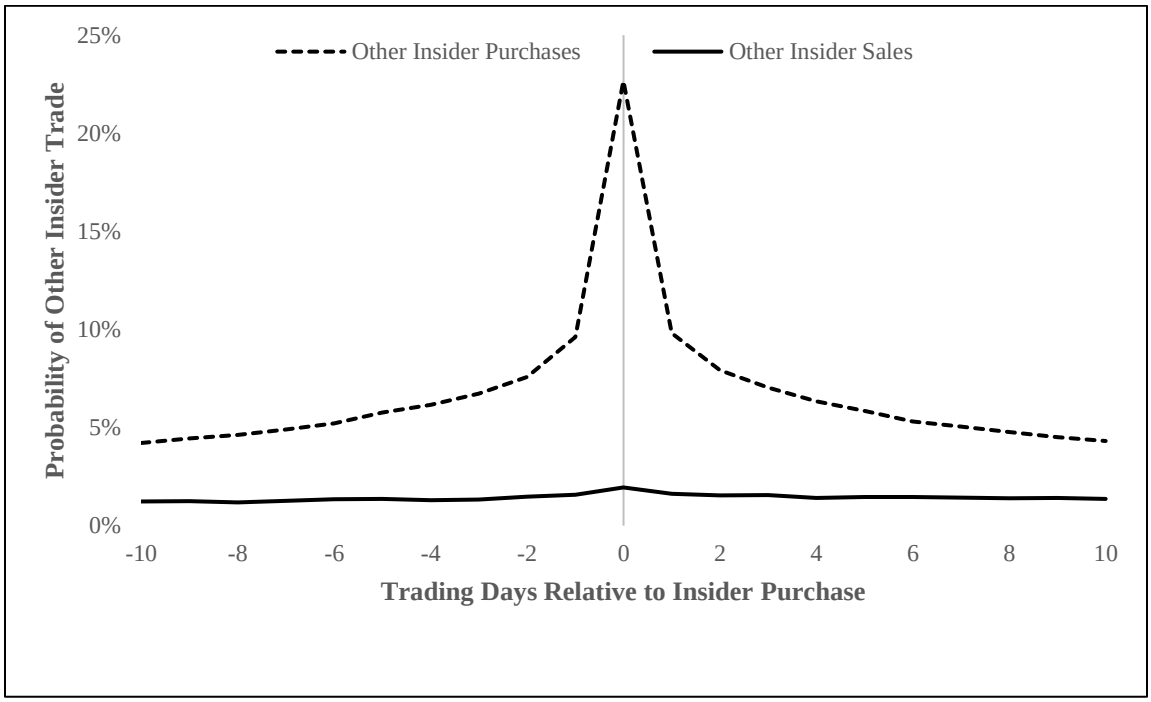
Figure I. Conditional Probability of Insider Trade. This figure shows the conditional probability of an insider trade given an insider sale (Panel A) and the conditional probability of an insider trade given an insider purchase (Panel B). The conditional probability of insider sales and purchases are represented separately.

Panel A. Conditional Probability of Insider Trading Given Insider Sale on Day *t*=0



Electronic copy available at: https://ssrn.com/abstract=2781761

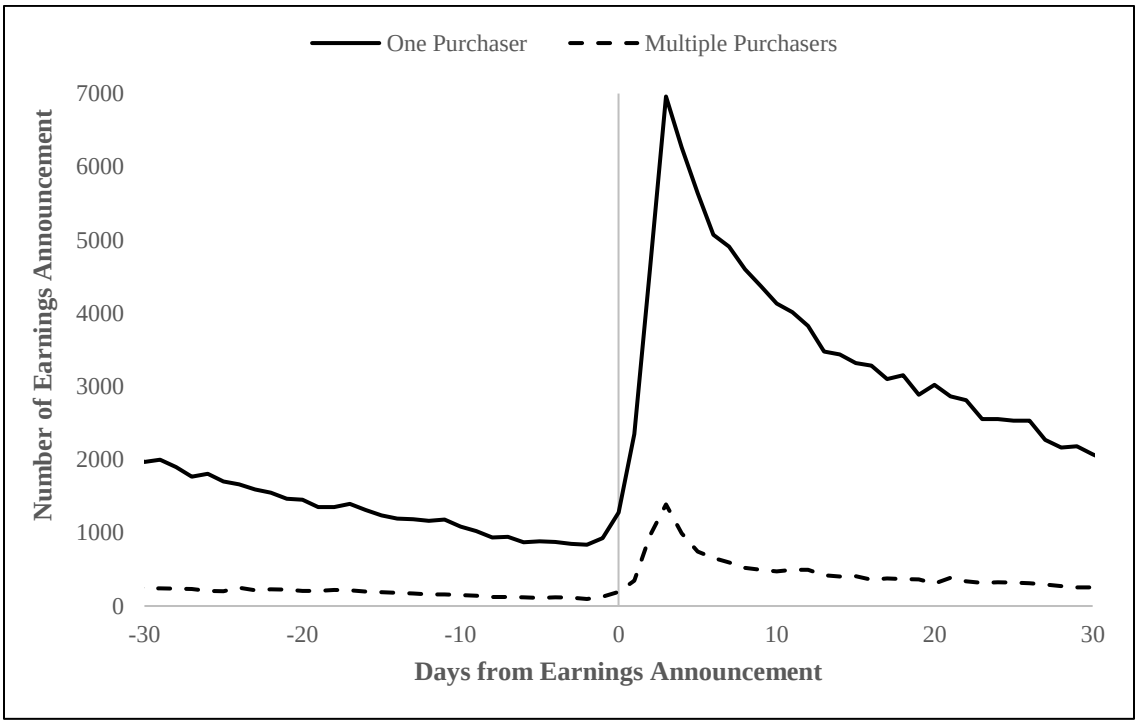
Panel B. Conditional Probability of Insider Trading Given Insider Purchase on Day *t*=0



Electronic copy available at: https://ssrn.com/abstract=2781761

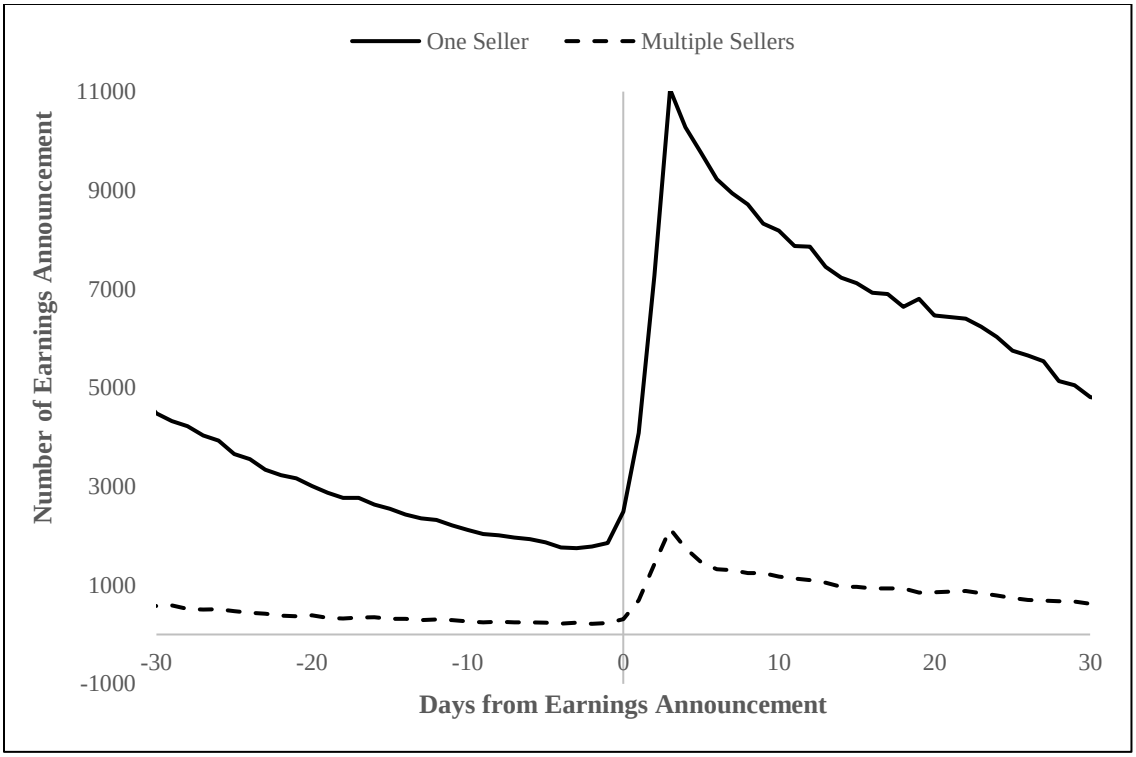
Figure II. Insider Trading around Earnings Announcements. This figure shows the number of quarterly earnings announcements from 1986 to 2014 that have insider trading on each individual day from 30 days leading up to and 30 days following the earnings announcement. Panel A represents insider purchasing activity and Panel B represents insider selling activity.

Panel A. Frequency of Insider Purchasing Activity around Earnings Announcements



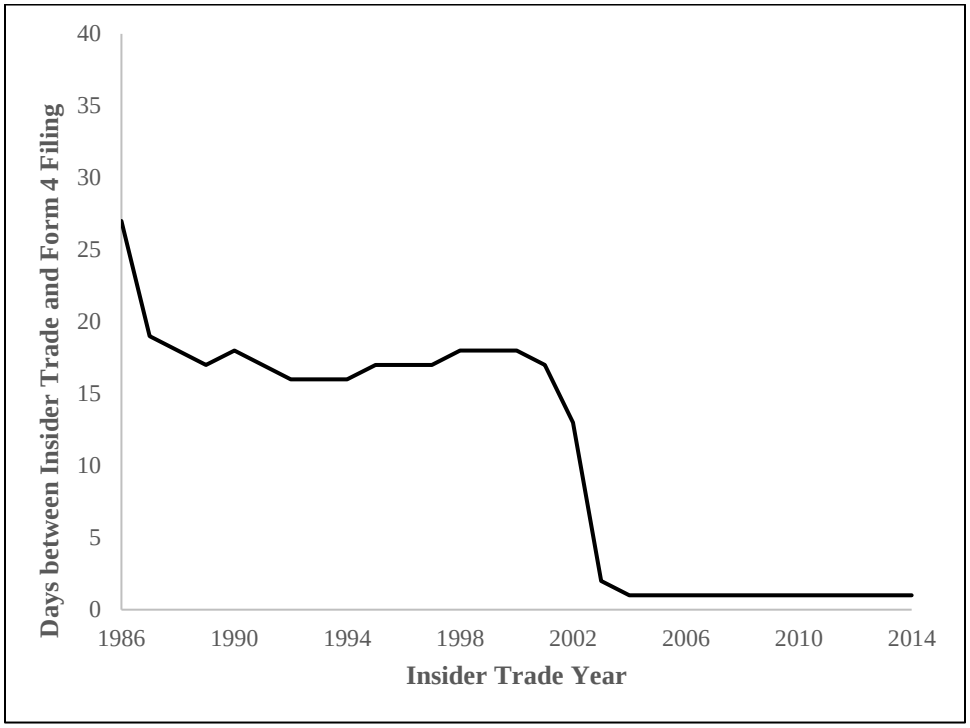
Electronic copy available at: https://ssrn.com/abstract=2781761

Panel B. Frequency of Insider Selling Activity around Earnings Announcements



Electronic copy available at: https://ssrn.com/abstract=2781761

Figure III. Timing of Form 4 Filing. This figure illustrates the average lag between the corporate executive trades and the insider filing the Form 4 with the U.S. Securities and Exchange Commission.



Electronic copy available at: https://ssrn.com/abstract=2781761

TABLE 1. Summary Statistics.

	Mean	Median	Std. Dev.	Percentile 5%	Percentile 95%
Panel A. Firm-Months with Zero Sellers and One Buyer (5,245 firms; 32,046 firm-month observations)					
B/M	0.64	0.57	0.39	0.14	1.37
Size	2,251	304	6,906	26	10,051
Traders per firm-month	1.00	1.00	1.00	1.00	1.00
# shares traded per insider	5,035	1,200	10,507	50	25,000
Panel B. Firm-Months with Zero Sellers and Multiple Buyers (4,214 firms; 18,332 firm-month observations)					
B/M	0.67	0.59	0.40	0.14	1.44
Size	1,459	228	5,193	25	5,379
Traders per firm-month	2.78	2.00	0.86	2.00	4.00
# shares traded per insider	7,473	2,213	13,199	100	46,873
Panel C. Firm-Months with Zero Buyers and One Seller (5,889 firms; 52,109 firm-month observations)					
B/M	0.50	0.44	0.33	0.11	1.12
Size	3,922	767	9,030	43	20,977
Traders per firm-month	1.00	1.00	1.00	1.00	1.00
# shares traded per insider	24,771	5,633	61,654	350	105,000
Panel D. Firm-Months with Zero Buyers and Multiple Sellers (5,455 firms; 45,911 firm-month observations)					
B/M	0.47	0.40	0.32	0.09	1.06
Size	3,078	609	7,708	49	15,504
Traders per firm-month	2.93	3.00	0.89	2.00	4.00
# shares traded per insider	33,751	10,000	71,172	900	153,333

Note: This table reports summary statistics for the sample of nonroutine insider firm-month observations from January 1986 to December 2014. The sample is divided into four subsets represented in Panel A, B, C, and D. *Size* is the previous year-end market value (in millions $). *B/M* is the previous year-end book-to-market ratio. Traders per firm-month and the number of shares traded per insider are also reported. The insider is considered a buyer if the net number of shares purchased during the month is greater than the net number of shares sold, and vice versa for sellers.

Electronic copy available at: https://ssrn.com/abstract=2781761

TABLE 2. Distribution of Insider Trading.

Panel A. Distribution of Insider Trading by Role

		No Sellers		No Purchasers	
	Full Sample (N = 482,370)	One Purchaser (N = 42,990)	Multiple Purchasers (N = 88,885)	One Seller (N = 65,618)	Multiple Sellers (N = 245,444)
CEO	9.6%	8.2%	9.8%	7.3%	10.8%
CFO	4.4%	4.7%	4.5%	4.8%	4.3%
Director	38.3%	57.6%	46.2%	32.9%	32.6%
Officer	35.3%	24.9%	23.0%	47.8%	39.0%
Other	12.4%	4.6%	16.5%	7.2%	13.3%

Panel B. Insider Trade Month Intensity

	Sellers					
Purchasers	Zero	One	Two	Three	Four +	Total
Zero	672,534	52,324	19,834	9,574	16,664	770,930
One	32,348	3,167	1,026	461	658	37,660
Two	9,398	778	243	126	187	10,732
Three	3,836	272	95	50	63	4,316
Four	5,274	382	124	52	102	5,934
Total	723,390	56,923	21,322	10,263	17,674	829,572

Note: This table reports the distribution of insider trading. Panel A reports the frequency of insider trading by months where insiders trade from January 1986 to December 2014. It presents the number of months by the quantity of insider traders who are net purchasers and sellers. The insider is considered a buyer if the net number of shares purchased during the month is greater than the net number of shares sold, and vice versa for sellers. Panel B presents firm-month observations from January 1986 to December 2014 by role in four samples: firm-months with a lone buyer, those with multiple purchasers but no sellers, those with a lone seller, and those with multiple sellers but no purchasers. The insider is considered a buyer if the net number of shares purchased during the month is greater than the net number of shares sold, and vice versa for sellers. The roles are identified by the primary role code classification in the Thomson Reuters Insider Filing Data Files.

Electronic copy available at: https://ssrn.com/abstract=2781761

TABLE 3. Insider Demand around Peer Insider Trades.

	(*t*–10,*t*–1)	(*t*–1,*t*–1)	(*t*,*t*)	(*t*+1,*t*+1)	(*t*+1,*t*+10)
Panel A. Net Number of Purchasers: # Purchasers – # Sellers					
Insider purchases (*N*=154,128)	0.322	0.123	0.489	0.123	0.310
Insider sales (*N* = 334,116)	-0.528	-0.181	-0.366	-0.181	-0.526
Difference	0.850	0.304	0.855	0.304	0.836
t-statistic	(235.38)	(135.21)	(223.29)	(135.61)	(235.32)
Panel B. Net Number of Shares Purchased: (# Shares Purchased – # Shares Sold)/(Shares Outstanding/1,000)					
Insider purchases (*N* = 154,128)	3.52	0.11	23.93	0.11	5.16
Insider sales (*N* = 334,116)	-2.24	-0.35	-1.67	-0.34	-2.07
Difference	5.76	0.46	25.60	0.45	7.23
t-statistic	(3.62)	(24.12)	(3.61)	(21.80)	(5.63)

Note: This table reports insider demand around purchases and sales by other insiders at the firm, as well as the difference between insider demand around insider purchases and insider demand around insider sales from January 1986 to December 2014 for 1- and 10-day windows before and after transactions. Insider trades occur on day *t*. In Panel A, insider demand is measured as the number of insiders at the firm purchasing stock, less the number of insiders at the firm selling stock. In Panel B, insider demand is measured as the number of shares purchased by insiders at the firm, less the number of shares sold by insiders at the firm, scaled by the number of shares outstanding in thousands. The *t*-statistics are in parentheses.

Electronic copy available at: https://ssrn.com/abstract=2781761

TABLE 4. Probability of Insider Trading.

	$Purchase_{i,j,t}$	$Shares\ Purchased_{i,j,t}$	$Sale_{i,j,t}$	$Shares\ Sold_{i,j,t}$
Peer Purchase$_{i,j,t-2,t}$	1.002	47.702	-0.026	-0.381
	(235.45)	(183.85)	(-3.02)	(-2.66)
Peer Purchase$_{i,j,t-5,t-3}$	0.202	9.367	-0.081	-1.421
	(32.31)	(28.97)	(-8.77)	(-9.16)
Peer Sale$_{i,j,t-2,t}$	0.005	0.165	0.684	10.839
	(0.66)	(0.39)	(274.09)	(239.53)
Peer Sale$_{i,j,t-5,t-3}$	-0.067	-3.461	0.178	2.645
	(-7.43)	(-7.46)	(59.12)	(52.40)
Own Purchase$_{i,j,t-20,t-6}$	0.956	45.522	-0.300	-4.901
	(233.39)	(182.8)	(-24.64)	(-24.13)
Own Sale$_{i,j,t-20,t-6}$	-0.196	-10.088	0.894	13.754
	(-17.62)	(-17.55)	(414.68)	(317.93)
Size	-0.047	-2.313	-0.020	-0.381
	(-50.22)	(-48.08)	(-36.94)	(-42.25)
B/M	0.094	4.642	-0.315	-5.258
	(14.86)	(14.33)	(-70.95)	(-70.61)
Momentum	-0.511	-24.926	0.273	4.506
	(-68.81)	(-64.55)	(86.93)	(86.35)
Safe	0.195	9.403	0.232	3.656
	(57.30)	(53.28)	(110.96)	(103.42)
Blackout	-0.109	-5.412	-0.170	-2.731
	(-34.69)	(-33.61)	(-86.03)	(-82.30)
Log Insiders	-0.075	-3.565	-0.119	-1.767
	(-26.55)	(-24.59)	(-67.64)	(-60.14)
Constant	-2.791	-140.239	-2.382	-39.014
	(-342.71)	(-239.53)	(-486.65)	(-365.65)
Observations	52,734,073	52,734,073	52,734,073	52,734,073

Note: This table contains probit and Tobit regressions predicting insider trading as a function of other insider trading at the firm from January 1986 to December 2014. In column 1, the dependent variable of the probit regression equals 1 for a purchase on day *t* by insider *i* at firm *j*, and 0 for all other trading days. In column 2, the dependent variable of the Tobit regression is the number of shares purchased by insider *i* at firm *j* on day *t*, in thousands of shares. In column 3, the dependent variable of the probit regression equals 1 for a sale on day *t* by insider *i* at firm *j*, and 0 for all other trading days. In column 4, the dependent variable of the Tobit regression is the number of shares sold by insider *i* at firm *j* on day *t*, scaled by the number of shares outstanding in thousands. The observations in the data set are at the insider firm-day level. *Peer Sale* (*Peer Purchase*) is an indicator equal to 1 if there is at least one sale (purchase) by other insiders at firm *j* in the specified windows (*t*–2 to *t* and *t*–5 to *t*–3). *Own Sale* (*Own Purchase*) is an indicator equal to 1 if there is at least one sale (purchase) by insider *i* at firm *j* in the window from *t*–20 to *t*–6. *Size* is the log of the previous year-end market value. *B/M* is the log of the previous year-end book-to-market ratio. *Momentum* is the cumulative market-adjusted return from days *t*–20 to *t*–1. *Safe* is equal to 1 if the trading day is within the (3, 12) window following the firm's earnings announcement. *Blackout* is equal to 1 if the trading day is within the (–30, 2) window around the firm's earnings announcement. *Log Insiders* is the log of the number of insiders trading in the firm-month. Parameter estimates and *t*-statistics (in parentheses) are reported for each regression.

Electronic copy available at: https://ssrn.com/abstract=2781761

TABLE 5. Insider Trading Following Earnings Announcements.

	$Purchase_{i,j,t}$	$Purchase_{i,j,t}$	$Purchase_{i,j,t}$	$Sale_{i,j,t}$	$Sale_{i,j,t}$	$Sale_{i,j,t}$
Peer Purchase$_{i,j,t-2,t}$	1.042	1.096	0.910			-0.132
	(257.94)	(232.74)	(118.51)			(-9.00)
Peer Purchase$_{i,j,t-2,t}$ × *Safe*		-0.182				
		(-20.85)				
Peer Sale$_{i,j,t-2,t}$			-0.069	0.734	0.770	0.642
			(-5.00)	(314.43)	(278.37)	(151.25)
Peer Sale$_{i,j,t-2,t}$ × *Safe*					-0.116	
					(-23.61)	
Own Purchase$_{i,j,t-20,t-6}$	0.968	0.966	0.864			
	(237.57)	(236.84)	(80.31)			
Own Sale$_{i,j,t-20,t-6}$				0.907	0.906	0.813
				(422.74)	(421.82)	(143.48)
Size	-0.048	-0.048	-0.046	-0.020	-0.020	-0.019
	(-51.24)	(-51.24)	(-24.50)	(-37.34)	(-37.30)	(-17.36)
B/M	0.101	0.101	0.161	-0.326	-0.326	-0.399
	(16.01)	(16.04)	(12.43)	(-73.35)	(-73.29)	(-44.18)
Momentum	-0.531	-0.534	-0.734	0.284	0.285	0.417
	(-71.77)	(-72.13)	(-48.39)	(91.01)	(91.32)	(66.70)
Safe	0.198	0.226		0.233	0.256	
	(58.28)	(62.54)		(111.56)	(111.99)	
Blackout	-0.108	-0.107		-0.173	-0.171	
	(-34.67)	(-33.98)		(-87.84)	(-86.55)	
Log Insiders	-0.071	-0.072	-0.099	-0.111	-0.111	-0.105
	(-25.46)	(-25.73)	(-17.42)	(-63.97)	(-63.99)	(-29.99)
Constant	-2.800	-2.806	-2.570	-2.388	-2.396	-2.127
	(-344.72)	(-344.94)	(-152.03)	(-488.20)	(-488.45)	(-211.57)
Observations	52,734,073	52,734,073	7,562,421	52,734,073	52,734,073	7,562,421

Note: This table contains probit regressions predicting insider trading as a function of other insider trading at the firm following earnings announcements. In columns 1–3, the dependent variable is an indicator for an insider purchase on day *t* by insider *i* at firm *j*, and in columns 4–6, the dependent variable is an indicator for an insider sale on day *t* by insider *i* at firm *j*. The observations in the data set are at the insider firm-day level. *Peer Sale* (*Peer Purchase*) is an indicator equal to 1 if there is at least one sale (purchase) by other insiders at firm *j* in the specified windows (*t*–2 to *t* and *t*–5 to *t*–3). *Own Sale* (*Own Purchase*) is an indicator equal to 1 if there is at least one sale (purchase) by insider *i* at firm *j* in the window from *t*–20 to *t*–6. *Size* is the log of the previous year-end market value. *B/M* is the log of the previous year-end book-to-market ratio. *Momentum* is the cumulative market-adjusted return from days *t*–20 to *t*–1. *Safe* is equal to 1 if the trading day is within the (3, 12) window following the firm's earnings announcement. *Blackout* is equal to 1 if the trading day is within the (–30, 2) window around the firm's earnings announcement. *Log Insiders* is the log of the number of insiders trading in the firm-month. Parameter estimates and *t*-statistics (in parentheses) are reported for each regression.

Electronic copy available at: https://ssrn.com/abstract=2781761

TABLE 6. Trading amid Attention, Uncertainty, and Information Asymmetry.

Panel A. Insider Purchase Clusters				
	$Purchase_{i,j,t}$	$Purchase_{i,j,t}$	$Purchase_{i,j,t}$	$Purchase_{i,j,t}$
Peer Purchase$_{i,j,t-2,t}$	1.042	1.043	0.955	0.998
	(257.94)	(211.37)	(175.42)	(88.85)
Peer Purchase$_{i,j,t-2,t}$ × *Attention*		-0.013		
		(-1.54)		
Peer Purchase$_{i,j,t-2,t}$ × *Uncertainty*			0.194	
			(24.66)	
Peer Purchase$_{i,j,t-2,t}$ × *Information*				0.051
				(4.23)
Attention		-0.072		
		(-20.34)		
Uncertainty			-0.062	
			(-20.22)	
Information				-0.004
				(-0.87)
Own Purchase$_{i,j,t-20,t-6}$	0.968	0.965	0.965	0.968
	(237.57)	(236.88)	(236.81)	(237.54)
Size	-0.048	-0.035	-0.052	-0.048
	(-51.24)	(-32.13)	(-53.12)	(-51.18)
B/M	0.101	0.094	0.089	0.101
	(16.01)	(14.87)	(13.80)	(15.94)
Momentum	-0.531	-0.536	-0.534	-0.531
	(-71.77)	(-72.17)	(-71.27)	(-71.76)
Safe	0.198	0.200	0.198	0.198
	(58.28)	(58.96)	(58.36)	(58.29)
Blackout	-0.108	-0.106	-0.108	-0.108
	(-34.67)	(-33.91)	(-34.49)	(-34.61)
Log Insiders	-0.071	-0.069	-0.075	-0.071
	(-25.46)	(-24.56)	(-26.53)	(-25.48)
Constant	-2.800	-2.855	-2.732	-2.797
	(-344.72)	(-335.64)	(-298.69)	(-310.16)
Observations	52,734,073	52,734,073	52,734,073	52,734,073

Electronic copy available at: https://ssrn.com/abstract=2781761

Panel B. Insider Sale Clusters				
	$Sale_{i,j,t}$	$Sale_{i,j,t}$	$Sale_{i,j,t}$	$Sale_{i,j,t}$
Peer $Sale_{i,j,t-2,t}$	0.734	0.742	0.676	0.729
	(314.43)	(219.70)	(192.62)	(117.09)
Peer $Sale_{i,j,t-2,t}$ × *Attention*		-0.015		
		(-3.41)		
Peer $Sale_{i,j,t-2,t}$ × *Uncertainty*			0.095	
			(20.91)	
Peer $Sale_{i,j,t-2,t}$ × *Information*				0.005
				(0.81)
Attention		0.007		
		(3.01)		
Uncertainty			0.056	
			(28.78)	
Information				0.004
				(1.48)
Own $Sale_{i,j,t-20,t-6}$	0.907	0.907	0.902	0.907
	(422.74)	(422.59)	(419.56)	(422.73)
Size	-0.020	-0.021	-0.013	-0.020
	(-37.34)	(-32.84)	(-21.94)	(-37.31)
B/M	-0.326	-0.325	-0.293	-0.326
	(-73.35)	(-73.04)	(-65.52)	(-73.30)
Momentum	0.284	0.284	0.270	0.283
	(91.01)	(90.93)	(86.28)	(90.88)
Safe	0.233	0.233	0.232	0.233
	(111.56)	(111.44)	(111.14)	(111.57)
Blackout	-0.173	-0.173	-0.174	-0.173
	(-87.84)	(-87.89)	(-88.33)	(-87.77)
Log Insiders	-0.111	-0.112	-0.104	-0.111
	(-63.97)	(-63.96)	(-59.33)	(-63.89)
Constant	-2.388	-2.386	-2.490	-2.391
	(-488.20)	(-468.92)	(-441.06)	(-437.65)
Observations	52,734,073	52,734,073	52,734,073	52,734,073

Note: This table contains probit regressions predicting insider trading as a function of other insider trading at the firm from January 1986 to December 2014. In Panel A, the dependent variable of the probit regression equals 1 for a purchase on day *t* by insider *i* at firm *j*, and 0 for all other trading days. In Panel B, the dependent variable of the probit regression equals 1 for a sale on day *t* by insider *i* at firm *j*, and zero for all other trading days. The observations in the data set are at the insider firm-day level. *Attention* equals 1 if analyst following is above median, and 0 otherwise. *Uncertainty* equals 1 if the volatility of monthly stock return over the past 24 months is above the median. *Information* is equal to 1 if the firm had no earnings surprise in the prior quarter. *Peer Sale* (*Peer Purchase*) is an indicator equal to 1 if there is at least one sale (purchase) by other insiders at firm *j* in the specified windows (*t*–2 to *t* and *t*–5 to *t*–3). *Own Sale* (*Own Purchase*) is an indicator equal to 1 if there is at least one sale (purchase) by insider *i* at firm *j* in the window from *t*–20 to *t*–6. *Size* is the log of the previous year-end market value. *B/M* is the log of the previous year-end book-to-market ratio. *Momentum* is the cumulative market-adjusted return from days *t*–20 to *t*–1. *Safe* is equal to 1 if the trading day is within the (3, 12) window following the firm's earnings announcement. *Blackout* is equal to 1 if the trading day is within the (–30, 2) window around the firm's earnings announcement. *Log Insiders* is the log of the number of insiders trading in the firm-month. Parameter estimates and *t*-statistics (in parentheses) are reported for each regression.

Electronic copy available at: https://ssrn.com/abstract=2781761

TABLE 7. Insider Trading Around Peer Insider Form 4 Filing.

	Purchase Filing$_{i,j,t}$	*Sale Filing*$_{i,j,t}$
Peer Purchase$_{i,j,t-1}$	0.684	
	(77.46)	
Peer Purchase$_{i,j,t+1}$	0.165	
	(12.92)	
Peer Sale$_{i,j,t-1}$		0.474
		(103.35)
Peer Sale$_{i,j,t+1}$		0.136
		(24.00)
Own Purchase$_{i,j,t-20,t-6}$	1.362	
	(363.68)	
Own Sale$_{i,j,t-20,t-6}$		1.132
		(494.80)
Size	-0.037	0.001
	(-33.37)	(0.74)
B/M	0.138	-0.233
	(18.42)	(-42.78)
Momentum	-0.370	0.236
	(-42.35)	(61.36)
Restrict	0.135	0.150
	(31.21)	(53.52)
Blackout	-0.098	-0.087
	(-27.04)	(-37.94)
Log Insiders	0.012	-0.038
	(3.52)	(-17.79)
Constant	-3.164	-2.878
	(-320.66)	(-471.48)
Observations	52,715,040	52,715,040

Note: This table contains probit regressions predicting insider Form 4 filing as a function of other insider trading at the firm. In column 1, the dependent variable is *Purchase Filing*, an indicator equal to 1 for the insider filing of a stock purchase on a Form 4 on day *t* by insider *i* at firm *j*, and in column 2, the dependent variable is *Sale Filing*, an indicator equal to 1 for an insider filing of a stock sale on a Form 4 on day *t* by insider *i* at firm *j*. The observations in the data set are at the insider firm-day level. *Peer Sale* (*Peer Purchase*) is an indicator equal to 1 if there is at least one sale (purchase) by other insiders at firm *j* in the specified windows (*t*–2 to *t* and *t*–5 to *t*–3). *Own Sale* (*Own Purchase*) is an indicator equal to 1 if there is at least one sale (purchase) by insider *i* at firm *j* in the window from *t*–20 to *t*–6. *Size* is the log of the previous year-end market value. *B/M* is the log of the previous year-end book-to-market ratio. *Momentum* is the cumulative market-adjusted return from days *t*–20 to *t*–1. *Safe* is equal to 1 if the trading day is within the (3, 12) window following the firm's earnings announcement. *Blackout* is equal to 1 if the trading day is within the (–30, 2) window around the firm's earnings announcement. *Log Insiders* is the log of the number of insiders trading in the firm-month. Parameter estimates and *t*-statistics (in parentheses) are reported for each regression.

Electronic copy available at: https://ssrn.com/abstract=2781761

TABLE 8. Market Response to Insider Trade Clustering.

	AR(*t*,*t*+4)	*AR*(*t*,*t*+4)	*BHAR*(*t*,*t*+19)	*BHAR*(*t*,*t*+19)	*BHAR*(*t*,*t*+59)	*BHAR*(*t*,*t*+59)	*BHAR*(*t*,*t*+119)	*BHAR*(*t*,*t*+119)
Panel A. Trade Date								
$Purchase_{j,t-2,t}$	0.00571		0.01188		0.01485		0.01236	
	(19.10)		(16.30)		(9.29)		(4.78)	
$Purchase\ Cluster_{j,t-2,t}$	0.00479		0.00902		0.01233		0.01552	
	(4.68)		(3.51)		(1.88)		(1.35)	
$Sale_{j,t-2,t}$		-0.00090		-0.00393		-0.00934		-0.01380
		(-5.14)		(-8.07)		(-8.56)		(-7.58)
$Sale\ Cluster_{j,t-2,t}$		0.00013		0.00017		-0.00017		0.00191
		(0.25)		(0.12)		(-0.06)		(0.36)
Size	-0.00036	-0.00037	-0.00147	-0.00150	-0.00466	-0.00470	-0.00903	-0.00907
	(-14.71)	(-15.27)	(-15.92)	(-16.25)	(-16.71)	(-16.86)	(-16.41)	(-16.48)
B/M	0.00229	0.00229	0.00960	0.00952	0.03096	0.03072	0.06218	0.06180
	(10.41)	(10.40)	(11.39)	(11.30)	(11.97)	(11.88)	(12.45)	(12.37)
Momentum	-0.00454	-0.00462	-0.00508	-0.00514	-0.00310	-0.00294	0.00769	0.00807
	(-14.93)	(-15.15)	(-4.94)	(-5.00)	(-1.06)	(-1.01)	(1.66)	(1.75)
Safe	0.00097	0.00105	0.00425	0.00445	0.00179	0.00214	0.00110	0.00153
	(10.42)	(11.23)	(17.03)	(17.83)	(4.12)	(4.94)	(1.51)	(2.10)
Blackout	-0.00029	-0.00034	0.00221	0.00208	0.00530	0.00505	0.00523	0.00491
	(-3.86)	(-4.46)	(8.48)	(7.97)	(11.94)	(11.34)	(7.03)	(6.58)
Log Insiders	0.00186	0.00196	0.00694	0.00720	0.01908	0.01954	0.03358	0.03415
	(25.57)	(26.83)	(25.25)	(26.17)	(23.24)	(23.81)	(20.77)	(21.10)
Constant	-0.00019	-0.00014	-0.00115	0.00009	0.01121	0.01160	0.02623	0.02680
	(-0.60)	(-0.43)	(-0.15)	(0.01)	(3.28)	(3.40)	(3.93)	(4.01)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	13,017,486	13,017,486	12,989,609	12,989,609	12,904,098	12,904,098	12,732,834	12,732,834

Electronic copy available at: https://ssrn.com/abstract=2781761

Panel B. Filing Date								
Purchase$_{j,t-2,t}$	0.00546		0.00842		0.00779		0.00567	
	(17.79)		(12.69)		(5.76)		(2.31)	
Purchase Cluster$_{j,t-2,t}$	0.00549		0.00907		0.01124		0.00888	
	(5.49)		(4.60)		(2.68)		(1.20)	
Sale$_{j,t-2,t}$		-0.00181		-0.00457		-0.00826		-0.01067
		(-10.40)		(-10.83)		(-8.62)		(-6.49)
Sale Cluster$_{j,t-2,t}$		-0.00101		-0.00057		0.00110		0.00202
		(-2.06)		(-0.52)		(0.44)		(0.49)
Size	-0.00036	-0.00037	-0.00148	-0.00149	-0.00468	-0.00470	-0.00905	-0.00906
	(-14.83)	(-15.27)	(-16.03)	(-16.22)	(-16.78)	(-16.85)	(-16.45)	(-16.47)
B/M	0.00229	0.00227	0.00961	0.00954	0.03099	0.03084	0.06221	0.06199
	(10.41)	(10.31)	(11.40)	(11.32)	(11.98)	(11.93)	(12.45)	(12.41)
Momentum	-0.00458	-0.00460	-0.00520	-0.00518	-0.00327	-0.00315	0.00751	0.00774
	(-15.04)	(-15.09)	(-5.06)	(-5.04)	(-1.12)	(-1.08)	(1.63)	(1.67)
Safe	0.00101	0.00104	0.00435	0.00439	0.00192	0.00198	0.00122	0.00128
	(10.88)	(11.13)	(17.41)	(17.58)	(4.43)	(4.56)	(1.68)	(1.76)
Blackout	-0.00030	-0.00034	0.00219	0.00210	0.00527	0.00514	0.00520	0.00506
	(-3.92)	(-4.51)	(8.40)	(8.06)	(11.85)	(11.56)	(6.98)	(6.79)
Log Insiders	0.00187	0.00198	0.00697	0.00717	0.01920	0.01949	0.03366	0.03397
	(25.69)	(27.17)	(25.35)	(26.08)	(23.35)	(23.69)	(20.74)	(20.91)
Constant	-0.00018	-0.00011	-0.00014	0.00016	0.01122	0.01148	0.02627	0.02661
	(-0.57)	(-0.35)	(-0.12)	(0.01)	(3.29)	(3.36)	(3.93)	(3.98)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	13,017,486	13,017,486	12,989,609	12,989,609	12,904,098	12,904,098	12,732,834	12,732,834

Note: This table documents the market response to insider trade clusters. Ordinary least squares (OLS) regressions predict market response to trade clusters by trade date (Panel A) and filing date (Panel B). The analysis is performed at the firm-day level. In columns 1 and 2, the dependent variable is *AR*(*t*,*t*+4), the 5-day cumulative abnormal return. The remaining columns include 20-, 60-, and 120-day buy-and-hold returns beginning on the day of the insider transaction, *t*, for both insider purchases (columns 3, 5, and 7) and sales (columns 4, 6, and 8). *Purchase* (*Sale*) is an indicator equal to 1 if there is at least one insider purchase (sale) at firm *j* during the specified window (*t*–2 to *t*). *Purchase* (*Sale*) *Cluster* is an indicator equal to 1 if there are at least two insider purchases (sales) at firm *j* during the specified window (*t*–2 to *t*). *Size* is the log of the previous year-end market value. *B/M* is the log of the previous year-end book-to-market ratio. *Momentum* is the cumulative market-adjusted return from days *t*–20 to *t*–1. *Safe* is equal to 1 if the trading day is within the (3, 12) window following the firm's earnings announcement. *Blackout* is equal to 1 if the trading day is within the (–30, 2) window around the firm's earnings announcement. *Log Insiders* is the log of the number of insiders trading in the firm-month. Parameter estimates and *t*-statistics (in parentheses) are reported for each regression.

Electronic copy available at: https://ssrn.com/abstract=2781761

TABLE 9. Multivariate Analysis of Insider Trading by Insider Role.

	CEO Purchase$_{i,j,t}$	*CFO Purchase*$_{i,j,t}$	*Director Purchase*$_{i,j,t}$	*Officer Purchase*$_{i,j,t}$
Peer CEO Purchase$_{i,j,t-2,t}$		0.898	0.735	0.617
		(36.90)	(45.42)	(40.26)
Peer CFO Purchase$_{i,j,t-2,t}$	0.890		0.793	0.398
	(35.58)		(42.21)	(17.23)
Peer Director Purchase$_{i,j,t-2,t}$	0.825	0.943	1.044	0.508
	(51.57)	(51.15)	(105.70)	(43.45)
Peer Officer Purchase$_{i,j,t-2,t}$	0.615	0.390	0.451	0.832
	(41.83)	(17.05)	(38.27)	(121.91)
Own Purchase$_{i,j,t-20,t-6}$	0.727	0.537	0.677	0.755
	(68.56)	(30.60)	(81.41)	(128.69)
Size	-0.048	-0.055	-0.052	-0.033
	(-18.98)	(-14.76)	(-29.19)	(-27.59)
B/M	0.122	0.132	0.0860	0.167
	(7.68)	(5.75)	(7.24)	(20.53)
Momentum	-0.713	-0.508	-0.512	-0.525
	(-36.55)	(-18.10)	(-36.77)	(-53.17)
Safe	0.230	0.226	0.139	0.188
	(26.86)	(18.11)	(21.48)	(43.19)
Blackout	-0.116	-0.061	-0.098	-0.137
	(-13.42)	(-4.97)	(-16.77)	(-33.08)
Log Insiders	-0.228	-0.097	-0.003	-0.014
	(-31.94)	(-9.05)	(-0.62)	(-3.77)
Constant	-3.160	-3.552	-3.278	-3.173
	(-152.06)	(-114.55)	(-211.89)	(-295.14)
Observations	52,734,073	52,734,073	52,734,073	52,734,073

Note: This table contains probit regressions predicting insider trading as a function of other insider trading at the firm. The dependent variable is an indicator for an insider trade on day *t* by insider *i* at firm *j* by insider role. Insiders are classified as CEO, CFO, director, or officer. All other insiders are discarded from the sample. *Peer CEO Purchase, Peer CFO Purchase, Peer Director Purchase,* and *Peer Officer Purchase* are indicators equal to 1 if there is at least one purchase by insider *i* at firm *j* in the specified window (*t*–2 to *t*) by the designated insider. *Own Purchase* is an indicator equal to 1 if there is at least one purchases by insider *i* in the window from *t*–20 to *t*–6. *Size* is the log of the previous year-end market value. *B/M* is the log of the previous year-end book-to-market ratio. *Momentum* is the cumulative market-adjusted return from days *t*–20 to *t*–1. *Safe* is equal to 1 if the trading day is within the (3, 12) window following the firm's earnings announcement. *Blackout* is equal to 1 if the trading day is within the (–30, 2) window around the firm's earnings announcement. *Log Insiders* is the log of the number of insiders trading in the firm-month. Parameter estimates and *t*-statistics (in parentheses) are reported for each regression.

Electronic copy available at: https://ssrn.com/abstract=2781761

TABLE 10. Insider Trading Profits.

	$AR(t,t+4)$	$AR(t,t+4)$	$AR(t,t+4)$	$AR(t,t+4)$	$AR(t,t+4)$
$Purchase_{j,t}$	0.00200	0.00560	0.00589	0.00487	0.00544
	(5.49)	(14.47)	(15.26)	(12.26)	(13.88)
$Purchase_{j,t} \times Peer\ Purchase_{j,t-2,t}$	0.00576				
	(4.58)				
$Purchase_{j,t} \times Peer\ CEO\ Purchase_{j,t-2,t}$		0.00316			
		(1.30)			
$Purchase_{j,t} \times Peer\ CFO\ Purchase_{j,t-2,t}$			0.00419		
			(1.22)		
$Purchase_{j,t} \times Peer\ Director\ Purchase_{j,t-2,t}$				0.00447	
				(3.13)	
$Purchase_{j,t} \times Peer\ Officer\ Purchase_{j,t-2,t}$					0.00104
					(0.56)
$Peer\ Purchase_{j,t-2,t}$	0.00468				
	(14.42)				
$Peer\ CEO\ Purchase_{j,t-2,t}$		0.00638			
		(6.10)			
$Peer\ CFO\ Purchase_{j,t-2,t}$			0.00708		
			(4.90)		
$Peer\ Director\ Purchase_{j,t-2,t}$				0.00261	
				(6.19)	
$Peer\ Officer\ Purchase_{j,t-2,t}$					0.00414
					(6.58)
Size	-0.00036	-0.00036	-0.00036	-0.00036	-0.00036
	(-14.81)	(-14.93)	(-14.96)	(-14.94)	(-14.95)
B/M	0.00230	0.00230	0.00231	0.00230	0.00231
	(10.45)	(10.47)	(10.47)	(10.47)	(10.47)
Momentum	-0.00457	-0.00460	-0.00461	-0.00460	-0.00461
	(-15.02)	(-15.12)	(-15.14)	(-15.11)	(-15.12)
Restrict	0.00099	0.00100	0.00100	0.00100	0.00100
	(10.60)	(10.77)	(10.79)	(10.74)	(10.78)
Blackout	-0.00030	-0.00031	-0.00031	-0.00031	-0.00031
	(-3.96)	(-4.07)	(-4.09)	(-4.05)	(-4.07)
Log Insiders	0.00185	0.00189	0.00100	0.00188	0.00189
	(25.45)	(26.01)	(26.02)	(25.86)	(25.91)
Constant	-0.00015	-0.00018	-0.00017	-0.00016	-0.00017
	(-0.44)	(-0.56)	(-0.55)	(-0.52)	(-0.53)
Year fixed effects	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes
Observations	13,017,486	13,017,486	13,017,486	13,017,486	13,017,486

Note: This table documents the abnormal returns following insider trade clusters by composition. Ordinary least squares (OLS) regressions predict insider trading profits as a function of different types of trade clusters. The dependent variable is $AR(t,t+4)$, the 5-day cumulative abnormal return. *Purchase* is an indicator equal to 1 if there is at least one insider purchase at firm *j* on day *t*. *Peer Purchase*, *Peer CEO Purchase*, *Peer CFO Purchase*, *Peer Director Purchase*, and *Peer Officer Purchase* are indicators equal to 1 if there is at least one purchase at firm *j* in the specified window (*t*–2 to *t*) by a peer insider with the designated insider role. See Table 8 for control variable definitions. Standard errors are clustered at the firm-year level. Parameter estimates and *t*-statistics (in parentheses) are reported for each regression.

Electronic copy available at: https://ssrn.com/abstract=2781761

TABLE 11. Insider Trade Clustering Post-SOX.

	$Purchase_{i,j,t}$	$Purchase_{i,j,t}$
Peer Purchase$_{i,j,t-2,t}$	1.028	0.982
	(226.24)	(162.94)
Peer Purchase$_{i,j,t-5,t-3}$	0.204	0.175
	(30.52)	(19.35)
Peer Purchase$_{i,j,t-2,t}$ × *Post-SOX*		0.105
		(11.71)
Peer Purchase$_{i,j,t-5,t-3}$ × *Post-SOX*		0.061
		(4.55)
Post-SOX	-0.032	-0.051
	(-10.49)	(-15.43)
Own Purchase$_{i,j,t-20,t-6}$	0.954	0.952
	(212.88)	(212.48)
Size	-0.047	-0.046
	(-44.92)	(-44.11)
B/M	0.098	0.100
	(13.74)	(14.04)
Momentum	-0.512	-0.511
	(-64.68)	(-64.57)
Safe	0.203	0.202
	(54.99)	(54.68)
Blackout	-0.112	-0.111
	(-32.47)	(-32.21)
Log Insiders	-0.070	-0.071
	(-22.31)	(-22.62)
Constant	-2.795	-2.790
	(-309.48)	(-309.06)
Observations	43,996,613	43,996,613

Note: This table contains probit regressions predicting insider trading as a function of other insider trading at the firm and the timeliness of trades from August 1992 to August 2012. In columns 1 and 2, the dependent variable is an indicator for an insider purchase on day *t* by insider *i* at firm *j*, and in columns 3 and 4, the dependent variable is an indicator for an insider sale on day *t* by insider *i* at firm *j*. *Peer Sale* (*Peer Purchase*) is an indicator variable equal to 1 if there is at least one sale (purchase) by other insiders at firm *j* in the specified windows (*t*–2 to *t* and *t*–5 to *t*–3). *Own Sale* (*Own Purchase*) is an indicator variable equal to 1 if there is at least one sale (purchase) by insider *i* at firm *j* in the window from *t*–20 to *t*–6. *Post-SOX* is an indicator equal to 1 for all observations after the Sarbanes–Oxley Act of July 2002. *Size* is the log of the previous year-end market value. *B/M* is the log of the previous year-end book-to-market ratio. *Momentum* is the cumulative market-adjusted return from days *t*–20 to *t*–1. *Safe* is equal to 1 if the trading day is within the (3, 12) window following the firm's earnings announcement. *Blackout* is equal to 1 if the trading day is within the (–30, 2) window around the firm's earnings announcement. *Log Insiders* is the log of the number of insiders trading in the firm-month. Parameter estimates and *t*-statistics (in parentheses) are reported for each regression.

Electronic copy available at: https://ssrn.com/abstract=2781761