Insider Trading Patterns[☆]

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Abstract

We find that corporate insiders trade over longer periods of time when they may have a longer-lived informational advantage. Controlling for the duration of insiders' trading strategies, we find that isolated stock sales and purchases, and extended sale and purchase sequences (those spread over multiple consecutive months), predict sizable abnormal returns on average. We discuss how failure to account for these trading patterns has previously masked the returns to insider trading. Finally, we provide evidence that insiders attempt to preserve their informational advantage to maximize trading profits by disclosing their trades after the market has closed. When insiders report their trades after business hours they are more likely to engage in sequences rather than isolated trades, they trade more shares over more days, and the abnormal returns are larger on average.

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I. Introduction

The information conveyed by insider trading is an important issue in financial economics. This topic is important to financial economists concerned with market efficiency and managers' behavior, to investors interested in signals of future stock returns, and to legal authorities charged with enforcing the laws against trading on private information. Although many researchers have studied insiders' trading activity, answers to questions as fundamental as whether on average corporate insiders' trades predict returns remain unclear.

On one hand, researchers have consistently found that when corporate insiders purchase their own stock it signals positive future abnormal returns. On the other hand, insights regarding the information content of insiders' stock sales have been elusive. Early work suggested that insiders' sales predicted negative abnormal returns on average, but this conclusion was called into question by subsequent work that more adequately controls for the multiple factors associated with expected stock returns. Accordingly, researchers often suggest that insiders appear to sell their stock mostly for diversification and liquidity needs. Recent efforts to filter out transactions that are unlikely to be informed also fail to uncover reliable evidence that a large subset of insiders' sales predict negative abnormal returns on average. For example, Cohen, Malloy, and Pomorski (2012) demonstrate that randomly-timed stock sales predict future returns that are lower than those that appear to be routine. However, according to their portfolio abnormal return tests, the difference appears to be driven largely by positive abnormal returns following trades classified as routine.[1]

In this paper, we revisit these questions and employ a simple but novel innovation that helps account for an important aspect of insiders' trading strategies. In doing so, we make two main con-

[1]Examples of early work suggesting both purchases and sales were informed include Jaffe (1974), Finnerty (1976), Seyhun (1986, 1992, 1998), and Chowdhury, Howe, and Lin (1993). Subsequent work by Lakonishok and Lee (2001) and Jeng, Metrick, and Zeckhauser (2003) show that the abnormal return results for stock sales are not robust to controls for firm size, book-to-market equity value, and momentum. See Jagolinzer, Larcker, and Taylor (2011) for a recent example of work that finds insignificant abnormal returns following insiders' sales when controlling for all of these risk factors. We are not aware of any other work employing adequate controls for expected returns that shows reliable evidence of abnormal returns following any large subset of insider stock sales.

tributions to this literature. We begin by implementing abnormal return tests that account for the duration of insiders' trading sequences, and uncover considerable evidence that on average both insiders' purchases and their sales predict abnormal returns. These results are robust to many alternative specifications and hold in both the pre- and post-Sarbanes-Oxley period. In the second part of our analysis, we consider the circumstances affecting the duration of insiders' trading strategies. Our focus is on the conditions that impact insiders' ability to maintain an informational advantage. Our analysis suggests that insiders spread their trading strategies out over longer periods of time when their informational advantage may be more persistent, and trade in short windows of time when their informational advantage is likely to quickly dissipate. We also find evidence that insiders attempt to extend their profitable trading strategies by manipulating the rate at which their informational advantage decays. In particular, we find that they are more likely to engage in longer trading strategies, and the abnormal returns following their trading are larger when they report their trades to the Securities and Exchange Commission (SEC) after the market has closed. In sum, this paper provides new evidence that on average insiders trades (both purchases and sales) predict abnormal returns, and that they actively attempt to maximize the profitability of their trading opportunities.[2]

The intuition motivating our work is simple: we expect opportunistic insiders to trade so long as they have an informational advantage. Consider, for example, two hypothetical firms where executives possess information that has not yet been incorporated into their stock price. At one firm, an executive knows that the firm is likely to miss its earnings in the near-term. At the other firm, an executive has been involved in negotiations with a key supplier that are not going well. This information has no near-term earnings implication, is not routine in nature, and will not be revealed to the market for a number of months. The trading patterns of opportunistic executives

[2]Alldredge and Cicero (2015) provide evidence that attentive insiders sometimes earn abnormal returns by trading quickly on public information relevant to their firms. In this paper, we do not distinguish between trading based on public versus private information, and the analysis presented here should apply in either situation.

in these situations may differ. In order to benefit from her information, the executive at the former firm could sell shares immediately and will probably only be able to trade in a short window of time before the negative information is incorporated into prices, either because the trading draws outside investors' attention to signals of earnings weakness or because the earnings are soon disclosed. In contrast, the executive at the latter firm may be able to trade over a longer period of time without the market inferring the unexpected announcement in the distant future (indeed, all other signs may point toward good performance in the near term).

Based on this intuition, we classify insiders' trades as either isolated trades, which are concentrated in a short window of time, or trade sequences, that extend over longer windows of time. If insiders are trading opportunistically on information, the isolated trades should be associated with a short-lived informational advantage and abnormal returns should be apparent shortly afterwards. If longer trade sequences are motivated by an informational advantage that is persistent – either because the market is inattentive to the trading, or because the type of information motivating the trades will not soon be disclosed – then abnormal returns should be apparent following the completion of the trade strategy. We therefore evaluate the abnormal returns that follow the completion of insiders' trading patterns. For extended trade sequences, we also measure abnormal returns over a window that begins when the insider starts trading and ends shortly after the trade sequence is completed, which should suggest whether trade sequences are motivated by an ex ante informational advantage.

For our analysis, we define a trade sequence as trading by an individual in the same direction across multiple calendar months. When allowing for gaps in trading not to exceed one month in length, we find that 59% of trading months are isolated and 41% are sequenced. The sequences average 3.6 months in length.[3]

[3]In our judgement, allowing for month-long gaps in sequences is the most appropriate classification scheme. This allows for trading gaps due to blackout periods where individuals are not allowed to trade (Bettis, Coles, and Lemmon, 2000). We also consider an alternative stricter definition of sequences that do not allow for gaps and results remain statistically significant and qualitatively similar.

An analysis of insider trades over the period 1986–2012 suggests that, on average, insiders are opportunistic when they engage in both isolated trades and trade sequences. We start by showing that calendar-time portfolio tests following sales months that do not account for insiders' trading patterns fail to find evidence of significant abnormal returns. However, once we account for trading patterns we find strong evidence of abnormal returns. Isolated sales months are followed by significant abnormal returns of negative 60 to 70 bps in the following month, and sales sequences are followed by abnormal returns of negative 120 to 140 bps in the month following the end of the sequence. The striking contrast from the naive results can be explained by the abnormal returns measured *during* sequences, which are *positive* 70 bps per month. An empirical strategy that treats these interim sequence months as independent observations is therefore positively biased, masking the abnormal returns.[4] We also find evidence that sequences are timed relative to information ex ante. The average abnormal returns beginning after the first sequenced trade month and ending three months after sequences are completed are approximately negative 150 bps.

Accounting for insiders' trading patterns also sharpens our understanding of the abnormal returns associated with insiders' stock purchases. Isolated stock purchases are followed by positive abnormal returns of between 115 and 160 bps, and sequences are followed by positive abnormal returns of 170 to 190 bps. In addition, the abnormal returns measured from the first month after a sequences begin until three months after they are completed are approximately 450 bps, which strongly suggests that purchase sequences are motivated by an ex ante informational advantage on average. The overall contrast in returns following insider purchases and sales is captured by four-factor calendar-time return tests for self-financing portfolios long stocks the month after isolated purchases and purchase sequence ends, and short stocks after isolated sales and sequence sales ends. This portfolio yields an alpha of 261 bps per month (31% annualized).

[4]Why would one find positive abnormal returns during a sequence of insider stock sales? This result will hold if the insider is opportunistically executing a sequence of trades on negative information that will not be forthcoming until after they have traded, and thus the interim months' returns are truncated from below.

These results are robust to a number of different sorts. For example, they are apparent following insiders' trades at both large and small firms, before and after passage of the Sarbanes-Oxley Act, and when evaluating only the trades of C-Suite executives or only those of the CEO or Chairman of the Board. In addition, given that these results hold over a 16 year time-period that precedes the pre-Sarbanes-Oxley Act, it is also evident that they are also not driven by pre-planned trading under Rule 10b5-1, which was enacted in October 2000.

We also consider whether abnormal returns are evident among the large subset of transactions classified as "routine" trades by recent literature (Cohen et al., 2012). Accounting for trade sequences, we find compelling evidence that these traders also engage in opportunistic trading on average: their isolated purchases and sales, as well as purchase and sale sequences, continue to predict sizable abnormal returns. A final robustness test contrasts the returns following insiders' sales to those apparent when insiders do not trade. Other recent work suggests that insiders are in fact *less* likely to sell stock when they possess negative private information about their firms (Marin and Olivier, 2008; Gao, Ma, and Ng, 2015). We find that the magnitude of negative abnormal returns following insiders' stock sales patterns are significantly larger than those following insiders' silence.

Having established the importance of accounting for trading patterns for understanding the abnormal returns associated with insider trading, we next examine the factors that predict whether insiders engage in isolated or sequenced trades. If investors are opportunistic and trade on information, we expect their trading sequences to be associated with more asymmetric information and the ability to maintain an informational advantage. Consistent with these expectations, trade sequences are more likely in firms that are smaller and are followed by fewer analysts. Trade sequences are also less likely than isolated trades to be followed by an immediate earnings surprise, indicating that routine information with valuation consequences is revealed sooner after isolated trades.

Our last area of inquiry is whether insiders try to preserve their informational advantage in order

to engage in more profitable trading. We find that an insider is more likely to engage in a trade sequence when they report their trades to the Securities and Exchange Commission (SEC) after the market has closed. As others have argued, investors are less attentive after business hours, and may therefore be less likely to timely interpret the information signaled by insiders' trades.[5] The association between after-hours reporting and extended trade sequences holds at both the firm and individual trader level, which would not be expected if insiders were merely executing pre-planned trading programs without concern for the market impact of their trades. We also find that trades reported after business hours are associated with larger abnormal returns. For example, isolated sales are followed by negative abnormal returns in the following month that are 26% larger and sales sequences are associated with negative abnormal returns that are 58% larger when the first trade of a strategy is filed after the market closes. Similarly, for isolated purchases and purchase sequences, after-hours reporting is associated with positive abnormal returns that are 32% and 71% larger, respectively.

Finally, we find that after-hours reporting is associated with both a greater number of trade days in a sequence and trading of more shares. These results are economically very significant. For example, the marginal effect associated with an indicator that the first trade in a sales sequence is reported after business hours indicates a 49% increase in the total number of shares sold during a sequence and an 11% increase in the number of trading days. For purchases, these marginal effects indicate a striking 159% increase in the number of shares sold and a 22% greater number of trading days in a sequence. All of these results are robust to alternative measures of the frequency of after-hours reporting of trades throughout a sequence. Taken together, these results provide strong evidence that after-hours trade reporting is associated with more profitable trading strategies. They are also consistent with a conjecture that insiders purposefully time their disclosures in order to minimize market impact and maximize their opportunities to profit.

[5]For evidence that investors are less attentive to after-hours announcements, see Patell and Wolfson (1982); Damodaran (1989); Neissner (2014).

This paper provides new insights into the scope of informed trading by corporate insiders and highlights important aspects of both their trading and trade reporting strategies. It supports an argument that, on average, insiders take advantage of profitable trading opportunities and manipulate their trading strategies to optimize these opportunities. It also provides evidence that insiders may manipulate the way they report their trading activity to the S.E.C. in order to minimize the market impact of the information that may be conveyed by the fact that they are trading their own stock.

These findings should be useful for regulators and investors who wish to understand the trading behavior of informed investors, either to identify those who violate the law, or to update their own beliefs about the value of firms' publicly traded securities. It should also inform researchers on the design of future research that attempts to uncover evidence of informed trading in yet-to-be identified contexts, or that uses indicators of informed insider trading as an input on a related research topic. What we show is that not all informed insider trading will look the same. The patterns of informed trading and the time at which trading profits are realized depend upon the nature of the insiders' informational advantage. By implementing a simple classification scheme as we have done here, future researchers will have a more powerful tool for identifying informed trades and traders. Finally, the intuition motivating our study may prove useful for the study of trading by other market participants. Classification schemes similar to those employed here may bring additional sharpness to tests for the return predictive abilities of trading by other groups of traders including retail investors, institutions that hold predominantly long positions such as mutual funds, and hedge funds that may hold both long and short positions.

The rest of our paper is arranged as follows. In section II, we provide further background from the insider trading literature, describe our sample selection, and discuss our key methodologies. In section III, we explore the determinants of insider trading patterns. In section IV, we present the results of our empirical analysis of returns following isolated and sequenced trades. We conclude in section V.

II. Hypotheses

The focus of this paper is on insiders' stock trading patterns as a function of their informational advantage. The first principle motivating this research is the fact that information, by its nature, is time sensitive; it will eventually be incorporated into prices. Insiders wishing to exploit an informational advantage therefore have a finite window of opportunity. The information will eventually be revealed either through earnings announcements, press releases, leakage from other insiders, or through the market impact of aggregate trading activity. We therefore expect that trades concentrated in a short period of time are likely to be motivated by an informational advantage and we expect insiders to concentrate their trading over short horizons when they possess the type of information that is likely to be quickly incorporated into prices.

There are times, however, when an insiders' informational advantage may be longer-lived. We expect this to be the case when the information is non-routine in nature. For example, an executive may know their firm is likely to lose a key business relationship in the coming months, have internal data indicating that a particular R&D project looks particularly promising, or be involved in merger discussions with another firm. Indeed, Heitzman and Klasa (2012) show evidence consistent with insiders trading around the time of private merger negotiations. It is reasonable to expect that insiders with such an advantage will spread their trades out over time. Prior research has shown that larger trades tend to move prices and trade prices convey information about firm values to the market (Meulbroek, 1992; Gloston and Milgrom, 1985). Optimal trading strategies based on private information therefore involve sequences of trades to avoid sending strong signals (Kyle, 1985). In addition, according to a 2000 internal S.E.C. memorandum discussing the investigation of insider trading, one of the most relevant factors is the size of a trade, so those trading on private information have an incentive to avoid conspicuously large trades (Foster, 2000). Sequences of trades spread over longer horizons may therefore be motivated by private information that takes longer to be incorporated into prices.

The alternative null hypothesis is that insiders spread their trades over longer periods of time

when they are trading merely for liquidity or diversification purposes. There may be less immediacy to these trades if insiders are not trying to exploit a temporary informational advantage. Insiders may spread these trades out over time because they still face the reality that the market has limited depth and larger trades tend to move prices, which could cause them to realize less favorable average trading prices. Consistent with this expectation, Lebedeva, Maug, and Schneider (2012) demonstrate that insiders spread their trades out over time when they face liquidity constraints.

A. Trading Patterns and Abnormal Returns

We begin our analysis by considering the abnormal returns associated with insider trading. As discussed above, we expect that trades concentrated in a short period of time are likely to be motivated by an informational advantage. If this is the case, we expect abnormal returns to follow soon after isolated trades. We have also hypothesized that longer sequences of insiders' trades may be motivated by a longer-lived informational advantage. If this is correct, then we should also find that extended trade sequences are associated with abnormal returns, but not until the sequences end. To conclude that trade sequences are motivated by an ex-ante informational advantage, we should also find that the eventual stock prices reflect new information relative to the pre-sequence price. This finding should rule out the possibility that trade sequences are executed by liquidity traders that anchor their stock valuations and choose to stop trading when large price movements occur (large declines during a sales sequence, or large increases during a purchase sequence).

B. Predicting Insiders' Trading Patterns

The second part of our analysis focuses on the circumstances associated with insiders' trading patterns. We examine whether proxies for different aspects of the information environment are related to whether insiders execute isolated trades or longer trade sequences. We expect opportunistic insiders to be less likely to initiate a trading sequence when their informational advantage will necessarily be short-lived. Our proxy for the immediacy of information is whether the next

quarterly earnings announcement following an insiders' trading delivers an earnings surprise in the direction consistent with profitable pre-announcement trading.

We also expect that the higher the general level of information asymmetry between insiders and outsiders, the more likely it is that insiders can maintain an informational advantage and execute longer trade sequences. Firm-specific characteristics may proxy for the speed with which the market incorporates information into stock prices. Prior studies have shown that the prices of smaller firms are less efficient (Seyhun, 1986; Lakonishok and Lee, 2001), and have argued that insiders also have a greater informational advantage in growth firms (Smith and Watts, 1992; Barclay and Smith, 1995). In addition, Frankel and Li (2004) show that insiders' individual trades are less profitable when they have a larger analyst following. We expect similarly that insiders' information advantage will dissipate faster when more analysts cover their firms, leading to fewer opportunistic trade sequences.

Insiders may also attempt to manipulate their information environment. Damodaran (1989), Patell and Wolfson (1982), and Neissner (2014) provide evidence that managers strategically disclose negative news regarding their firms after business hours in order to minimize it's market impact. If investors are similarly inattentive to insider trading disclosures that are made public after the market closes, then this activity may also be associated with more extended trade sequences. If insiders have discretion over the timing of these disclosures, it is possible that they may, in fact, intentionally report after business hours to maximize their trading opportunities. This conjecture depends critically upon whether insiders have control over the time when their forms are filed with the S.E.C. In many cases this activity is likely delegated to a corporate secretary or outside legal counsel. However, as previous studies of executive stock option backdating reveal, there seem to be many times when executives exert influence or control over the reporting process, as evidenced by the fact that backdated option grants and exercises are associated with longer reporting lags (Heron and Lie, 2007; Cicero, 2009; Dhaliwal, Erickson, and Heitzman, 2009).

C. Data

The main data source used in this analysis is the Thompson Reuters Financial Network Insider Filing Data, which provides detailed information on insiders' transactions in the stock and derivatives of their own companies. An "insider" is broadly defined under S.E.C. regulations to be those who have "access to non-public, material, insider information," and includes officers, directors and 10% beneficial owners of a company's stock. We focus our analysis on insiders' stock trades. For each insider, we aggregate trades on a calendar month basis, and treat months as sales or purchase months based on the net of their transactions. For abnormal return tests, we use the full time series of transactions available in the data, which run from January 1986 to December 2012.

A key part of our analysis relies on identifying patterns of isolated and sequenced trading. We classify trade months as sequenced if the insider trades in the same direction in multiple months, allowing for one-month long gaps only (Appendix Table A1 provides a detailed description of the sample selection and trade classification process). For example, say an executive sells stock in April, May, July, and October of a given year. We will consider her to have executed one trade sequence beginning in April and ending in July, and to have executed another isolated trade in October. Sequences are also allowed to span calendar years. As an alternative, we also calculate sequences based on consecutive trading months only, and find results that are qualitatively and quantitatively similar. As can be seen in Table 1, a large fraction of insiders' trades are sequenced. There are 344,149 isolated sale months in our sample, and 268,109 sequenced sale months. The sequence sale months add up to 87,405 sequences with an average length of 3.58 months. For purchases, there are 217,611 isolated purchase months and 117,767 sequenced purchase months, for a total of 38,667 sequences that are an average of 3.59 months in length. Overall, 41% percent of trade months are sequenced. Figure 1 presents a summary of the durations of the trade sequences.

Another notable finding is that insiders trade more shares during a sequence than in isolated transactions months. For sales, the mean (median) number of shares traded is 278,550 (37,235) during a sequence versus 153,954 (10,000) in isolated sales months. In purchase sequences, in-

siders trade a mean (median) of 243,518 (11,000) shares versus only 72,940 (2,000) in isolated purchase months. This shows that insiders make much larger adjustment to their portfolios when they trade over a number of months. If sequenced trades are motivated by private information, then this suggests that the conditions allowing for insiders to trade over longer periods of time also allow them to capture greater profits.

As discussed above, we also consider whether the timing of insiders' trade disclosures is related to the length of insiders' trading programs. By regulation, insiders are required to report all of their transactions to the S.E.C.[6] Since 2002, insiders are supposed to report trades within two business days of executing a trade and the forms, which are filed electronically, are made available to the public through EDGAR almost immediately. Fig. 2 presents a histogram of the frequency of insider transaction reporting throughout the day. The timestamps on the filings begin at 6 a.m. and steadily increases during the day until 5 p.m, which is one hour after the market closes. By the time the market closes, 48% of sales have been disclosed, and an additional 19% are disclosed between 4 p.m. and 5 p.m. The remaining 33% are reported between 5 p.m. and 10 p.m., with a steady decline in reporting activity over this time. For purchases, 58% are reported before 4 p.m., 17% are reported during the 4 p.m. hour, and 25% are reported after business hours. If after-hours reporting draws less attention, the greater prevalence of after-hours reporting of sales suggests that insiders have greater incentives to keep bad news from being impounded into their stock price than good news.[7]

We have hypothesized that investors may be less attentive to news about insider trading that is disclosed after the market closes. However, given the observed distribution, is is not clear whether we should expect investors' attention to decline when the market closes at 4 p.m., when they can no

[6]Insiders file Forms 3 to report initial beneficial ownership of shares, Forms 4 to report changes in beneficial holdings, Forms 5 to report annual changes in beneficial ownership, and Forms 144 to declare their intention to sell restricted shares.

[7]This could reflect both the greater litigation risk associated with selling stock when the price is declining, as well as the additional benefit to purchasing during price increases that stock already held is appreciating at the same time.

longer make quick market trades on the information, or if we should expect investors to maintain their attention during the period of high reporting volume from 4 to 5 p.m. and redirect their focus only later in the evening. We therefore control for both possibilities in our empirical analysis.

III. Empirical Analyses

In this section we present empirical analyses testing the hypotheses discussed in Section 2. We start, though, with an illustration of the patterns we analyze in this paper. Consider the trades of two CEOs who sold their companies' stock from February to May 2005. The companies will be identified as Company A and Company B, and their trades and stock returns during that period are shown in Fig. 2. After not reporting any insider sales in the previous month, the CEOs of both companies report a sale on February 1 of 2005. Over the next six months, Company A's CEO reports no further trades. In contrast, following his trade in February, Company B's CEO reports sales in March, April and May.

Fig. 2 shows that in the month following the CEO of Company A's isolated sale, its stock price fell by 41%, suggesting his trade was informed and the private information was quickly incorporated into the stock price. A review of *World Street Journal* articles reveals that Company A reported a 15% decline in quarterly revenue at the end of April and the firm's earnings swung from a profit to a loss. In contrast, the price of Company B actually rose by about 13% over the time that its CEO was executing his sequence of trades. In the three months following the completion of the sequence, however, the stock price fell by 44% and ended 31% lower than when he started trading. This suggests that while the CEO of Company B's trading was informed, it ultimately took longer for the information to be revealed to the market. In this case, the decline in value is concentrated around the time that Company B announced not only that they had missed earnings expectations, but that they had canceled a major distribution contract in Canada. This is the type of information that the CEO would likely have been able to anticipate for some time, but that the market would have had difficulty identifying.

A. Analysis of Returns

We have hypothesized that due to the time-sensitivity of information, informed insiders with a short-lived informational advantage will trade quickly and their isolated trades will be followed by abnormal stock returns. In contrast, informed insiders with a long-lived informational advantage will spread their trades over several months, and their trade sequences will not be associated with favorable abnormal return until the sequences end. In this section, we present a number of empirical tests of these hypotheses by comparing the returns following isolated trading months to those that follow trading months that occur in a sequence.

We use two different methods for calculating abnormal returns. The first is a calendar-time portfolio approach where we regress the returns to an an equally-weighted portfolio of stocks where insiders have traded onto factors thought to explain expected stock returns including the market return, firm size, the book-to-market equity ratio, and recent return momentum. The intercept from these regressions, or alpha, represents the abnormal returns.[8] We report separately the results of models controlling for just the equally-weighted market return, the three factors of Fama and French (1993), and the four factors of Carhart (1997).

An issue with implementation of the portfolio regressions is how to treat instances where multiple insiders at a firm trade in the same window, or have overlapping sequences. We treat isolated trades by multiple insiders at a firm in the same month as one observation. However, we treat a firm-month as a sequenced trade month so long as at least one insider is engaging in a sequence of trades. A month with an isolated trade by one insider and a sequenced trade by another is therefore not included in tests of isolated trading. In addition, when there are overlapping sequences at the same firm the stock does not go into the portfolio for tests evaluating returns after sequenced trading until the end of the latest overlapping sequence. For the tests evaluating returns following

[8]We focus our analysis on equal-weighted portfolios because we are interested in whether, in general, insiders' trades predict abnormal returns. The results are qualitatively similar if one value-weights the test portfolio, although this method would over-emphasize trading at larger firms.

the beginning of a sequence, the firm goes into the portfolio following the first trade month of the earliest overlapping sequence and stays in the portfolio until after the latest overlapping sequence ends.

The portfolio tests described may not be best suited to test whether individual trades are motivated by an informational advantage. To better evaluate this question, we also conduct tests at the individual trade level using a matching approach similar to that of Daniel, Grinblatt, Titman, and Wermers (1997) and Wermers (2004). For each observation, a firm's return is compared to the return on the appropriate portfolio of firms formed based on size and market-to-book, and recent return momentum. Specifically, each firm-month is matched to one of 125 portfolios of firms formed using the Daniel et al. (1997) annual breakpoints for size and book-to-market quintiles, and rolling monthly 12 month past return quintiles.[9] For tests of the abnormal returns associated with individual trades that make up trading sequences, a matching portfolio is selected based on momentum over the 12 months immediately preceding the month of interest. For tests of the aggregate abnormal return associated with a full trade sequence, returns are compared to that of the matching portfolio selected as of the first month of the sequence. These empirical tests are conducted at the individual trade month or trade sequence level. This means that a firm may be in the sample multiple times in the same month, and therefore the standard errors are clustered by both firm and calendar month.

A.1. Abnormal Returns Associated with Isolated and Sequenced Trades

In this subsection, we evaluate the abnormal returns following insiders' isolated and sequenced stock trades. We begin with the calendar-time portfolio regressions in Table 2 Panel A. However, before controlling for insiders' trading patterns, Column (1) reports the regression alphas from tests treating each trade month as an independent observation. Here we find the typical pattern seen in previous literature of generally insignificant returns following stock sale months, and

[9]The DGTW benchmarks are available via http://www.smith.umd.edu/faculty/rwermers/ftpsite/Dgtw/coverpage.htm.

significant positive alphas following purchase months. But patterns supporting our hypotheses emerge clearly in subsequent regressions controlling for insider' trading patterns. Column (2) reports results following isolated trading months. The alphas following sales are now significant and negative, ranging from about -60 to -70 bps per month; and the returns following isolated purchases are larger than the naive results by an additional 30 bps per month. These results support the hypothesis that isolated trades are informative about future stock returns.

Sequenced trades are evaluated in Columns (3) – (7) of Table 2. We begin in Column (3) by treating each sequenced trade month as a independent observation. Interestingly, the alphas for sales months is now a positive and significant 70 or so bps per month. It is easy to see that it was the inclusion of these months in the naive tests that drove the alpha towards zero. But the reality is masked. In Column (4), we only include stocks in the portfolio in the months during a sequenced, but prior to sequence end. Here the alphas are even larger and positive. It is not until we require the sequences to end before putting stocks into the portfolio that we also uncover evidence of negative abnormal returns associated with sequenced stock sales. Column (5) shows that there is a significant alpha of approximately -125 bps in the month following sequences, and Column (6) shows that this monthly alpha remains approximately the same if we keep stocks in the portfolio for three months following then ends of sequences. These tests provide clear evidence that abnormal returns in the expected direction follow completed stock sale sequences.

Given the positive abnormal returns evident during the sequences, however, it is not yet clear that the initiation of sales sequences predicts negative abnormal returns. In Column (7) we include stocks in the portfolio from the month following sequence initiations until three months following the end of the sequences, and find statistically-significant alphas of -22 to -25 bps per month. This indicates that the initiation of a sequence of trades predicts eventual lower stock returns. The interim positive abnormal returns during sales sequences are also consistent with a delay in the revelation of bad information, which could truncate the return distribution from below. Together, these results suggest that on average sales sequences are motivated by information that predicts

negative abnormal returns that is not quickly incorporated into prices.

Similar return patterns hold when evaluating purchase sequences. The one main difference is that although the during-sequence returns reported in Column (4) are muted, they are still positive. Purchase sequences therefore predict larger abnormal returns following their completion, but are also associated with smaller positive alphas while being executed. It is possible that the differing return patterns across sales and purchases reflects different legal risks. Because there is less risk of liability, insiders' may continue to purchase their stock as information is being incorporated into it's price, but they may be careful to stop selling their stock before negative information is impounded into the price due to the greater legal risk associated with informed stock sales.[10]

In Panel B of Table 2, we report the alphas for portfolios long firms where an insiders have completed either isolated or sequenced stock purchases, and short the firms where insiders have completed isolated or sequenced stock sales. The portfolio is rebalanced monthly. The monthly alphas are highly significant and are approximately 250 basis points per month. This translates into an annual abnormal return of approximately 30 percent, and indicates the considerable economic significance of our findings.

As discussed above, the calendar-time portfolio tests are not best suited for evaluating whether, on average, individual trade patterns predict abnormal returns if insiders' trades overlap. We therefore present matching-firm abnormal returns in Table 3. The results are similar.[11] In Panel A Column (1) we show that isolated insider sales are followed by significant -82 bp abnormal return, and isolated purchases are followed by significant abnormal returns of 161 bps. In Columns (2) through (4) we report returns for both sale and purchase sequences that are similar to those found with the portfolio tests. For sales, for example, sequenced months are followed by positive

[10] See Skinner (1994), Brochet (2010), and Chen, Martin, and Wang (2013) for arguments regarding the relatively greater legal risk associated with selling stock before price declines.

[11] The test presented in Table 3 measure observations at the insider level, and thus allow for multiple observations per firm, per month. We have also conducted these tests allowing only one observation per firm, per month, and find qualitatively similar results.

returns on average (Column (2)), which is driven by the large positive returns during the sequence (Column (3)); but they are followed by sizeable negative abnormal returns (Column (4)). In Panel B, we report the buy-and-hold abnormal returns (BHARs) that are evident from the month after sequences begin until three months after they end. In these tests sequences have different lengths, so we als report the average monthly abnormal return that is implied by the aggregate BHARs. The initiation of sales sequences are followed by significant BHARs of -2%, which translates into an average montly abnormal return of -52 bps. Purchase initiations are followed by 5% BHARs that indicate positive abnormal returns of 108 bps per month. In sum, these results confirm the conclusions of the portfolio analysis when considering individual trade patterns.

A.2. Robustness of the Abnormal Return Results

To establish the robustness of our results, we conduct abnormal return tests on a variety of subsamples of insider trades. The four-factor alphas for portfolios of stocks formed following either isolated or trade sequences in these subsamples are reported in Table 4. For comparison purposes, Column (1) restates the alphas using the full sample. In Columns (2) and (3), we demonstrate that all of the results hold when only considering trading by insiders at large and small firms, separately. The Column (4) results are based on trading from 1986 to 2002, and Column (5) reports results for trading from 2003 to 2012. All of the main results continue to hold, although the alphas following insiders' purchases are more pronounced in the earlier period. The next three columns focus on just the trades of top executives. Interestingly, the abnormal returns are actually more pronounced following trades by members of the executive team (Column (6)), as well as for the trades of just the CEO or Chairman of the Board (Column (7)). This is an important result considering that these executives are under the most scrutiny, and demonstrates the importance and power of controlling for insiders' trading patterns. And in Columns (8) we show that the abnormal returns following the trades of just the CEO or Chairman are still evident following the enhanced scrutiny of trading adopted in 2002. This evidence of ongoing opportunistic trading by top executives may be of

particular concern to researchers and regulators alike.

An additional robustness test considers trades treated as routine by prior research. It is reasonable to expect that some insiders trade only for liquidity or diversification reasons, but it is difficult to know the prevalence of this behavior. Other researchers have proposed sorting mechanisms to help distinguish these traders from those who are more likely to be exploiting an informational advantage. One particularly useful sorting mechanism proposed by Cohen et al. (2012) classifies insiders as routine traders if they trade in the same calendar month in three consecutive years, a pattern that may not be expected if an insider is trading on private information that presents itself more randomly.[12]

Similar to Cohen et al. (2012), in unreported tests we find that the alphas following both opportunistic sales and purchases seem to reflect more trading on private information than those following routine sales or purchases. However, once we control for isolated and sequenced trades, we find considerable evidence of informed trading in both subsamples. As can be seen in Columns (9) and (10), the alphas following both isolated sales and sales sequences in the subsample thought to capture routine trading are significant and very similar in magnitude as those following expected opportunistic trades. The alphas following purchases expected to be routine are large, although not quite as pronounced as those in the sample of expected opportunistic trades.

The lack of evidence of informed stock sales in the routine trader subsample overall may be found in the ratio of sequenced and isolated trades. We find a higher percentage of sequenced trade months among traders classified as routine under the Cohen et al. (2012) methodology than in the sample of non-routine traders. If each trade is treated as an independent observation, the abnormal returns following "routine" trades are biased towards zero by the greater fraction of intra-sequence trades.[13] These tests demonstrate that once insiders' trading patterns are taken into

[12]See the Appendix for a detailed description of the process we use to classify trade months as either routine or opportunistic.

[13]Remember that the abnormal returns following an intra-sequence trade month appear to be opposite of the hypothesized direction. The fraction of sequenced trade months by "routine" traders is approximately 60% compared to

account, there is more evidence of informed trading among both non-routine traders and those previously thought to trade only for routine purposes, and suggests that informed trading is more widespread than previously thought. It also points to the potential benefit of a more accurate mechanism for isolating those traders that do not appear to trade because of an informational advantage.

A final robustness test contrasts the returns following insiders' sales to those apparent when insiders do not trade. Marin and Olivier (2008) show that the absence of insider stock selling is positively correlated with the probability of a stock crash and argues that this result reflects trading constraints on insiders. Gao et al. (2015) find similar results and argue that the likely explanation is the increased litigation risk associated with selling stock ahead of very large price moves. In Table 5, we report the four-factor alphas that are apparent following windows of trade inactivity ranging from 3 to 12 months, and also show the alphas to portfolios long these firm-months and short stocks in the three months following isolated sales or sales sequences. The magnitude of the abnormal returns immediately following trading is larger than those that are apparent when insiders have been silent, and the alpha on the long/short portfolio is significant. It is possible, then, that our results demonstrate insiders' willingness to trade when in possession of information that predicts more modest price swings, whereas insiders are silent ahead of rare but large price movements. Indeed, in an SEC memorandum on how to conduct an insider trading investigation available on the SEC's website, a Senior Attorney in the Division of Enforcement notes that establishing the "materiality" of information traded upon generally requires a price movement of 10% or more (Foster, 2000).

45% among traders classified as "opportunistic". It is reasonable that a rule classifying traders as routine based in part on trade frequency would be more likely to pick up sequence traders so long as they also trade more often. We verify that this is the case. Among those traders that can be classified under the Cohen et al. (2012) system, those with an above median number sequenced trades (3 or more of their trades being sequenced) trade in 4.5 times more months than isolated traders.

B. Predicting Insider Trading Patterns

In this section, we turn to an analysis of the determinants of the duration of insiders' trading patterns. As discussed in Section 2, we expect that insiders attempting to profit from an informational advantage will trade over a longer period of time when their informational advantage is longer-lived. The circumstances we expect to lead to a longer-lived informational advantage include the immediacy of the information, i.e., how quickly it will be disclosed or can be interpreted, and the intensity of investors attention to the firm.

Table 6 presents logistic regressions predicting whether new trading by an insider is an isolated event or the beginning of a longer sequence of trades. The sample includes each month were an insider begins trading after having not traded for at least two months, and the dependent variable is an indicator that takes a value of 1 if the observation begins a trade sequence. A value of 0 for the dependent variable therefore indicates an isolated trade month. The independent variables of interest are motivated in Section 2 and include an indicator for whether the firm announces an earnings surprise consistent with the direction of the insiders' trading at the next announcement (*Near term earnings surprise*), the number of analysts following the firm (*ln(No. of Analysts)*), the firms' stock market value (*Ln(Market Cap)*), and it's market-to-book equity value (*Ln(market equity/book equity)*).

We begin with an analysis of insiders' sales in Panel A. The relationship between analyst coverage and sales sequences is negative in regressions that do not include the firm characteristics (Columns (1) and (3)). However, when including firm size and book-to-market, the marginal effect of additional analyst coverage is positive. Sales sequences are less likely to be associated with a near-term negative earnings surprise (Columns (2) and (3)). This result continues to hold when controlling for additional firm characteristics in Column (4). From the regression in Column (4), we also see that sales sequences are less likely in larger firms and are more likely in higher market-to-book firms. The regressions predicting purchase sequences are reported in Panel B. Purchase sequences are negatively related to both analyst coverage and a favorable near-term

earnings surprise across all specifications. They are also less likely in larger firms. We find a marginally significant negative relationship (at the ten percent level) between purchase sequences and market-to-book. Overall, sequences are associated with a number of our proxies for information asymmetry. The most persistent results are that sequences are more likely at smaller firms and less likely when there is a near-term earnings surprise that can eliminate information asymmetry.

We next turn to an analysis of insiders' reporting of their trades. Since 2002, insiders have been required to report their trades to the SEC within two business days, and their disclosure forms are available almost immediately on the SEC's website. As discussed above, a substantial fraction of these forms are reported after the market closes. Motivated by prior literature showing evidence of investor inattention to information that becomes public after business hours, we hypothesize that opportunistic insiders may report their trades in the evening in order to preserve their informational advantage and extend profitable trading sequences. Table 7 presents logistic regressions that test this hypothesis. The specifications are similar to those reported in Table 6, but also include dummy variables indicating whether the first trade of a new trading month was reported to the SEC either in the hour after the market closed (*Reported during 4 pm hour*), or later in the evening (*Reported after 5 pm*).

We find that after-hours reporting is associated with the initiation of trade sequences. The coefficients on the after-hours reporting dummies are consistently positive and significant. Interestingly, this relation is strongest when the trade is reported after 5 p.m. In terms of marginal significance, the regression in Column (3) of Panel A indicates a 10% increase in the odds of at least one follow-on trade month when an insiders reports her initial sale during the 4 p.m. hour, and a 15% increase when the trade is disclosed after 5 p.m.[14] For purchases, the regression in Column (3) of Panel B indicates an increase in the odds of additional sequenced trading of 17% and 20%, respectively, when the trades are reported during the 4 p.m. hour or after 5 p.m.

[14]The marginal effects are calculated using the delta method while holding all other variables at their mean values.

The association between after-hours disclosure and the likelihood of an extended trading sequence raises the possibility that insiders purposefully report after business hours to maximize their trading opportunities. Columns (4) and (5) of Table 7 report regressions with either firm or person fixed effects, and the relation between after-hours reporting and trade sequences persists. This pattern would not be expected if insiders were merely executing pre-planned trading programs without concern for the market impact of their trades. In addition, in unreported analyses, we find that the likelihood an insider reports her trades after business hours is increasing in the number of shares traded. This also would not be expected if disclosure timing were either random or highly persistent by firm or individual.

If corporate insiders are opportunistic when they report their trades, we may also expect after-hours trade reporting to be associated with greater trading profits. We therefore also consider whether the returns associated with insider trading are larger and whether insiders actually trade more shares when they report their trades after the market closes. Table 8 reports regressions of the matching-firm abnormal returns onto a dummy variable indicating whether the first trade of the month was reported after 5 pm. We focus on the first trade of a new trading program because the insiders' behavior at this point should be the best indicator of their intentions when they begin a new trading strategy and minimizes concerns about endogenous choices whether to report subsequent trades after business hours based on market reactions to earlier trades in the same strategy. Panel A presents an analysis of isolated trades. The results in Columns (1) and (2) provide evidence that sales are followed by larger negative abnormal returns when they are reported after 5 p.m., and that this result is robust to the inclusion of firm fixed effects. Column (3) demonstrates that isolated purchases are followed by larger abnormal returns when they are reported after business hours, but Column (4) shows that this result is not robust to firm fixed effects.

Panel B of Table 8 presents an analysis of trade sequences. Here we evaluate the full abnormal return that is apparent from the month following sequence initiation until three months following

sequence completion. In column (1), we find that the overall abnormal return to sales sequences is over twice as large when the first trade is reported after business hours. This result continues to be evident for sales sequences when controlling for firm fixed effects in Column (2). The results for purchase sequences in Columns (3) and (4) show marginally-significant results that the returns associated with purchase sequences are larger when the first trade is reported after business hours. However, as with isolated purchases, this result is not robust to the inclusion of firm fixed effects. For robustness, we present in the Appendix (Panel A of Table A2) similar tests that control instead for whether the insider reported either above 25% (roughly the median) or more than 50% of trades in a sequence after the market closed. The results are qualitatively the same using these alternative measures.[15]

We then turn to an analysis of after-hours reporting and the volume of shares traded or trade days in a sequence. The analysis of share volume is reported in Panel A of Table 9, and an analysis of the number of trading days in a sequence is presented in Panel B. We find strong evidence that both measures are greater when an insider reports trades after the market closes. This is true for both sales and purchase sequences, and is generally robust to the inclusion of firm fixed effects, with the exception of the number of trade days in sales sequences (Panel B, Column (2)). The marginal effects are also economically significant. For example, the coefficients on *Reported after 5 pm* in Panel A translate into marginal increases in shares sold during a sales sequence of 49% and 14%, respectively, when firm fixed effects are excluded and included. The coefficients indicate increases in shares bought in purchase sequences of 159% and 18%. The analysis in Panel B indicates an increase in trade days in sales sequences of 11% when no fixed effects are included, and an increase in purchase days of 22% and 9%, respectively, when firm fixed effects are excluded and included.

A number of robustness tests (which we report in the Appendix) also support this analysis. In

[15]We do not attempt to account for individual fixed effects in our analyses of sequences and after-hours reporting due to the fact that the number of individual traders is high relative to the total number of trading sequences.

Panel B of Table A2, we demonstrate that these results are similar when we replace the variable of interest with a dummy indicating that greater than either 25% or 50% of the trades during a sequence were reported after business hours. Finally, in Panel C Table A2, we evaluate whether after-hours reporting is related to the number of shares reported on that specific disclosure form. We find strong evidence that this is the case. This result also holds when firm fixed effects are included in the regression. Finally, to ensure that this result doesn't merely reflect the fact that trades may be naturally reported later in the same day when an executive trades more heavily, we also show that the result holds when only considering those trades reported on a subsequent day.

Overall, these analyses suggest insiders intentionally reporting their trades after the market closes to maximize their trading profits. After-hours reporting is associated with sequences of trades, more trading during these sequences, and larger abnormal returns. None of these patterns would be expected if the timing of reporting were either random or merely reflected some other institutional detail.

IV. Conclusion

This paper develops new insights about informed trading by corporate insiders by focusing on their trading patterns. The simple intuition motivating this work is an expectation that opportunistic insiders will trade so long as they can maintain an informational advantage. We identify how insiders trade during a short window of time when their trades are motivated by a short-lived informational advantage, and stretch their trades across longer horizons when their informational advantage will persist. Controlling for these patterns, we find strong evidence that both insiders' sales and purchases predict abnormal returns. These results for insiders sales, in particular, is in contrast to prior research failing to control for these patterns.

We find that insiders are more likely to execute extended sequences of trades when their firms' information environment is poorer, and when investors are less attentive. One circumstance that appears to delay investors' recognition of the information conveyed by insiders' trading is when

they report their trades to the S.E.C. after the market has closed, which is a time when investors may be less attentive. We find that the after-hours reporting of trades is associated with heavier overall trading by insiders and larger subsequent abnormal returns. Since the timing of these disclosures is discretionary, this raises the possibility that insiders purposefully manipulate the timing of their disclosures to maximize the duration of their informational advantage and their trading profits.

The analysis of this paper gives us a greater understanding of how insiders exploit their informational advantages. It also shows that informed insider trading may be more frequent than previously supposed. Future researchers may sharpen their research designs and results by accounting for the patterns uncovered here when investigating new hypotheses about informed trading. In addition, regulators and outside investors could benefit from these insights as they pursue the objective of identifying informed trading.

Appendix: Sample Selection and Classification Scheme

Table A1 summarizes the sorting procedure that generates the samples of insider trades for our analysis. Corporate insiders' stock grant and trading data is contained in the Thomson Reuters Insider Filing Data Feed Table 1. Starting with the full dataset, we first eliminate observations that are not open market transactions by limiting the sample to those with *trancode* of "S" (sale) or "P" (purchase), and an *acqdisp* code of "D" (disposition) or "A" (acquisition). We also delete observations missing transactions prices, the number of shares traded, or a six-digit CUSIP identifier. These screens result in a preliminary sample size of 4,669,720 observations. We then link the insider trading data to CRSP and Compustat using the CRSP Stocknames file and the CRSP/Compustat Linking Table. This results in a primary sample that consists of 3,702,691 observations, which represent 1,606,107 individual trading days and 951,769 individual trading months.

We categorize these months as *Sell Only*, *Buy Only*, or *Mixed* based on the activity of the insider over the calendar month. We then categorize the *Sell Only* and *Buy Only* months as either *Isolated* or *Sequenced* trading months. An *Isolated Sell* (*Isolated Purchase*) is where an insider sells (purchases) stock on the open market and has not made a similar transaction in the prior 2 calendar months and does not make a similar transaction in the subsequent 2 calendar months. A *Sequenced Sell* (*Sequenced Purchase*) is where an insider sells or purchases stock on the open market and has made a similar transaction in one of the prior 2 calendar months and/or makes a similar transaction in one of the subsequent 2 calendar months.

We also conduct abnormal return tests on samples of trades classified as *Routine* or *Opportunistic* according to Cohen et al. (2012). To generate these subsamples, we limit the observations of insider transactions that occur after the insider has traded in 3 consecutive calendar years. An insider is classified as a *Routine Trader* after they have a transaction in the same calendar month over three consecutive calendar years; all other insiders are classified as *Opportunistic Traders*. All of the transactions that occur during or after the classification year are "classified" trades. If the insider is never classified as *Routine* then all of these transactions are classified as *Opportunistic*.

Any trades that occur during or after the classification year but prior to the *Routine* classification year are considered *Opportunistic*, and any trades that occur during or after the *Routine* classification year are considered *Routine*. The *Routine* subsample consists of all the transactions by insiders while they are classified as *Routine Traders* and the *Opportunistic subsample* consists of all the transactions by insiders while they are classified as *Opportunistic Traders*.

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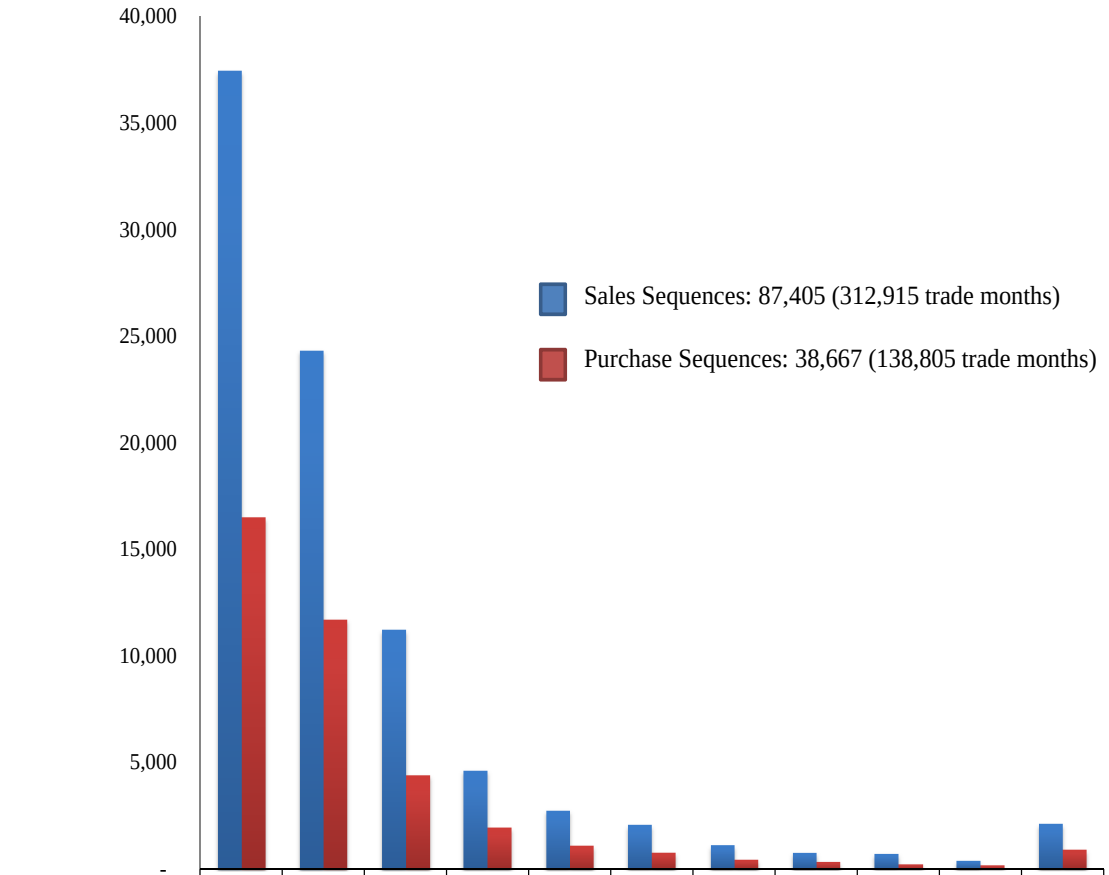
Fig. 1: The figure shows the distribution trade sequences in our sample. A net sales (purchase) month is one where insider sales (purchases) exceed purchases (sales) in that month. We identify an *isolated* trading month as one where insiders did not trade in the month before or after. We identify a *sequenced* trade month as one where the insiders also had net transactions of the same type (sales or purchases) in contiguous months. The chart shows the number of sequences sorted by the total number of contiguous trade months in the sequence.



	2	3	4	5	6	7	8	9	10	11	12+
Sale Sequences	37,448	24,334	11,204	4,592	2,747	2,042	1,106	756	688	391	2,097
Purchase Sequences	16,523	11,737	4,424	1,948	1,120	787	449	337	233	195	914

Sequence Length (Months)

Fig. 2: This figure presents a histogram of the percent of insider trades that are reported to the S.E.C. during different one hour intervals from 6:00 a.m. to 10:00 p.m.

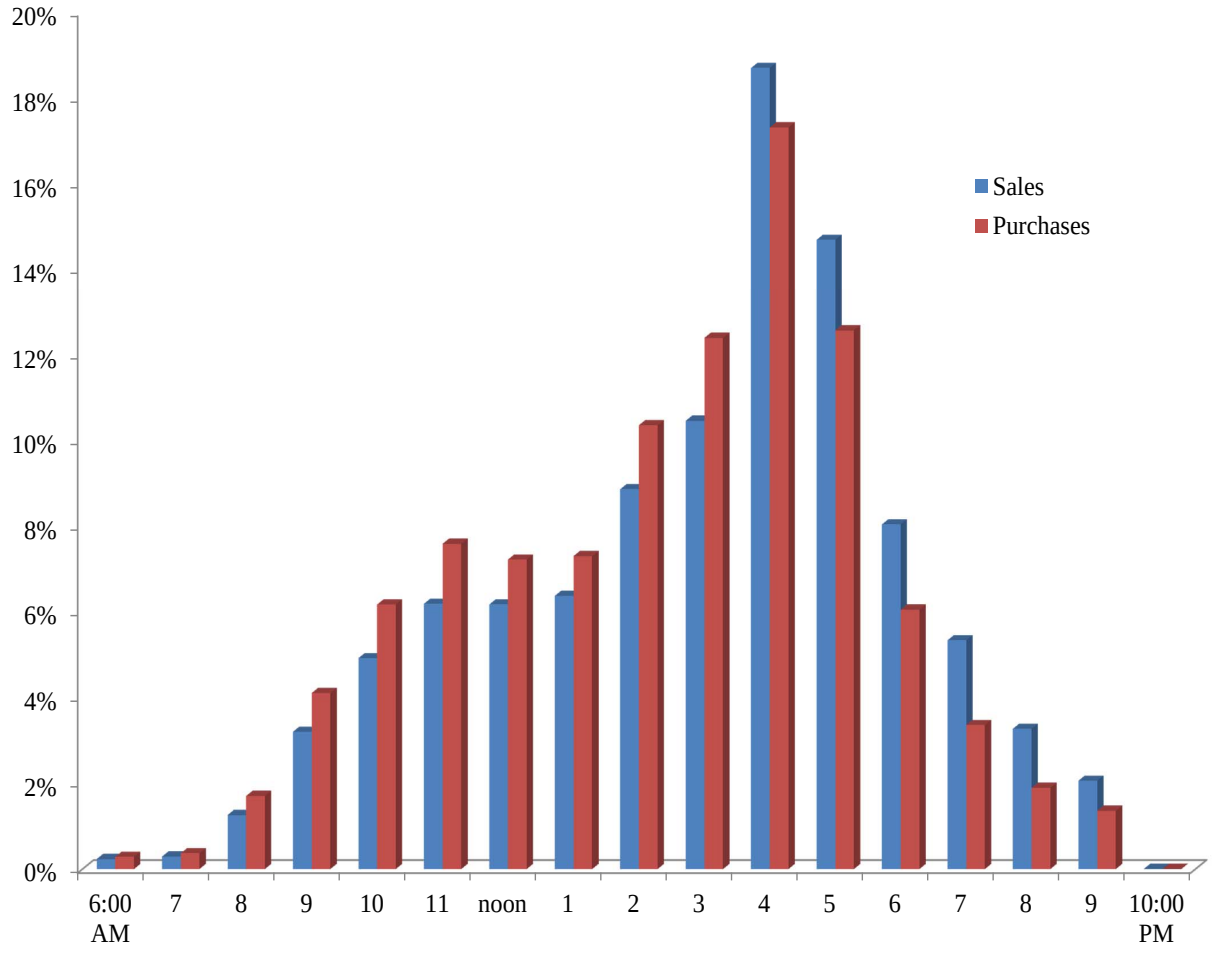


Fig. 3: The figure shows own company stock sales and stock prices for executives at Company A and Company B between December 2004 and July 2005. (Price = 1 on 02/01/2005)

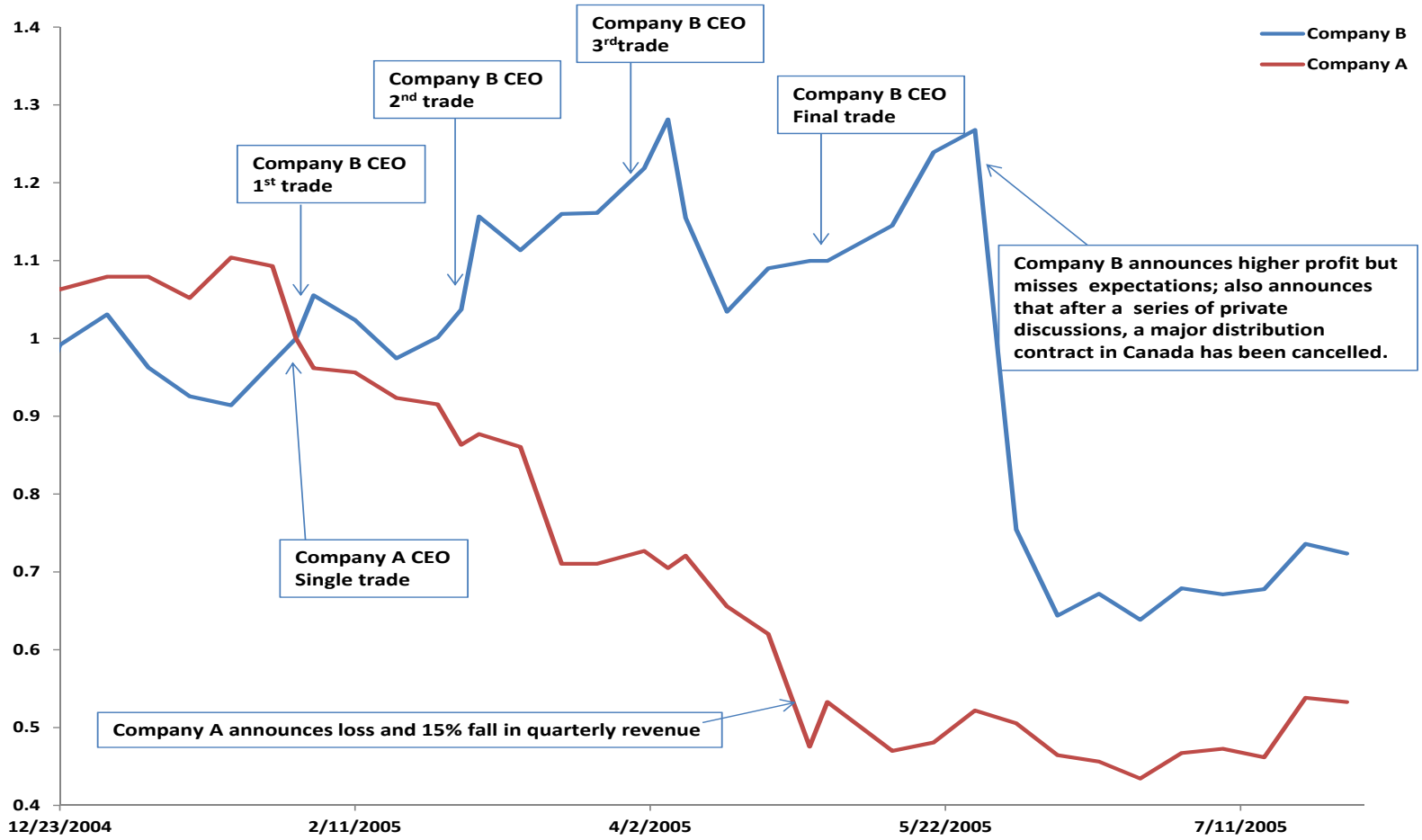


Table 1

Summary Statistics

The table presents a summary of the sample we use in this paper, and shows the distribution of isolated and sequenced trades. We identify an isolated sale (purchase) month as one where insiders did not sell (buy) in the two months before or after. We identify a sequenced sale (purchase) as one where the insiders also had net sales (purchases) in either of the two months before or after the trade month. The Cohen et al routine and opportunistic trade months are as defined in Cohen et al. (2012). Details regarding the sample selection process are provided in the Appendix. *a* represents significance at the 1% level.

Panel A: Sale Transactions by Insiders

	Isolated Trades		Sequenced Trades			
	Mean	Median	Mean	Median	Diff. in Means	Diff. in Means $t-$statistic
Firms	11,826		9,042			
Insiders	114,380		47,218			
CEO/COB	10,567		5,258			
Top Executives	25,954		11,905			
All Others	101,219		37,952			
Number of Shares Traded	153,954	10,000	278,550	37,235	(124,596)[a]	(11.64)
Number of Trade Days	1.43	1.00	6.64	4.00		
Months in Sequence			3.58	3.00		
Market Value of Equity ($Mil.)	6,109	816	5,048	642.96	1,061[a]	(13.04)
Book Equity/Market Equity	0.44	0.35	0.40	0.32	0.037[a]	(9.30)
Prior 6 Month Return	21.9%	13.4%	23.4%	13.1%	−1.41%[a]	(6.21)
Num. of Person-Firm-Months with Trading	344,149		268,109			
Cohen et al – Routine	12,297		19,055			
Cohen et al – Opportunistic	35,959		32,562			
Number of Trade Events	344,149		87,405			

Panel B: Purchase Transactions by Insiders

	Isolated Trades		Sequenced Trades			
	Mean	Median	Mean	Median	Diff. in Means	Diff. in Means $t-$statistic
Firms	12,419		8,250			
Insiders	90,988		23,065			
CEO/COB	10,743		3,321			
Top Executives	23,466		6,087			
All Others	76,256		17,679			
Number of Shares Traded	72,940	2,000	243,518	11,000	(170,578)[a]	(4.96)
Number of Trade Days	1.24	1.00	6.41	3.00		
Months in Sequence			3.59	3.00		
Market Value of Equity ($Mil.)	2,004	151	1,258	98.83	745.7[a]	(13.27)
Book Equity/Market Equity	0.77	0.59	0.82	0.62	(0.045)[a]	(6.06)
Prior 6 Month Return	−1.0%	−3.0%	−0.1%	−2.9%	−0.83%[a]	(3.32)
Num. of Person-Firm-Months with Trading	217,611		117,767			
Cohen et al – Routine	9,967		14,121			
Cohen et al – Opportunistic	19,240		12,071			
Number of Trade Events	217,611		38,667			

Panel C: Firm Month Categorization

	Sale Months		Purchase Months	
	Isolated	Sequenced	Isolated	Sequenced
Cohen et al opportunistic sample	31,024	28,256	17,192	11,021
Cohen et al routine sample	10,847	16,208	7,407	10,353

Table 2

Portfolio returns following isolated and sequenced trades.

The table shows monthly abnormal return associated with insiders' trades. Firms with isolated trades are added to the portfolio in the month after the trade and kept in the portfolio for a month. Firms with sequenced trades are kept in the portfolio for the different time-periods shown in the tables. We report the alphas (αs) from a regression of portfolio returns on the market factor, the return difference between a portfolio of "small" and "big" stocks, the return difference between a portfolio of "high" and "low" book-to-market stocks from Fama and French (1993), augmented with a momentum factor from Carhart (1997). t-statistics are reported in parentheses. a, b and c represent significance at the 1%, 5% and 10% levels respectively.

Panel A: Portfolio returns following isolated and sequenced trades

	All	Isolated	Sequences			
			During sequence	One month following sequence	Three months following sequence	From beginning to three months following sequence
Sales						
CAPM	−0.000605	−0.00593^a	0.00722^a	−0.0129^a	−0.0134^a	−0.00234
	(−0.416)	(−4.363)	(4.123)	(−7.113)	(−8.757)	(−1.494)
Fama-French 3 Factors	−0.00107^c	−0.00683^a	0.00688^a	−0.0135^a	−0.0136^a	−0.00247^a
	(−1.724)	(−8.679)	(7.818)	(−11.03)	(−18.03)	(−3.890)
Carhart 4 Factors	−0.000648	−0.00611^a	0.00738^a	−0.0123^a	−0.0130^a	−0.00217^a
	(−0.930)	(−6.457)	(8.274)	(−9.906)	(−15.84)	(−3.189)
Purchases						
CAPM	0.0123^a	0.0149^a	0.00688^a	0.0177^a	0.0133^a	0.00910^a
	(7.021)	(8.529)	(3.661)	(7.546)	(6.942)	(4.994)
Fama-French 3 Factors	0.0108^a	0.0136^a	0.00519^a	0.0160^a	0.0120^a	0.00769^a
	(7.667)	(9.569)	(3.417)	(8.002)	(7.522)	(5.142)
Carhart 4 Factors	0.0132^a	0.0160^a	0.00739^a	0.0189^a	0.0146^a	0.0102^a
	(8.863)	(10.75)	(4.668)	(9.015)	(8.849)	(6.564)

Panel B: Long – Short Portfolios

(Long = Buy Isolated/Sequence End; Short = Sell Isolated/Sequence End)

CAPM	Fama-French	Carhart 4 Factors
0.0248^a	0.0242^a	0.0261^a
(21.25)	(20.89)	(23.25)

Table 3

Characteristic-matched abnormal returns following isolated and sequenced trades.

The table shows the characteristic-matched abnormal returns associated with corporate insiders' stock trades. The abnormal returns are measured relative to a portfolio of stocks in the same size, book-to-market and previous 12-month momentum quintile. The benchmarks for the size and book-to-market quintiles are as described in Daniel et al. (1997) and Wermers (2004) while the benchmark for momentum is based on stock returns in the 12 months prior to the trading month. Panel A begins by showing abnormal returns following isolated trading months. It then presents abnormal returns following individual sequenced trading months (All), following only those sequenced trade months that precede the end of trade sequences (During), and following the end of trade sequences (Following). Panel B shows the buy-and-hold abnormal returns (BHAR) beginning the calendar month after a sequence of trades begins and ending three months following sequence ends. Standard errors are clustered at both the firm and month level and *t*-statistics are reported in parentheses. *a*, *b*, and *c* represent significance at the 1%, 5% and 10% levels, respectively.

Panel A: Abnormal returns relative to matching firms

	Isolated Sells	Sequenced Sells		
		All	During	Following
1 Month Abnormal Return	−0.00815[a]	0.00326[a]	0.0122[a]	−0.0145[a]
	(−15.46)	(5.255)	(16.79)	(−15.52)
Number of Observations	249,834	181,982	121,120	60,862
	Isolated Buys	Sequenced Buys		
		All	During	Following
1 Month Abnormal Return	0.0161[a]	0.00678[a]	0.00212[c]	0.0168[a]
	(17.01)	(6.308)	(1.662)	(9.691)
Number of Observations	137,106	80,059	54,692	25,367

Panel B: Buy and hold abnormal returns following the beginning of sequences

	Sales Sequences	Purchase Sequences
BHAR Total	−0.0202[a]	0.0506[a]
	(−9.267)	(11.95)
BHAR / Months in Sequence	−0.0052[a]	0.0108[a]
	(−12.25)	(12.99)
Number of Observations	39,265	19,678

Table 4

Portfolio returns following isolated and sequenced trades – subsample analysis.

The table shows four-factor abnormal returns following subsamples of insiders' trades. Firms with isolated trades are added to the isolated trades in the month after the isolated trade and kept in the portfolio for a month. Firms with sequenced trades are added in the month following the sequence end and kept in the portfolio for three months. The portfolios are rebalanced monthly. The Cohen et al routine and opportunistic trades are as defined in Cohen et al. (2012). *t*-statistics are reported in parentheses. *a*, *b* and *c* represent significance at the 1%, 5% and 10% levels respectively.

	Full sample	Large firms	Small firms	1986–2002	2003–2012	Executive Team	CEO or Chairman	CEO (Post 1995)	Cohen et al (2012) Routine	Cohen et al (2012) Opportunistic
Isolated Sales										
alpha (α)	−0.00611^a	−0.00519^a	−0.00658^a	−0.00641^a	−0.00574^a	−0.00886^a	−0.00998^a	−0.00980^a	−0.00689^a	−0.00694^a
t-stat	(−6.457)	(−6.298)	(−3.747)	(−4.067)	(−6.537)	(−9.944)	(−8.467)	(−6.891)	(−3.395)	(−6.226)
Sequenced Sales										
alpha (α)	−0.0123^a	−0.00452^a	−0.0127^a	−0.0118^a	−0.0135^a	−0.0189^a	−0.0224^a	−0.0246^a	−0.0135^a	−0.0123^a
t-stat	(−9.906)	(−2.774)	(−5.643)	(−6.118)	(−8.107)	(−11.25)	(−11.31)	(−10.04)	(−5.425)	(−7.217)
Isolated Buys										
alpha (α)	0.0160^a	0.00741^a	0.0208^a	0.0204^a	0.00915^a	0.0241^a	0.0240^a	0.0248^a	0.0144^a	0.0197^a
t-stat	(10.75)	(6.263)	(10.13)	(8.336)	(6.318)	(11.34)	(9.007)	(7.200)	(6.235)	(10.06)
Sequenced Buys										
alpha (α)	0.0189^a	0.0117^a	0.0201^a	0.0235^a	0.0119^a	0.0221^a	0.0216^a	0.0233^a	0.0157^a	0.0254^a
t-stat	(9.015)	(3.485)	(7.417)	(7.327)	(4.208)	(7.500)	(6.104)	(5.291)	(4.302)	(7.719)

Table 5

A comparison to the returns following insider "silence".

The table contrasts the abnormal returns following a period of insider "silence" (i.e., months with no insider trades) to those following insider sales. Column (1) shows the abnormal returns following periods of different lengths of no insider trading, and column (2) shows the return from a portfolio that is long the firms where insiders have been silent and short firms following isolated sales or the ends of sales sequences in the previous month. We report the alphas (αs) from a regression of portfolio returns on the market factor, the return difference between a portfolio of "small" and "big" stocks, the return difference between a portfolio of "high" and "low" book-to-market stocks from Fama and French (1993), augmented with a momentum factor from Carhart (1997).

	(1)	(2)
	Cahart 4-factor alpha (α) Silence	Long silence/ Short isolated or sequence end
Silence for 1 month	−2.51e-06	0.00619[a]
	(−0.00356)	(8.929)
Silence for 3 months	−0.000701	0.00549[a]
	(−0.931)	(7.461)
Silence for 6 months	−0.00171[b]	0.00448[a]
	(−2.089)	(5.511)
Silence for 12 months	−0.00375[a]	0.00244[a]
	(−4.324)	(0.00792)

Table 6

Predicting insider trading patterns.

The table reports logit regressions predicting whether new trading initiates an extended trade sequence. Panel A reports regressions for sales and Panel B reports regressions for purchases. The dependent variable is equal to one if the trade month begins a sequence and is zero if it represents an isolated trade. Log(# of Analysts) is the natural log of one plus the average number of analysts that provided fiscal quarter-end forecasts for the firm. Near-term earnings surprise dummy equals one if the observation was a sale (purchase) month and the firm misses (beats) earnings expectation for the fiscal quarter of the trade, and zero otherwise. Ln(market cap) is the natural log of the firms' market value of equity, and Ln(market equity/book equity) is the natural log of firms' market-to-book equity ratio. *t*-statistics are reported in parentheses and are based on robust standard errors. *a*, *b*, and *c* represent significance at the 1%, 5% and 10% levels, respectively.

Panel A: Sales Months

VARIABLES	(1)	(2)	(3)	(4)
Ln(# of Analysts)	-0.043^{a}		-0.059^{a}	0.024^{a}
	(−8.64)		(−11.72)	(3.53)
Near-term earnings surprise dummy		-0.205^{a}	-0.223^{a}	-0.206^{a}
		(−19.50)	(−21.02)	(−19.39)
Ln(market cap)				-0.151^{a}
				(−23.70)
Ln(market equity/book equity)				0.213^{a}
				(28.22)
Constant	-1.300^{a}	-1.320^{a}	-1.210^{a}	-1.512^{a}
	(−130.56)	(−246.30)	(−112.45)	(−103.55)
Observations	292,812	292,812	292,812	292,812
Pseudo R-squared	0.000253	0.00132	0.00178	0.00597

Panel B: Purchases Months

VARIABLES	(1)	(2)	(3)	(4)
Ln(# of Analysts)	-0.188^{a}		-0.184^{a}	-0.142^{a}
	(−21.64)		(−21.06)	(−12.27)
Near-term earnings surprise dummy		-0.124^{a}	-0.096^{a}	-0.095^{a}
		(−7.63)	(−5.91)	(−5.84)
Ln(market cap)				-0.073^{a}
				(−4.97)
Ln(market equity/book equity)				-0.031^{c}
				(−1.95)
Constant	-1.600^{a}	-1.761^{a}	-1.559^{a}	-1.532^{a}
	(−127.00)	(−160.02)	(−109.76)	(−71.45)
Observations	127,736	127,736	127,736	127,736
Pseudo R-squared	0.00453	0.000566	0.00487	0.00519

Table 7

Insider trading patterns and SEC reporting time-stamps.

The table reports logit regressions predicting whether or not a trade is an isolated trade or part of a sequence. Panel A reports regressions for sales and Panel B reports regressions for purchases. The dependent variable is one if the trade is part of a sequence and zero if the trade is an isolated trade. Log(# of Analysts) is the natural log of one plus the average number of analysts that provided fiscal quarter-end forecasts for the firm in the fiscal year before the trade month. Near-term earnings surprise dummy equals one if the observation was a sale (purchase) month and the firm misses (beats) earnings expectation for the fiscal quarter of the trade, and zero otherwise. Ln(market cap) is the natural log of the firms' market value of equity, and Ln(book equity/market equity) is the natural log of firms' book-to-market equity ratio. The standard errors are robust and are clustered at the monthly level. *t*-statistics are reported in parenthesis. *a*, *b*, and *c* represent significance at the 1%, 5% and 10% levels, respectively. Reported in 4:00 pm hour is a dummy variable indicating that the first trade of the month was reported to the S.E.C. during the 4:00 pm hour. Reported after 5:00 pm is a dummy variable indicating that the first trade of the month was reported to the S.E.C. after 5:00 pm. *t*-statistics are reported in parentheses and are based on robust standard errors. *a*, *b*, and *c* represent significance at the 1%, 5% and 10% levels, respectively.

Panel A: Sales Months

VARIABLES	(1)	(2)	(3)	(4)	(5)
Reported in 4 pm hour	0.137^a	0.128^a	0.123^a	0.081^a	0.052^b
	(7.73)	(7.22)	(6.94)	(4.05)	(2.13)
Reported after 5 pm	0.206^a	0.186^a	0.180^a	0.086^a	0.056^b
	(13.88)	(12.48)	(12.01)	(4.74)	(2.52)
Ln(# of Analysts)			0.030^a		
			(2.95)		
Near-term earnings surprise dummy			−0.228^a		
			(−14.40)		
Ln(market cap)		−0.140^a	−0.165^a	−0.246^a	−0.058^b
		(−21.24)	(−19.29)	(−8.77)	(−2.14)
Ln(market equity/book equity)		0.220^a	0.210^a	0.114^a	0.034
		(19.30)	(18.21)	(4.99)	(1.27)
Constant	−1.416^a	−1.540^a	−1.497^a		
	(−143.20)	(−83.31)	(−65.56)		
Observations	138,338	138,338	138,338	133,607	74,287
Pseudo R-squared	0.00141	0.00652	0.00816	0.000895	0.000218
Fixed Effects				Firm	Person

Panel B: Purchases Months

VARIABLES	(1)	(2)	(3)	(4)	(5)
Reported in 4 pm hour	0.151^a	0.171^a	0.180^a	0.145^a	0.102^c
	(4.13)	(4.65)	(4.90)	(3.44)	(1.90)
Reported after 5 pm	0.178^a	0.191^a	0.210^a	0.192^a	0.088^c
	(5.57)	(5.95)	(6.51)	(4.82)	(1.71)
Ln(# of Analysts)			−0.162^a		
			(−8.57)		
Near-term earnings surprise dummy			−0.126^a		
			(−4.58)		
Ln(market cap)		−0.228^a	−0.098^a	−0.083	−0.012
		(−11.16)	(−4.13)	(−0.93)	(−0.19)
Ln(market equity/book equity)		−0.100^a	−0.077^a	−0.066	−0.042
		(−3.67)	(−2.82)	(−1.17)	(−0.72)
Constant	−1.953^a	−1.710^a	−1.555^a		
	(−106.42)	(−50.07)	(−41.98)		
Observations	47,267	47,267	47,267	35,890	15,190
Pseudo R-squared	0.00102	0.00669	0.00945	0.00121	0.000491
Fixed Effects				Firm	Person

Table 8

Abnormal returns when trades are reported after business hours

The table evaluates the relation between characteristic-matched abnormal returns and trades reported after business hours for both isolated insider trades and trade sequences. The abnormal returns are calculated as in Table 3. For isolated trade months, *Reported after 5 pm* is an indicator variable set to one when the first trade of the month is reported to the SEC after 5 pm. For sequences, we make this distinction based on the first trade in the sequence. Panel A shows the results for returns in the month following isolated trades. Panel B shows the results for buy-and-hold abnormal returns (BHAR) beginning in the calendar month following the first trade and ending three months after the trading sequence ends. Columns 2 and 4 in each panel control for firm-level fixed effects. *t*-statistics are reported in parentheses. *a*, *b* and *c* represent significance at the 1%, 5% and 10% levels respectively.

Panel A: Isolated Trades

	1-month abnormal returns relative to DGTW portfolio returns			
	Isolated Sales Months		Isolated Purchase Months	
	(1)	(2)	(3)	(4)
Reported after 5 pm	−0.00152^a	−0.00119^c	0.00392^b	−0.000354
	(−2.649)	(−1.863)	(2.562)	(−0.214)
Constant	−0.00435^a		0.00848^a	
	(−13.24)		(11.16)	
Observations	120,447	120,447	53,133	53,133
R-squared	0.000	0.000	0.000	0.000
Fixed Effect		firm		firm

Panel B: Sequenced Trades

	Buy and hold abnormal returns from beginning of sequence			
	Sales Sequences		Purchase Sequences	
	(1)	(2)	(3)	(4)
Reported after 5 pm	−0.0203^a	−0.0119^b	0.0187^c	0.0216
	(−4.497)	(−2.256)	(1.657)	(1.438)
Constant	−0.0146^a		0.00769	
	(−5.676)		(1.357)	
Observations	17,001	17,001	5,743	5,743
R-squared	0.001	0.000	0.001	0.001
Fixed Effect		firm		firm

Table 9

Reporting after business hours and sequenced trading activity

The table evaluates the relation between after-hours trade reporting and trading activity in trade sequences. For isolated trade months, Reported after 5 pm is an indicator variable set to one when the first trade of the month is reported to the SEC after 5 pm. For sequences, we make this distinction based on the first trade in the sequence. The dependent variable in the Panel A regressions is the natural log of the total number of shares traded by an insider over a sequence. In Panel B, the dependent variable is the natural log of the number of trading days over each sequence. Columns 2 and 4 in each panel control for firm-level fixed effects. *t*-statistics are reported in parentheses. *a*, *b* and *c* represent significance at the 1%, 5% and 10% levels respectively.

Panel A: Shares Traded During Sequences

	Ln(Number of Shares Traded Over Sequence)			
	Sales Sequences		Purchase Sequences	
	(1)	(2)	(3)	(4)
Reported after 5 pm	0.397^a	0.127^a	0.951^a	0.164^b
	(14.42)	(4.341)	(12.59)	(2.378)
Constant	10.52^a		9.126^a	
	(650.9)		(254.7)	
Marginal Effect (%)	48.74%	13.54%	158.83%	17.82%
Observations	17,001	17,001	5,743	5,743
R-squared	0.012	0.001	0.030	0.002
Fixed Effect		firm		firm

Panel B: Number of Trades During Sequences

	Ln(Number of Trading Days Over the Sequence)			
	Sales Sequences		Purchase Sequences	
	(1)	(2)	(3)	(4)
Reported after 5 pm	0.101^a	0.0193	0.201^a	0.0870^a
	(7.744)	(1.296)	(7.426)	(2.773)
Constant	1.401^a		1.385^a	
	(184.4)		(110.0)	
Marginal Effect (%)	10.63%	1.95%	22.26%	9.09%
Observations	17,001	17,001	5,743	5,743
R-squared	0.004	0.000	0.011	0.002
Fixed Effect		firm		firm

Table A1. Sample selection
The table outlines the selection process that for the sample that is summarized in Table 1.

	Observations	
TFN – Table 1	13,210,799	
Observations eliminated by primary filters	8,541,079	
Sample size (post primary filters)	4,669,720	
Observations not linked to CRSP Permno	814,694	
Observations not linked to Compustat	152,335	
Sample Size	3,702,691	
Number of trade-days (individual/firm level)	1,606,107	
Number of trade-months (individual/firm level)	951,769	
Number of trade-months (firm level)	468,789	
Break down of trade-months (individual/firm level)		
Sell only	612,258	
Buy only	335,378	
Both buy and sell	4,133	
Total	951,769	
Break down of trade-months (individual/firm level)		
Sell only months		
Isolated	344,149	56%
Sequence – Beginning and Middle	180,704	30%
Sequence – End	87,405	14%
Buy only months		
Isolated	217,611	65%
Sequence – Beginning and Middle	79,100	24%
Sequence – End	38,667	12%
Total (*Buy and Sell only months*)	947,636	
Break down of trade-months (individual/firm level)		
Cohen et al (2012) Routine	55,840	
Cohen et al (2012) Opportunistic	100,282	
Total Cohen Classified	156,122	

Table A2. Evaluation of abnormal returns and trading volume using alternative measures of after-hours reporting.

In this table we provide robustness checks of the relations between after-hours trade reporting and the abnormal returns associated with insider trading or trading volume. Panel A provides alternative analyses of the BHARs associated with trade sequences. The indicator *After 5 PM Ratio At or Above Median* is set to one when the fraction of trades in a sequence reported to the SEC after 5 pm is at our above 25%, which is the sample median. The indicator *After 5 PM Ratio Above 50%* is set to one when the fraction of trades in a sequence reported to the SEC after 5 pm is above 50%. Panel B provides alternative regressions evaluating the total number of shares traded during sequences and the number of trades made during sequences. Panel C presents an analysis of the number of shares traded on individual trade days as a function of the time the transactions are reported to the SEC. *Reported after 5 pm* is an indicator variable set to one when any transaction from the trade day is reported to the SEC after 5 pm. In columns 3 and 4 of Panel C, we limit the sample to trade days where reporting to the SEC does not occur on the same day as the reported transactions. *t*-statistics are reported in parentheses. *a*, *b* and *c* represent significance at the 1%, 5% and 10% levels respectively.

Panel A: Sequence Abnormal Returns

	Buy and hold abnormal returns from beginning of sequence			
	Sales Sequences		Purchase Sequences	
	(1)	(2)	(3)	(4)
After 5 PM Ratio At or Above Median	−0.00986^{b}		0.0122	
	(−2.341)		(1.209)	
After 5 PM Ratio Above 50%		−0.0153^{a}		0.0131
		(−3.487)		(1.215)
Constant	−0.0167^{a}	−0.0159^{a}	0.00779	0.00895
	(−5.856)	(−5.970)	(1.256)	(1.535)
Observations	17,001	17,001	5,743	5,743
R-squared	0.000	0.001	0.000	0.000

Panel B: Sequence Total Shares Traded and Number of Trades

	Ln(Number of Shares Traded Over Sequence)				Ln(Number of Trading Days Over the Sequence)			
	Sales Sequences		Purchase Sequences		Sales Sequences		Purchase Sequences	
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
After 5 PM Ratio At or Above Median	0.444^{a}		1.044^{a}		0.145^{a}		0.189^{a}	
	(17.00)		(15.93)		(11.79)		(8.137)	
After 5 PM Ratio Above 50%		0.553^{a}		1.408^{a}		0.200^{a}		0.370^{a}
		(18.70)		(16.08)		(14.01)		(11.63)
Constant	10.43^{a}	10.51^{a}	8.957^{a}	9.118^{a}	1.361^{a}	1.382^{a}	1.362^{a}	1.370^{a}
	(553.7)	(692.3)	(230.9)	(269.5)	(155.8)	(196.2)	(97.09)	(115.3)
Marginal Effect (%)	55.89%	73.85%	184.06%	308.78%	15.60%	22.14%	20.80%	44.77%
Observations	17,001	17,001	5,743	5,743	17,001	17,001	5,743	5,743
R-squared	0.017	0.021	0.044	0.051	0.008	0.012	0.012	0.029

Panel C: Number of Shares Traded

	Ln(Number of Shares Traded During Tradeday)			
	(1)	(2)	(3)	(4)
Reported after 5 pm	0.482^{a}	0.160^{a}	0.478^{a}	0.166^{a}
	(24.50)	(14.05)	(24.66)	(13.76)
Constant	8.469^{a}		8.520^{a}	
	(545.4)		(531.7)	
Sample	No limitations		No transactions where trandate=SECdate	
Marginal Effect (%)	61.93%	17.35%	61.28%	18.06%
Observations	595,913	595,913	506,441	506,441
R-squared	0.013	0.002	0.012	0.002
Fixed Effect		firm		firm