Insider Trading Patterns[☆]

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Abstract

We analyze the information content of corporate insiders' trades after accounting for certain trading patterns. We find that insiders trades over longer periods of time when they may have a longer-lived informational advantage and when outside investors are less attentive. We also find evidence that insiders are more likely to trade in extended sequences when they disclose their trades after market hours, which is when investors may be less attentive. Both isolated trades and trade sequences (those spread over multiple consecutive months) predict sizable abnormal returns; although for sequences, these abnormal returns are manifest only following the completion of the sequence. The return patterns we identify continue to hold for a large group of insiders that would have been classified as "routine" traders by prior research, suggesting that informed insider trading may be more widespread than previously identified.

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I. Introduction

Academic research has contributed toward our understanding of the scope and scale of informed insider trading. It has commonly been found that insider stock purchases are followed by positive abnormal returns, suggesting they are motivated by an informational advantage. However, the evidence with respect to stock sales in general has been mixed. Some researchers have uncovered evidence of informed trading under uncommon circumstances such as merger negotiations or accounting fraud. Recently researchers have turned their attention to predicting which trades are likely to be informed based on the previous trading behavior of the specific insider. More recent work argues that at least some of insiders profitable trading result from their ability to trade quickly on public information.[1]

However, prior research has often ignored potential heterogeneity in insiders' trading patterns, and has therefore likely been handicapped in its ability to detect evidence of profitable trading.[2] Most prior studies have typically used a uniform method to identify a trade (or trading period) and abnormal returns are measured across a uniform window following trades.[3]

The intuition motivating this work is simple: we expect opportunistic insiders to trade so long as they have an informational advantage. When insiders have a short-lived informational advantage, we expect them to engage in isolated, even singular trades. We call this pattern *isolated trading*. In contrast, we expect insiders with an informational advantage that can be maintained for longer (either because the market is inattentive to the trading, or because the type of infor-

[1]Examples of work in this area include Lorie and Niederhoffer (1968); Jaffe (1974); Finnerty (1976); Seyhun (1986, 1992, 1998); Chowdhury, Howe, and Lin (1993); Bettis, Vickrey, and Vickery (1997); Lakonishok and Lee (2001); Jeng, Metrick, and Zeckhauser (2003); Agrawal and Cooper (2008); Agrawal and Nasser (2012); Cohen, Malloy, and Pomorski (2012); Alldredge and Cicero (2015), among others.

[2]We do not try to distinguish between trades that are informed by private information and those that are informed by public information. The conclusions in this paper with respect to the duration of an insiders' informational advantage vis-a-vis outside investors should apply in either situation. As used throughout, the term "informed" is meant generally to represent both possibilities.

[3]Recent work on informed stock option exercises highlights the importance of controlling for insiders' trading strategies in that related context, although the strategies explored there are unique to options (Cicero, 2009; Dhaliwal, Erickson, and Heitzman, 2009).

mation motivating the trades will not soon be disclosed) to exploit their advantage by engaging in an extended sequence of trades, perhaps over several months. We term this pattern *sequenced* trading. Based on this intuition, we evaluate whether insiders' exploit longer-lived informational advantages by engaging in extended trading sequences, if they appear to attempt to optimize their trading advantage, and whether they earn abnormal returns.

For concreteness, consider 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 six months or more. The trading patterns of these executives 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 once 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 spread trades 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).

Given the difference in the nature of the information animating isolated and sequenced trading patterns, we make two predictions with respect to the abnormal returns that we will observe following informed insider trading. We predict that isolated trades will be followed very quickly by abnormal returns that are negative (positive) for insider sales (purchases). In contrast, we predict that there will no abnormal returns following insider trades during a sequence, but that the completion of a sequence will be followed by abnormal returns similar to those observed for isolated trades. In addition, if insiders' trade sequences are motivated by an informational advantage, we expect to find that they eventually earn abnormal returns relative to the time they begin trading.

We base most of our analysis on insiders' trades that would not be classified as "routine"

according to prior research. Cohen et al. (2012) show that both the trades of insiders who do not appear to trade for routine purposes in fact predict abnormal returns (they classify traders as routine if they appear to systematically trade in the same calendar months). In contrast, the trades of the systematic traders do not predict abnormal return when they are treated as independent observations. We find that a large fraction of the trades of non-systematic traders are sequenced. Under a definition allowing for no calendar-month-long breaks, sequence trade months make up approximately one-quarter of our samples and the sequences average about three months in length. Combining sales and purchases, there are 227,000 isolated trade months and 70,000 sequenced trade months. Trading days are also more frequent during sequenced trade months, accounting for about forty percent of overall trade days. In our samples, there are 558,000 trade days in isolated trading months, and 345,000 trade days in sequenced trading months.

Before examining abnormal return patterns, we first examine the factors which predict whether or not trades were isolated or sequenced. We find that trade sequences are more likely in firms that are smaller, have higher market-to-book equity values, and are followed by fewer analysts. To the extent that these factors proxy for the firm's information environment, these results suggest that a sequence of trades is more likely in firms where greater information asymmetry means that insiders can maintain an informational advantage for longer. We also find that sequences of trades are less likely than isolated trades to be followed by an immediate earnings surprise. This finding highlights the fact that routine information with valuation consequences is revealed sooner after isolated trades.

Interestingly, we also find that an insider is more likely to engage in an extended sequence of trades when they report their trades to the Securities and Exchange Commission (SEC) after the market has closed. As others have argued, investors are likely more attentive during market hours, and may therefore be less likely to timely interpret the information that is signaled by insiders'

trades when they are reported during a period of relative inattention.[4] This relation suggests the possibility that insiders may purposefully report their trades after hours in order to minimize market impact and maximize their opportunities to profit. Although there isn't enough evidence to assert this conclusion with certainty, a couple of additional results suggest it's plausibility. For one, we find that 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. In addition, we find that the likelihood an insider reports her trades after hours is increasing in the number of shares traded. This also would not be expected if the timing of reporting were random, and it seems plausible that it reflects an attempt to minimize the market impact of the stronger signals of their view of firm value in order to maximize trading opportunities.

We next evaluate the information content of insiders' trades in this context. An analysis of the returns following insider trades over the period 1986–2010 strongly suggest that insiders are opportunistic when they engage in both isolated trades and trade sequences. As we predict, in the month following isolated insider stock sales, we find significant negative abnormal returns of around 120 basis points. This suggests that isolated insider sales are more likely to precede information that is quickly incorporated into market prices. We find a similar pattern with insider purchases: isolated trade months are followed by positive returns of around 150 basis points while individual sequenced trade months are followed by abnormal returns of around 90 basis points. Overall, estimates of monthly abnormal returns following isolated insider stock sale (purchase) months around -100 basis points (150 basis points) greater in magnitude than those following individual trade months that are sequenced.

Upon closer examination, we find that trade sequences also predict future returns. In line with our predictions, while abnormal returns *during* a sequence do not predict near-term abnormal

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

returns, we find significant abnormal returns *following the completion* of sequences. This suggests that the overall trade sequence was indeed motivated by an informational advantage regarding firm value. In the three months following the completion of a sequence of insider sales (purchases), we find negative (positive) abnormal returns of around 200 basis points (300 basis points). To give an idea of just how informative completed sequenced trades are, a long-short portfolio (sequenced buys *minus* sequenced sales) formed and held for a month, after waiting one month to confirm the end of a sequence, earns abnormal returns of 171 basis points per month (t = 6.90, 22.6% annualized).

Throughout our analysis we present results for the full set of insiders required to report their trades, and also for just the trades of top executives. While a broad cross-section of insiders may have access to short-lived information that is soon revealed to the market, senior executives are more likely to be privy to the kind of information that will take longer to be revealed (e.g. a change in strategic direction, potential loss of a major customer, etc.). In most of our analysis, we find more pronounced abnormal returns following sequenced trades by firms' most senior executives.[5] For example, a long-short portfolio of stocks formed the month after the end of trade sequences by senior executives and held for a month (sequenced buys *minus* sequenced sales) earns abnormal returns of 237 basis points per month (t = 4.15, 32.5% annualized).

Finally we consider whether, once insiders' trading patterns are accounted for, there is actually evidence of opportunistic behavior among the group of insiders previously thought to trade only for routine purposes. However, once we account for trade sequences, we find compelling evidence that these traders also engage in opportunistic trading on average: isolated purchases and sales, as well as purchase and sale sequences, continue to predict sizable abnormal returns among this subsample. As we discuss in Section IV.C, these results were previously masked because each trade month was treated as an independent observation. A rule for identifying "routine" traders based

[5]Senior executives include the chief executive officer, chairman of the board, chief financial officer, president, chief operating officer, and general counsel.

on trade frequency naturally picks up more sequence traders because they trade more frequently, and the higher proportion of intra-sequence trade months biases abnormal return tests toward zero. These results highlight the importance of accounting for insiders' trading patterns, expand the set of insiders that should be considered possibly informed traders, and demonstrate a need for more accurate methods of identifying those insiders who trade their stock for reasons other than an informational advantage.

This paper contributes to our understanding of how insiders structure their trading behavior to maximize their utility. 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.

The findings of this paper 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 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.

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

A large body of research has examined the information content of insider trades. In early studies, abnormal returns following both insider purchases and sales suggested they were informed transactions (Lorie and Niederhoffer, 1968; Jaffe, 1974; Finnerty, 1976; Seyhun, 1986, 1992; Chowdhury et al., 1993; Bettis et al., 1997; Seyhun, 1998). However, follow-on studies that controlled for additional risk factors suggested that it was only insider purchases at small firms that were informed (Lakonishok and Lee, 2001; Jeng et al., 2003). More recently, Cohen et al. (2012), used a screen based on an executive's previous trading history to identify "routine" and "opportunistic" trades, and show that both stock sales and purchases in the latter group are more likely to predict abnormal returns. A closely related literature focuses on executive stock options. Recent work in that area has examined executives' exercise strategies, and shows that the evidence of information-based trading is much stronger once the researcher distinguishes between the two most common exercise patterns (Cicero, 2009; Dhaliwal et al., 2009). The important distinction in that context is whether the insider holds onto the acquired shares, and the answer to this question predicts whether the exercise was motivated by positive or negative news.

Another recent study, Alldredge and Cicero (2015), provides evidence that corporate insiders may earn abnormal returns not because they are trading on private information, but because they are more attentive than outside investors to public information relevant to their firm. The analysis we conduct in this paper should be valid so long as corporate insiders obtain an informational advantage relative to outside investors, regardless of it's source.

In contrast to these prior studies, 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 it's 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 to do so. The information will eventually be revealed either through earnings announcements, press releases, leakage from other insiders, or through the market impact of aggregate insider trading

activity. We therefore expect that trades concentrated in a short period of time are likely to be motivated by an informational advantage. In particular, we expect insiders to concentrate their trades over short horizons when they possess the type of information that likely to be quickly incorporated into prices.

However, there are times 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 to the market about firm values (Meulbroek, 1992; Gloston and Milgrom, 1985). Optimal trading strategies based on private information therefore involves sequences of smaller trades to avoid sending a strong signal to the market (Kyle, 1985). In addition, according to a 2000 internal S.E.C. memorandum discussing the investigation of possible illegal insider trading, one of the most relevant facts 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. This makes sense as well. There should be less immediacy to these trades since the insiders aren't trying to exploit a temporary informational advantage. Insiders may therefore 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 overall. Consistent with this expectation, Lebedeva, Maug, and Schneider (2012) demonstrate that insiders spread their trades out

over time when they face liquidity constraints.

A. Predicting Trade Sequences

If insiders shape their trading patterns based on the nature of their informational advantage, we expect them to trade over shorter (longer) periods of time when their informational advantage will soon dissipate (will persist). A number of factors may impact the duration of an insiders' informational advantage. The first is the immediacy of the information, as discussed above. In addition, the extent of an informational advantage can be impacted by conditions related to investors' ability to incorporate information into prices. We execute logistic regressions to determine whether proxies for these different conditions are related to whether insiders execute isolated trades or trade over longer periods of time. If, on the other hand, insiders' trades are not intended to capture profits based on private information, we do not expect to find a relation between their ability to maintain an informational advantage and the duration of their trade sequences.

We proxy for the immediacy of information by identifying whether the earnings announcement following a trade reveals information indicating the trade should be profitable. To account for this we construct a dummy variable that equals one (and zero otherwise) if there is an earnings surprise in the next quarter-end earnings announcement. We predict that an insider is less likely to initiate a sequence (and more likely to engage in an isolated trade) when the informational advantage will be eliminated by the end of the current quarter, i.e. when the information is relatively short-lived.

We consider a number of other variables that may impact the speed with which the market incorporates information into stock prices. We 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. Prior studies have shown that the prices of smaller firms are less efficient (Seyhun, 1986; Lakonishok and Lee, 2001), and have argued that insiders have a greater informational advantage in growth firms (Smith and Watts, 1992; Barclay and Smith, 1995). Two of our variables of interest are therefore firms' market value of equity (*ln(Market Cap)*) and the

market-to-book value of their equity (*Ln(market equity/book equity)*).

We also consider other variables that may proxy for, or affect, investor attention. (Frankel and Li, 2004) show that insiders' trades are less profitable when they have a larger analyst following. Similarly , we expect that insiders will lose their informational advantage quicker when more analysts cover their firms. Damodaran (1989); Patell and Wolfson (1982); Neissner (2014) provides evidence that managers strategically disclose negative news regarding their firms after 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, indeed, there is a relation between the timing of trading disclosure and the duration of insiders' informational advantage, then this would raise additional interesting questions. Since insiders have discretion over the timing of these disclosures, it is possible that they may intentionally report after hours to maximize their trading opportunities.

B. Trading Patterns and Abnormal Returns

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 to find abnormal returns favorable for the insiders following 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.

If sequences of insider trades are motivated by private information, then it is also the case that trades that *precede* the end of a sequence should actually be followed by abnormal returns that appear to go *against* the insider. An insider trading on private information would not be expected to engage in an extended series of trades unless she anticipated a significant delay before the private information is revealed to the market. The near-term return distribution will therefore be truncated, with fewer realizations in the direction the insider anticipates the stock will eventually move. In

addition, if the price moves in the direction of the insider's prior (because the market deciphers the information or for any other reason) then an insider trading on private information will no longer have incentive to continue trading. If this pattern in fact holds, it is actually additional evidence of informed trading in sequences, since trades motivated by diversification, liquidity or incentive re-alignment would not demonstrate the same pattern.

We also argue that to conclude that trade sequences are motivated by an ex-ante informational advantage, we should 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 there are large price movements that would affect them negatively (large declines during a sales sequence, or large increases during a purchase sequence). If this alternative holds, we would still expect to find abnormal returns following the end of the sequences, but would not expect the final price on average to reflect an abnormal return relative to the pre-trading price.

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. For this analysis, we conduct our tests on both the broad cross-section of insiders covered in the data, and also on a subset of top executives that includes Chief Executive Officers ("CEO" rolecode1 in the Thompson data), Chairmen of Boards ("CB"), Chief Financial Officers ("CFO"), Presidents ("P"), Chief Operating Officers ("CO") and General Counsels ("GC").

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 2011. In addition, firm financial statements data must be available in Compustat and return data must be available through CRSP. We initially restrict our analysis to trades that can be characterized as "opportunistic" according to the analysis of Cohen et al. (2012). To satisfy this requirement, we remove all trades by insiders that trade in the same calendar month in three consecutive years, since they may be classified as "routine" traders who are unlikely to trade on information.

A key part of our analysis is identifying patterns of isolated and sequenced trades. We classify trade months as a sequence if they occur in consecutive months and isolated if the insider did not trade in the month before a trade or the month after.[6] As can be seen in Table 1, isolated trade months make up the largest percentage of both sale and purchase months. There are 130,592 isolated sale months and 41,770 sequenced sale months. The sequence sale months add up to 17,335 sequences. For purchase months, the patterns are similar but there are fewer transaction months. There are 105,285 isolated purchase months and 27,294 sequenced purchase months, for a total of 11,387 sequences. Overall, the sequence trades make up about one-quarter of trade months. The longest sequences run over 12 months in a row, but the majorities consist of two or three months of trading in a row.

It is worth noting the concentration of trade days in the trade months. There are a mean (median) of 2.9 (1.0) trades per isolated sales month, compared to 6.1 (2.0) for sequence sales months. Somewhat similarly, there are a mean (median) of 1.7 (1.0) for isolated purchase months, and 3.3 (1.0) for sequence purchase months. It therefore appears that our classification system at the monthly level is consistent with the distribution of trading within the months. For sales, these numbers aggregate to 379,000 isolated sales trading days, versus 255,000 sequence trading days.

[6] As an alternative, we relax the rule that sequences should be in consecutive months and allow a one month gap between sequenced trades. The results using this classification are qualitatively and quantitatively similar to the results we present in the rest of the paper, although the percentage of trades classified as sequenced trades is of course larger.

For purchases, there are 179,000 isolated trading days, and 90,000 sequence trading days. It is also interesting that the isolated trading events are most commonly characterized by one trading day, which suggests the insider may view the trading opportunity as very time sensitive, and this may also help explain why on average there are fewer trades in these instances.

We provide additional summary statistics for our sample in Table 1. One notable finding is that insiders trade more shares in sequenced month than in isolated transactions months. For sales months, the mean (median) number of shares traded is 54,633 (9,605) during sequenced months versus 44,522 (5,000) in isolated sales months. In sequenced purchase months, insiders trade a mean (median) of 33,534 (2,025) versus only 15,199 (1,300) in isolated purchase months. The average sequence length is 2.50 months for sales, and 3.34 for purchases. Together these statistics indicate that insiders make much larger adjustment to their portfolios when they trade over a number of months. If both isolated and sequenced transactions are motivated by private information about firm value, then this suggests that the conditions allowing for insiders to trade over longer periods of time also allow them to capture greater profits.

In addition, there are differences in average firm characteristics across the isolated and sequence trade months. We also find some significant differences, in the firm characteristics and number of shares per trade, between isolated and sequenced trades. The firms associated with sequenced trades are bigger and have a lower market-to-book ratio than firms associated with isolated trades. Fewer shares are traded in isolated trades than sequence trades, across both sales and purchases. Although these are univariate statistics and we do not attach any specific inferences to them at this point, they do suggest that there are systematic differences between the nature of the information contained in isolated and sequenced trades.

As discussed above, we consider whether the timing of insider trading disclosure 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. [7] Under the Sarbanes-Oxley Act, insiders are supposed to report trades to the S.E.C. within two business days of executing a trade, and since 2001 the forms, which are filed electronically, are made available to the public through EDGAR almost immediately. Fig. 3 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, 37% of transactions have been disclosed, and an additional 21% are disclosed between 4 p.m. and 5 p.m. The remaining 41% are reported between 5 p.m. and 10 p.m., with a steady decline in reporting activity from 18% during the 5 p.m. hour to 2% during the 9 p.m. hour. There are no timestamps indicating that forms were filed between 10 p.m. and 6 a.m., so it appear the S.E.C.'s electronic filing system is not operational during these hours. 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 isn't clear whether we should expect investors' attention to decline when the market closes at 4 p.m., when they can no longer make quick large market trades on the information, or if we should expect investors to maintain their attention during this period of high reporting volume and redirect their focus only later in the evening. We control for both possibilities in our empirical analysis evaluating the determinants of extended trade sequeunces.

III. Empirical Analyses

In this section we present empirical analyses that test the hypotheses discussed in Section 2. However, we start with an anecdotal 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

[7] 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.

this 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. However, over the next six months, Company A's CEO reports no further trades. Thus, we would classify Company A's sale as an isolated trade. In contrast, following his trade in February, Company B's CEO reports sales in March, April and May. Since these trades are in consecutive months, they would be classified as a sequence of trades ending in May 2005.

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 information was reflected in his firm's stock in a relatively timely manner. 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, which likely drove the decline in value. In contrast, the price of Company B actually rose by about 13% over the time that its CEO was executing his sequence of trades. However, in the three months following the completion of the sequence the stock price fell by 44% such that the price 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 (albeit with higher earnings than the previous quarter), 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. Predicting Insider Trading Patterns

The first main empirical analysis examines the determinants of insider 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.

Our main tests of these hypotheses are logistic regressions predicting whether new trading by an insider is an isolated event or the beginning of a longer sequence of trades. The observations include each month were an insider begins trading after having not traded for at least one month, and the dependent variable is an indicator that takes a value of 1 if the observation is followed by at least one more consecutive month of trading in the same direction (i.e., is the beginning of a sequence of trades). 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)*), whether the trading activity was reported after market hours (*Reported during 4 pm hour* and *Reported after 5 pm*), the firms' stock market value (*Ln(Market Cap)*), and it's market-to-book equity value (*Ln(market equity/book equity)*).

The results of this analysis are reported in Table 2. Panel A present results for all transaction months, Panel B regressions only include sales months, and those in Panel C only include purchase month observations. The results provide evidence that sequences of trades are associated with each of the dependent variables as hypothesized. The coefficients on the variables capturing analyst following and the revelation of a near-terms earnings surprise are consistently negative and highly statistically significant. From column (5) of Panel A, we find that the marginal effect of the absence of a near-term earnings surprise on the odds of a follow-on trade month is 19% (a 12% change of a follow-on trade versus a 10% chance when there is a near-term earnings surprise).

In contrast, the coefficients on the after hours reporting dummies are consistently positive and significant. Interestingly, the relation between after-hours reporting and trade sequences is strongest when the trade is reported after 5 p.m. This contrast is particularly strong for insider purchases (Panel C), where the coefficient on *Reported during 4:00 pm hour* is actually insignif-

icant, and the coefficient on *Reported after 5:00 pm* is larger and highly significant. In terms of marginal significance, the regression in Column (5) of Panel A indicates an increase in the odds of at least one follow-on trade month of 9.3% when an insiders reports her initial trade during the 4 p.m. hour, and of 15.0% when the trade is disclosed after 5 p.m.[8]

Firm market value is consistently negatively related the probability of a sequence of trades in each panel, and market-to-book equity has a consistently positive relation with trade sequences. These results provide compelling evidence that initiation of a sequence of insider trades is associated with firm's information environment.

The association between after-hours disclosure and the likelihood of an extended trading sequence raises questions about whether insiders purposefully report after hours to maximize their trading opportunities. It is probably impossible to provide conclusive evidence on this question with a large-scale empirical analysis, but we conduct some additional tests that are instructive. Table 3 presents additional logistic regressions evaluating the link between after-hours reporting and trade sequences after controlling for firm and individual insider fixed effects. We find that this relation is generally persistent across specifications adding the fixed effects using all observations, sales months only, and purchase months only. The only exception is the regression in column (6) which evaluates insider sales and includes individual fixed effects. 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 hours is increasing in the number of shares traded. This would not be expected if disclosure timing were either random or highly persistent by firm or individual.[9]

[8]These marginal effects are calculated while holding all other variables at their mean values.

[9]There is also a link between the number of trades in a day and the number of shares traded, and as insiders make more trades in a day they may be more likely to disclose them in the evening. To ensure that this association doesn't drive the relation between shares traded and after-hours disclosure, we confirm that this result continues to hold in the sample where the disclosure is made on a day subsequent to the trading day.

B. 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 trade will be followed shortly 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 abnormal return until the sequences end. In this section, we present a number of empirical tests of this thesis by comparing the returns following isolated trading months to those that follow trading months that occur in a sequence, using the methodologies we described in the previous section.

B.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 first evaluate cross-sectional and fixed-effect regressions. The total one-month return following trade months is regressed onto the total market return and other variables that account for additional risk factors, including the firm's stock market value, book-to-market value of equity, prior twelve- and one-month returns, and the trade size in number of shares.

Beginning with sales by all insiders (Table 4, Panel A), we first confirm in column (1) that we find similar results as Cohen et al. (2012), in that these "opportunistic trade" months are followed by abnormal returns of approximately 90 basis points as indicated by the coefficient on the constant in the regression.[10] In column (2), we also add the log of the number of shares sold and confirm that this does not impact our abnormal return estimate. Columns (3)–(6) add the dummy variable indicating that the trade month was isolated (and varying fixed effects), and confirm that the abnormal returns following isolated trades are more negative than those following sequenced trades by a magnitude that ranges from between -0.75% ($t = -8.28$) and -1.19% ($t = -7.65$). The fact

[10]One difference in our sample from the Cohen et al. (2012) opportunistic trades sample is that we include trades by executives that traded in fewer than 3 consecutive calendar months. They require a trader to have three years of trading to classify them as routine or opportunistic.

that these return patterns hold, and are even stronger, when we include firm and individual fixed effects suggests that individual traders may purposefully design their trade strategies in response to the informational advantage they hold at a particular time.

Panel B provides the same analysis for top executives only, and the results are more dramatic. The abnormal returns following isolated trades by top executives are more negative than those following sequenced trades by a magnitude that ranges from between −1.03% ($t = -5.69$) and −2.00% ($t = -6.79$).

Table 5 shows similar patterns for insider purchase months. The Cohen et al. (2012) "opportunistic" trade result is again confirmed in column (1). The latter columns demonstrate the abnormal returns following isolated trades are larger than those following sequenced trades by a magnitude that ranges from between 1.12% ($t = 8.14$) and 1.41% ($t = 5.55$). Here as well, the evidence of informed trading is again larger in the top executive group, as demonstrated in the incremental abnormal returns following isolated trades by top executives of approximately 1.5% in the latter columns of Panel B.

Next we implement calendar-time portfolios in Table 6. Firms are added to the appropriate portfolio at the beginning of the month following that in which the trade was made and kept in the portfolio for one month. The portfolio is then rebalanced at the beginning of the next month based on new trades. We report the alphas (in percentage terms) from a regression of portfolio returns on: (1) the market factor (CAPM); (2) the market factor, the return difference between a portfolio of "small" and "big" stocks and the return difference between a portfolio of "high" and "low" book-to-market stocks from Fama and French (1993); (3) all three factors in (2), augmented with a momentum factor from Carhart (1997).

Table 6 confirms the results of the prior analysis. For example, focusing on Carhart alphas, we find that portfolio returns are insignificant following sequenced sales but are a significant −0.42% ($t = -5.13$) following isolated sales. A long-short portfolio that is long sequenced sales and short isolated sales yields an alpha of 0.60% ($t = 5.11$). We see a similar pattern for purchases. Portfolio

returns following isolated purchases are significantly bigger than those following sequenced purchases; a long-short portfolio that is long isolated purchases and short sequenced purchases yields an alpha of 0.66% (t = 4.82). Again, we find that the difference between isolated and sequenced trades is more pronounced when we limit our analysis to top executives. Alltogether, the results in this section are strongly consistent with our hypothesis that isolated trades are more likely when the information will be revealed to the market soon while sequenced trades are more likely when it takes longer for information to be revealed to the market.

B.2. Further Analysis of Sequenced Trades

In this section, we look closer at the return patterns associated with sequenced insider trades. If insiders engage in sequences of trades solely for diversification and liquidity purposes, then we expect to find typical returns during and following sequenced trades. On the other hand, if sequences are motivated by private information, then we expect to find abnormal returns in their favor following the end of the trade sequences. In addition, as discussed in Section 2, if insiders are trading over an extended period because they expect a delay before information is revealed to to the market, we expect to find the appearance of abnormal returns in the opposite direction while they are trading.

Table 7 provides a breakdown of average monthly abnormal returns for different windows during or following trading sequences. For the sequenced sales of all insiders (Panel A), we see that average monthly abnormal returns following the beginning of the sequence to the month before the sequence ends, monthly portfolio alpha is 0.97% (t = 4.20). But the monthly portfolio return in the three months following the end of the sequence is −0.51% (t = −6.24). We see a symmetric but opposite pattern for purchases; for the period following the beginning of the sequence to the month before the sequence ends, the monthly portfolio alpha insignificant. However, average monthly portfolio alphas in the three months following the end of the sequence is 0.95% (t = 7.65). The final column of this table is of greatest interest, as it shows average monthly abnormal returns over

the period starting from when sequences begin and ending three months after sequences end. The results show that these periods are associated with significant negative returns for sales sequences (−0.17%, $t = 2.33$), and significant positive returns for purchase sequences (0.90%, $t = 7.77$). Here, too, the results are stronger when only considering top executives. Overall, the results in Tables 7 support the hypothesis that sequenced trades which may appear to be uninformed are actually informed trades where the information is not incorporated into prices until after the sequence ends.

B.3. Trading Strategies

The results we presented above – that isolated and sequenced trades by insiders predict future stock returns – is useful for understanding the economics of insider trading. It may not be easy, though, for investors to incorporate this information into their own trading strategies since the returns may quickly follow the trading activity.[11] However, the results for sequences of trades suggest they continue to predict information over a number of months after they end. It may therefore be possible to construct a trading strategy to take advantage of this information. This analysis also provides further evidence of the economic magnitude of how informed sequenced trades are.

We present some possible trading strategies in Table 8. We assume that an investor can identify the end of a sequence of trade months by the second month after the final trade, after which the stock can be added to a portfolio. In other words, the investor can wait for a month to actually confirm that a sequence of trades has ended. The firms are held in the portfolio for one month after which the portfolio is then rebalanced based on newly completed sequenced trades. We find that such a strategy earns sizeable abnormal returns, particularly when the focus is on the transactions of top executives. The Carhart alphas are a significant −0.55% per month (−0.69% per month)

[11] In unreported results, we find that the abnormal returns following isolated trades also continue over the next three months, but at a diminished rate. Following both sale and purchase months about 0.5% of additional abnormal return accrues over the additional two-months.

for strategies that go short after confirming the end of a sequence of all insider (top executive) sales, and approximately 1.15% per month (1.76% per month) for strategies that go long after confirming the end of a sequence of all insider (top executive) purchases. A long-short portfolio that buys stocks after confirming the end of a sequence of insider (top executive) purchases, and shorts stocks after confirming the end of a sequence of insider (top executive) sales earns month alphas of 1.71% (2.37%), or 22.6% (32.5%) annualized.

Of course, any trading strategies also need to also account for trading costs. The portfolios described would need to be rebalanced monthly, and there would be direct and indirect trading costs depending on the amount of capital invested. Korajczyk and Sadka (2004) estimate the profitability of momentum strategies that are rebalanced monthly and also have similar pre-trading cost returns as our strategy, so their conclusions serve as a good guide. They estimate monthly-rebalanced momentum strategies with direct trading costs and price impact using four different trading cost models.[12]

They focus only on long-only strategies, since the analysis is complicated when trying to estimate shorting costs. They identify momentum strategies that generate an alpha of between 1.17% and 1.60% per month over the time period 1967 to 1999, which is very close in magnitude to the alphas we find for long-only portfolios following insider purchases. After accounting for transactions costs, they determine that these strategies continued to generate positive alpha with investments of up to approximately $5 billion, although the statistical significance of the alpha is lost after an approximate $1 to $2 billion additional investment. It seems reasonable, then, to predict a similar result for portfolios formed based on insider purchases. However, given the smaller alphas associated with insider sales and the additional short-selling costs, it is not clear that a strategy focused only on those transactions would be profitable.

[12] Korajczyk and Sadka (2004) use two proportional trading cost models based only on quoted and effective spreads, and the non-proportional trading cost models of Glosten and Harris (1988) and Breen, Hodrick, and Korajczyk (2002) that account for price impact.

C. An Analysis of "Routine" Trades

It seems reasonable to expect that some insiders trade only for liquidity or diversification reasons, but it is difficult to know how prevalent this behavior is. As discussed above, past researchers have proposed a sorting mechanism to distinguish these traders from those who are more likely to be trading to exploit an informational advantage. Cohen et al. (2012), in particular, adopt a sorting mechanism that classifies about half of insiders as routine traders and show that on average their trades do not predict abnormal returns. Under their methodology, insiders are considered routine traders if they trade in the same calendar month in three consecutive years.

In this section, we use the technology developed in this paper to evaluate the returns of insiders identified as routine traders under the Cohen et al. (2012) methodology. Table 9 presents abnormal return regressions similar to those in Tables 4 and 5, but where the observations are drawn only from the trades of insiders who trade in the same calendar month in three consecutive years. In both Panel A (Routine Sale Months) and Panel B (Routine Purchase Months), the regression in Column (1) confirms the results of Cohen et al. (2012) that these trades are not followed by significant abnormal returns on average. However, the results in Columns (2) (no fixed effects) and (3) (monthly fixed effects) demonstrate highly significant abnormal returns following isolated trade months as well as trade sequences in this subsample, consistent with our main results. These regressions also demonstrate significant abnormal returns in the opposite direction following intra-sequence trade months which is further consistent with the analysis above.

An explanation for the insignificant abnormal returns in the routine trader sample 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. The ratio of sequenced to isolated trade months by "routine" traders is approximately 1:1 compared to a ratio of 1:3 among other traders. It makes sense 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. Traders with above median levels of sequenced trades (18% or more of their trades being sequenced) trade in 3.6 times more months than isolated 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, which can lead to incorrect inferences regarding the prevalence of routine versus optimistic insider trading.

The results of this section demonstrate that once insiders' trading patterns are taken into account, there is indeed evidence of informed trading among both non-routine traders and those previously thought to trade only for routine purposes. This finding suggests that informed trading is more widespread than previously thought, and demonstrates the importance of controlling for trading patterns when analyzing the profitability or information content of insiders trades. It also points to a need for a more accurate mechanism for isolating those traders that do not appear to trade because of an informational advantage.

IV. Conclusion

Based on the simple intuition that insiders trading on private information will trade so long as they can maintain their advantage, this paper develops new insights about the nature of insiders' trading patterns. 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.

Insiders are more likely to execute 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 after the market has closed, which is a time when investors may be less attentive. 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, and calls into question the strength of current methods for identifying mere liquidity and diversification trading. Future researchers may do well to account for the patterns uncovered here when investigating new hypotheses about informed trading, in order to maximize the power of tests of such behavior. In addition, regulators and outside investors could benefit from these insights. As our understanding of informed trading grows, our ability to minimize the total cost of participating in the public markets may decline.

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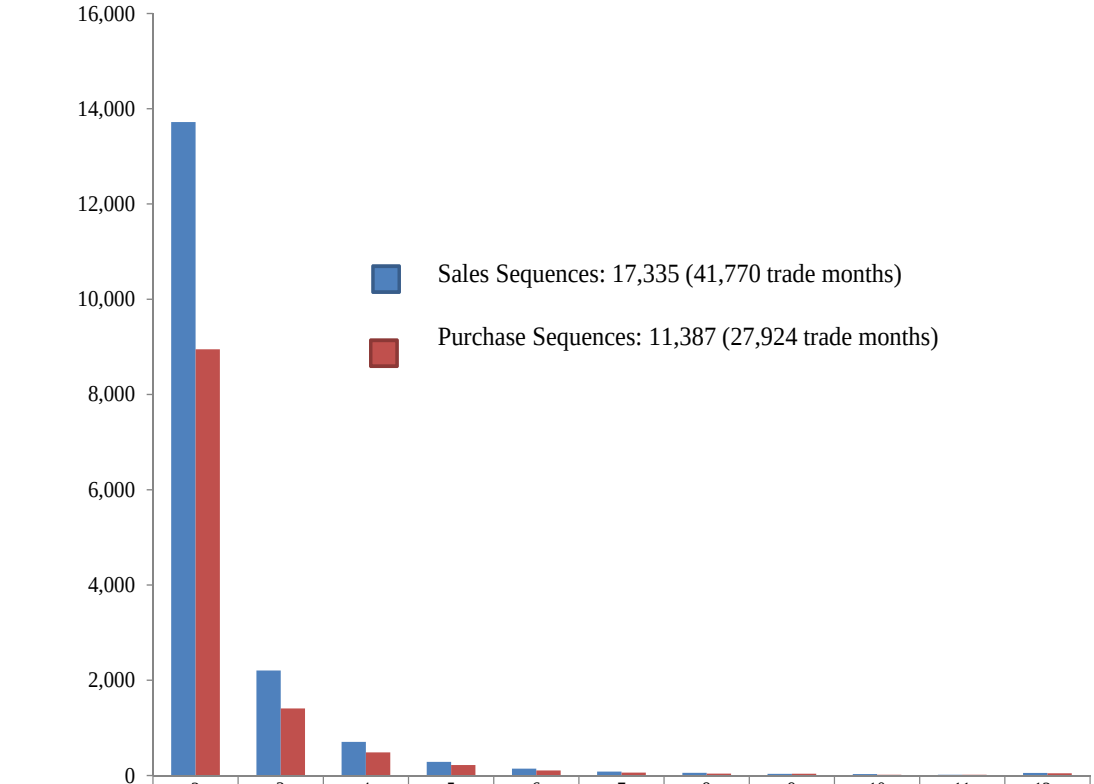
Fig. 1: The figure shows the distribution trade sequences in our sample. A net sales (purchase) month is one where insider sales (purchases) exceed purchases (sales) in that month. We identify an *isolated* trading month as one where insiders did not trade in the month before or after. We identify a *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+
Sales Sequences	13721	2204	705	287	143	82	57	35	31	17	53
Purchase Sequences	8950	1409	486	220	106	60	40	38	17	15	46

Sequence Length (Months)

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)

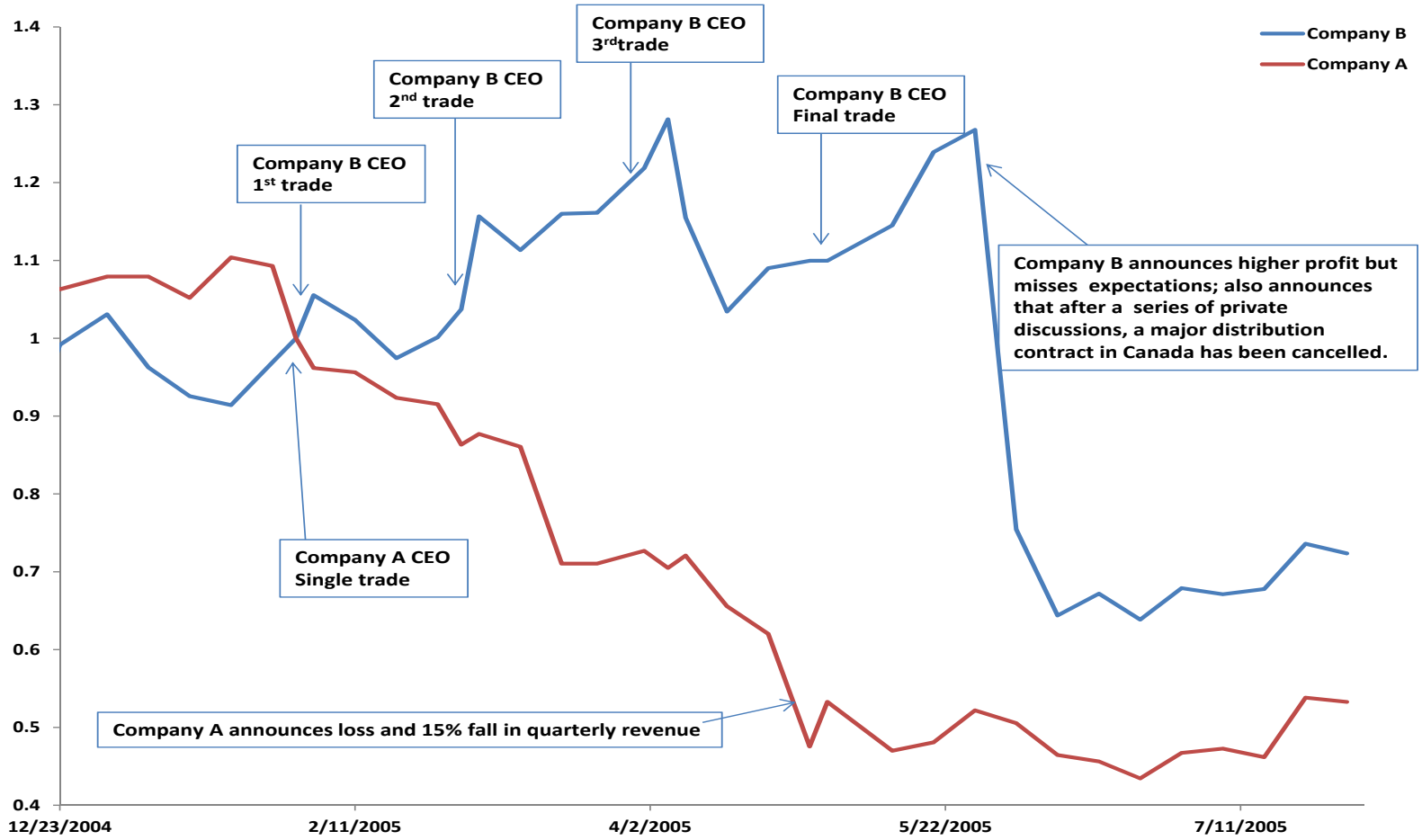


Fig. 3: This figure presents a histogram of the percent of insider trades that are reported to the S.E.C. during different one hour intervals from 6:00 a.m. to 10:00 p.m.

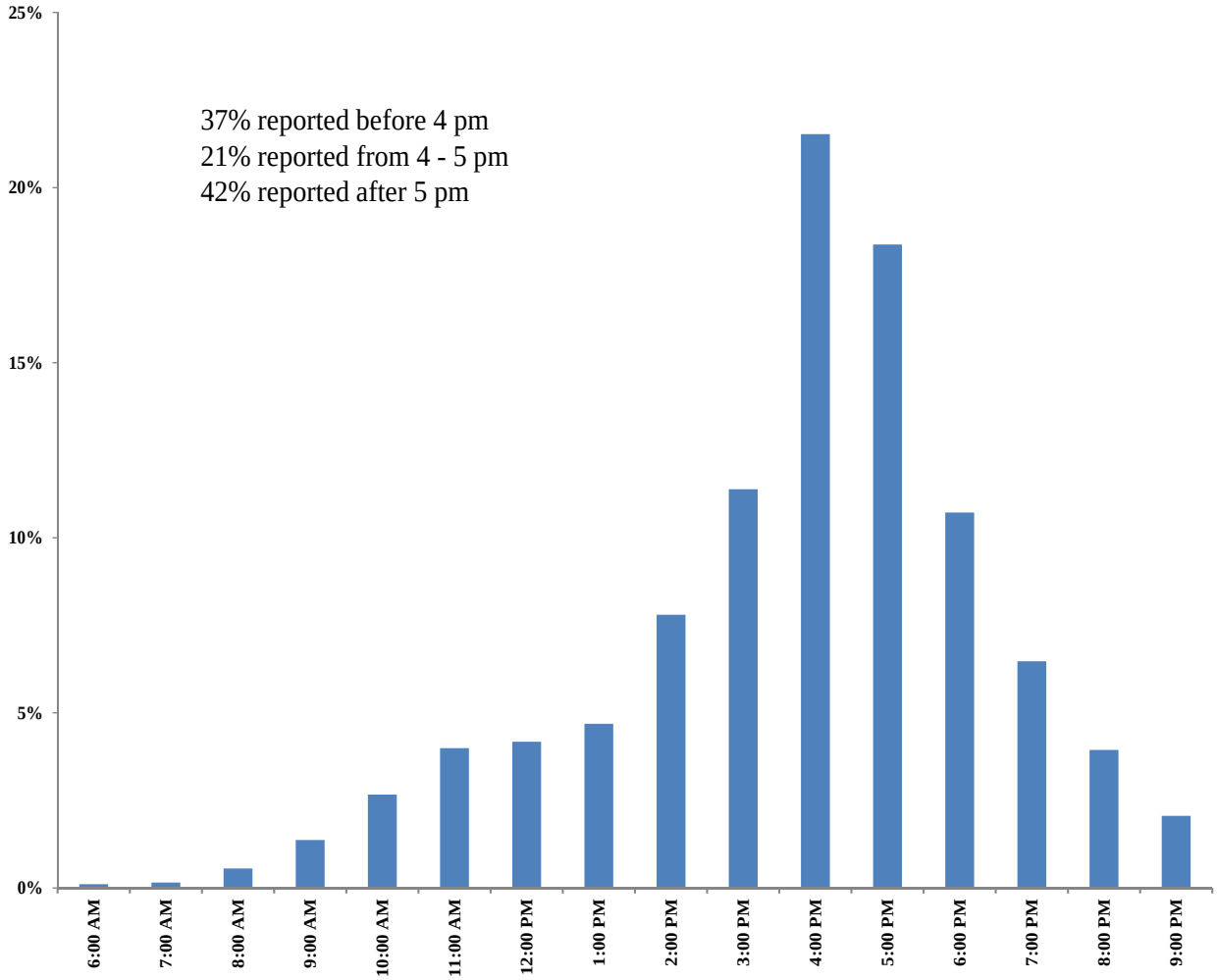


Table 1

Summary Statistics

The table shows a summary overview of the sample we use in this paper, and shows the distribution of isolated and single trades. A net sales (purchase) month is one where insider sales (purchases) exceed purchases (sales) in that month. We identify an isolated net sale (purchase) month as one where insiders did not sell (buy) in the month before or after. We identify a sequenced net sale (purchase) month as one where the insiders also had net sales (purchases) in either the month before or after, or in both the month before and after. *a* and *b* represent significance at the 1% and 5% levels respectively.

Panel A: Months with Net Sales by Insiders

	Isolated trades		Sequenced trades		
	Mean	Median	Mean	Median	Diff. in Means *t*-statistic
Firms	7,412		4,809		
Insiders	56,203		12,375		
Top Executives	10,831		2,883		
All Others	49,260		10,304		
Trade Months	117,193		41,770		
Trade Months/Firm	15.81	8.00	8.69	6.00	
Trade Months/Insider	2.09	1.00	3.38	2.00	
Unique Trade Months	75,908		35,370		
Sequence Length (months)	1.00	1.00	2.52	2.00	
Trade Size (# shares)	44,522	5,000	54,633	9,605	-2.01^b
Market Value of Equity ($Mils)	3,714.7	4,465.6	2,642.6	3,131.8	11.05^a
Book Equity/Market Equity	0.56	0.47	0.53	0.45	10.25^a
6 Month Pre-Trade Return	12.77%	11.40%	14.18%	13.07%	-7.75^a

Panel B: Months with Net Purchases by Insiders

	Isolated trades		Sequenced trades		
	Mean	Median	Mean	Median	Diff. in Means *t*-statistic
Firms	6,939		3,944		
Insiders	47,841		8,358		
Top Executives	10,771		2,153		
All Others	40,123		6,689		
Trade Months	105,285		27,924		
Trade Months/Firm	13.66	9.00	7.08	4.00	
Trade Months/Insider	1.98	1.00	3.34	2.00	
Unique Trade Months	62,797		23,197		
Sequence Length (months)	1.00	1.00	3.19	2.00	
Trade Size (# shares)	15,199	1,300	33,534	2,025	-10.92^a
Market Value of Equity ($Mils)	2,317.1	1,947.8	1,377.3	1,158.4	9.77^a
Book Equity/Market Equity	0.70	0.58	0.79	0.64	-17.15^a
6 Month Pre-Trade Return	0.97%	1.93%	−1.77%	−0.79%	12.06^a

Table 2

Predicting insider trading patterns.

The table reports logit regressions predicting whether or not a new trade month begins a sequence. Observations include each trade month by an individual that is not immediately preceded by a trade month in the same direction. Panel A reports regressions using both sales and purchase trade months, Panel B only includes sales months, and Panel C reports regressions that only include purchase month observations. The dependent variable is one if the trade starts 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. Reported during 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. 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.

Panel A: All Transactions Months

VARIABLES	(1)	(2)	(3)	(4)	(5)
Log(# of Analysts)	-0.163^a			-0.155^a	0.024
	(−8.13)			(−7.59)	(0.78)
Near-term earnings surprise dummy		-0.239^a		-0.191^a	-0.194^a
		(−5.80)		(−4.39)	(−4.46)
Reported during 4:00 pm hour			0.094^a	0.105^a	0.101^a
			(2.80)	(3.14)	(3.01)
Reported after 5:00 pm			0.157^a	0.181^a	0.159^a
			(3.86)	(4.41)	(3.93)
Ln(market cap)					-0.125^a
					(−10.13)
Ln(book equity/market equity)					0.091^a
					(3.06)
Constant	-1.782^a	-1.966^a	-2.066^a	-1.792^a	-2.234^a
	(−46.62)	(−65.49)	(−65.82)	(−47.16)	(−32.09)
Observations	64,582	64,582	64,582	64,582	64,582
Pseudo R-squared	0.00351	0.00149	0.000516	0.00514	0.00841

Panel B: Sales Months

VARIABLES	(1)	(2)	(3)	(4)	(5)
Log(# of Analysts)	−0.182[a]			−0.184[a]	0.053[c]
	(−8.86)			(−8.90)	(1.65)
Near-term earnings surprise dummy		−0.122[b]		−0.109[b]	−0.115[b]
		(−2.51)		(−2.19)	(−2.28)
Reported during 4:00 pm hour			0.080[c]	0.095[b]	0.085[b]
			(1.94)	(2.28)	(2.09)
Reported after 5:00 pm			0.097[c]	0.128[b]	0.093[c]
			(1.84)	(2.39)	(1.77)
Ln(market cap)					−0.170[a]
					(−11.95)
Ln(book equity/market equity)					0.113[a]
					(3.31)
Constant	−1.616[a]	−1.897[a]	−1.954[a]	−1.630[a]	−2.195[a]
	(−37.97)	(−56.46)	(−53.14)	(−37.09)	(−29.12)
Observations	38,659	38,659	38,659	38,659	38,659
Pseudo R-squared	0.00428	0.000355	0.000264	0.00498	0.0112

Panel C: Purchase Months

VARIABLES	(1)	(2)	(3)	(4)	(5)
Log(# of Analysts)	−0.256[a]			−0.230[a]	−0.114[b]
	(−6.87)			(−5.51)	(−2.18)
Near-term earnings surprise dummy		−0.315[a]		−0.150[c]	−0.149[c]
		(−4.63)		(−1.89)	(−1.87)
Reported during 4:00 pm hour			0.077	0.083	0.082
			(1.24)	(1.33)	(1.31)
Reported after 5:00 pm			0.210[a]	0.225[a]	0.220[a]
			(3.27)	(3.51)	(3.42)
Ln(market cap)					−0.075[a]
					(−3.27)
Ln(book equity/market equity)					−0.029
					(−0.50)
Constant	−1.892[a]	−2.099[a]	−2.235[a]	−1.918[a]	−2.111[a]
	(−34.77)	(−38.07)	(−39.35)	(−33.52)	(−17.22)
Observations	25,923	25,923	25,923	25,923	25,923
Pseudo R-squared	0.00768	0.00288	0.000687	0.00901	0.0102

Table 3

Additional analysis of the relation between after-hours reporting and insider trade sequences

The table reports logit regressions with either no, firm, or individual person level fixed effects predicting whether or not a new trade month begins a sequence. Observations include each trade month by an individual that is not immediately preceded by a trade month in the same direction. The regressions in Columns (1) – (3) use both sales and purchase trade months as observations, those in Columns (4) – (6) only include sales months, and those in Columns (7) – (9) only include purchase months. The dependent variable is one if the trade starts a sequence and zero if the trade is an isolated trade. All variables are as described in the header to Table 2. The standard errors are robust and are clustered at the monthly level. t-statistics are reported in parenthesis, and a, b, and c represent significance at the 1%, 5% and 10% levels, respectively.

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Reported after 4 pm	0.189^a	0.168^a	0.118^a	0.144^a	0.100^a	0.055	0.191^a	0.179^a	0.160^b
	(7.66)	(5.77)	(3.02)	(4.70)	(2.65)	(1.08)	(4.57)	(3.47)	(2.27)
Ln(market cap)	−0.127^a	−0.125^a	−0.051	−0.160^a	−0.180^a	−0.091^c	−0.126^a	−0.022	−0.012
	(−17.90)	(−3.49)	(−1.45)	(−17.82)	(−3.83)	(−1.68)	(−9.87)	(−0.33)	(−0.18)
Ln(book equity/market equity)	−0.256^a	−0.373^a	−0.304^b	−0.422^a	−0.628^a	−0.471^b	0.089	0.087	−0.182
	(−4.69)	(−3.45)	(−2.39)	(−5.52)	(−3.77)	(−2.24)	(1.17)	(0.53)	(−0.93)
Constant	−2.072^a			−1.857^a			−2.467^a		
	(−71.16)			(−48.94)			(−53.48)		
Observations	64,640	53,084	16,856	38,683	29,066	9,569	25,957	15,580	5,233
Pseudo R-squared	0.00824	0.00143	0.00120	0.0117	0.00128	0.000923	0.00935	0.00136	0.00163
Fixed Effect	none	firm	person	none	firm	person	none	firm	person
Number of groups		2,385	3,962		1,777	2,412		1,105	1,334

Table 4

Stock returns in month following isolated sales relative to sequenced sales.

The table reports results of a regression of monthly stock returns on firm characteristics following isolated and sequenced trades. The dependent variable is the return in the month following an insider trade. The key explanatory variable is a dummy variable (Isolated Sale Month) that takes a value of one if the month follows an isolated sale and zero if the month follows a sequenced sale. Panel A shows the results for all insiders. Panel B shows the results for top executives where the top executives is either the chief executive officer, chairman of the board, chief financial officer, president, chief operating officer, or general counsel. *t*-statistics are reported in parenthesis. *a*, *b*, and *c* represent significance at the 1%, 5% and 10% levels, respectively.

Panel A: Months with net sales by all insiders

	(1)	(2)	(3)	(4)	(5)	(6)
Constant	−0.898^a	−0.956^a	−0.405^a			
	(−8.55)	(−8.30)	(−2.99)			
Isolated Trade Month			**−0.748^a**	**−0.803^a**	**−0.919^a**	**−1.194^a**
			(−8.28)	**(−8.95)**	**(−9.61)**	**(−7.65)**
Ln(Shares Traded)		0.030	0.008	0.010	0.043^c	0.022
		(1.24)	(0.31)	(0.40)	(1.66)	(0.45)
Ln(Market Cap)	−0.066^a	−0.066^a	−0.050^b	−0.026	−1.276^a	−1.101^a
	(−2.64)	(−2.64)	(−2.00)	(−1.01)	(−19.02)	(−10.10)
Book Equity/Market Equity	1.132^a	1.140^a	1.177^a	1.058^a	1.208^a	1.414^a
	(6.40)	(6.41)	(6.62)	(6.12)	(4.75)	(3.67)
Prior 1 Year Return	0.707^a	0.699^a	0.681^a	0.636^a	0.024	−0.032
	(4.71)	(4.63)	(4.51)	(3.99)	(0.15)	(−0.13)
Prior 1 Month Return	0.950^c	0.934^c	0.915	0.861	−0.171	−0.194
	(1.69)	(1.66)	(1.62)	(1.47)	(−0.34)	(−0.27)
Market Return	78.297^a	78.292^a	78.221^a	−48.894^a	75.841^a	75.023^a
	(93.28)	(93.29)	(93.18)	(−11.62)	(93.55)	(65.24)
Fixed Effects	none	none	none	month	firm	person
Observations	111,278	111,278	111,278	111,278	111,278	111,278
R-squared	0.102	0.102	0.102	0.133	0.222	0.526

Panel B: Months with net sales by top executives

	(1)	(2)	(3)	(4)	(5)	(6)
Constant	−1.459[a]	−1.285[a]	−0.557[c]			
	(−6.18)	(−4.56)	(−1.74)			
Isolated Trade Month			**−1.043[a]**	**−1.033[a]**	**−1.490[a]**	**−1.997[a]**
			(−5.83)	**(−5.69)**	**(−7.11)**	**(−6.79)**
Ln(Shares Traded)		−0.068	−0.076	−0.068	−0.034	0.026
		(−1.37)	(−1.53)	(−1.39)	(−0.54)	(0.25)
Ln(Market Cap)	−0.016	−0.012	0.013	0.015	−1.423[a]	−1.879[a]
	(−0.32)	(−0.24)	(0.25)	(0.28)	(−8.84)	(−7.46)
Book Equity/Market Equity	1.529[a]	1.509[a]	1.572[a]	1.547[a]	2.038[a]	1.939[b]
	(3.59)	(3.51)	(3.68)	(4.04)	(3.27)	(2.53)
Prior 1 Year Return	0.803[a]	0.825[a]	0.815[a]	0.749[b]	0.144	0.246
	(2.88)	(2.94)	(2.90)	(2.54)	(0.44)	(0.61)
Prior 1 Month Return	0.801	0.853	0.913	0.981	−0.356	−0.839
	(0.86)	(0.91)	(0.98)	(0.99)	(−0.36)	(−0.71)
Market Return	84.556[a]	84.578[a]	84.585[a]	−25.096[a]	80.159[a]	82.204[a]
	(46.89)	(46.95)	(46.98)	(−3.43)	(44.56)	(35.57)
Fixed Effects	none	none	none	month	firm	person
Observations	30,384	30,384	30,384	30,384	30,384	30,384
R-squared	0.107	0.107	0.108	0.137	0.351	0.517

Table 5

Stock returns in month following isolated purchases relative to sequenced purchases.

The table reports results of a regression of monthly stock returns on firm characteristics following isolated and sequenced trades. The dependent variable is the return in the month following an insider trade. The key explanatory variable is a dummy variable (Isolated Purchase Month) that takes a value of one if the month follows an isolated purchase and zero if the month follows a sequenced purchase. Panel A shows the results for all insiders. Panel B shows the results for top executives where the top executives is either the chief executive officer, chairman of the board, chief financial officer, president, chief operating officer, or general counsel. *t*-statistics are reported in parenthesis. *a*, *b*, and *c* represent significance at the 1%, 5% and 10% levels, respectively.

Panel A: Months with net purchases by all insiders

	(1)	(2)	(3)	(4)	(5)	(6)
Constant	0.527^a	0.430^a	-0.493^a			
	(5.12)	(4.20)	(−3.53)			
Isolated Trade Month			**1.188^a**	**1.127^a**	**1.115^a**	**1.411^a**
			(9.80)	**(9.35)**	**(8.14)**	**(5.55)**
Ln(Shares Traded)		0.277^a	0.292^a	0.309^a	0.271^a	0.320^a
		(10.28)	(10.78)	(11.53)	(8.02)	(4.94)
Ln(Market Cap)	-0.291^a	-0.258^a	-0.284^a	-0.244^a	-1.500^a	-0.788^a
	(−9.02)	(−8.04)	(−8.77)	(−7.48)	(−16.37)	(−6.78)
Book Equity/Market Equity	0.732^a	0.722^a	0.737^a	0.457^a	0.749^a	0.976^a
	(4.87)	(4.81)	(4.91)	(2.97)	(3.93)	(3.23)
Prior 1 Year Return	−0.325	−0.191	−0.230	−0.113	-1.173^a	-1.326^a
	(−1.63)	(−0.96)	(−1.15)	(−0.55)	(−5.21)	(−3.93)
Prior 1 Month Return	-2.634^a	-2.310^a	-2.386^a	-2.618^a	-3.523^a	-3.103^a
	(−4.52)	(−3.98)	(−4.11)	(−4.16)	(−6.04)	(−3.65)
Market Return	77.585^a	77.637^a	77.379^a	-42.316^a	74.703^a	69.900^a
	(78.40)	(78.40)	(78.33)	(−8.44)	(75.18)	(48.75)
Fixed Effects	none	none	none	month	firm	person
Observations	85,994	85,994	85,994	85,994	85,994	85,994
R-squared	0.086	0.087	0.088	0.129	0.198	0.534

Panel B: Months with net purchases by top executives

	(1)	(2)	(3)	(4)	(5)	(6)
Constant	1.014^{a}	0.598^{a}	−0.702^{a}			
	(5.67)	(3.38)	(−2.66)			
Isolated Trade Month			**1.640**^{a}	**1.534**^{a}	**1.448**^{a}	**1.492**^{a}
			(6.64)	**(6.22)**	**(4.31)**	**(3.27)**
Ln(Shares Traded)		0.543^{a}	0.539^{a}	0.557^{a}	0.403^{a}	0.715^{a}
		(10.20)	(10.12)	(10.62)	(5.40)	(5.79)
Ln(Market Cap)	−0.388^{a}	−0.360^{a}	−0.396^{a}	−0.308^{a}	−2.232^{a}	−2.429^{a}
	(−5.23)	(−4.88)	(−5.31)	(−4.06)	(−9.43)	(−7.12)
Book Equity/ Market Equity	0.689^{a}	0.660^{a}	0.695^{a}	0.360	0.777^{b}	1.021^{b}
	(3.12)	(3.00)	(3.15)	(1.62)	(2.32)	(2.18)
Prior 1 Year Return	−0.765^{b}	−0.461	−0.514	−0.344	−2.172^{a}	−1.984^{a}
	(−2.30)	(−1.39)	(−1.55)	(−0.97)	(−4.67)	(−3.42)
Prior 1 Month Return	−3.019^{a}	−2.266^{b}	−2.248^{b}	−2.995^{a}	−2.748^{b}	−2.698^{c}
	(−2.89)	(−2.17)	(−2.16)	(−2.75)	(−2.37)	(−1.83)
Market Return	85.033^{a}	85.007^{a}	84.654^{a}	−39.990^{a}	78.299^{a}	74.058^{a}
	(42.12)	(42.11)	(41.98)	(−4.39)	(36.87)	(26.75)
Fixed Effects	none	none	none	month	firm	person
Observations	26,098	26,098	26,098	26,098	26,098	26,098
R-squared	0.086	0.089	0.091	0.150	0.354	0.564

Table 6

Portfolio returns following isolated and sequenced insider trades.

The table reports returns to portfolios formed in the month following isolated or sequenced trades. Firms are added to the appropriate portfolio at the beginning of the month following that in which the trade was made and kept in the portfolio for a month. The portfolio is then rebalanced at the beginning of the next month based on new trades. We report the alphas (in percentage terms) from a regression of portfolio returns on: (1) the market factor (CAPM); (2) the market factor, the return difference between a portfolio of "small" and "big" stocks and the return difference between a portfolio of "high" and "low" book-to-market stocks from Fama and French (1993); (3) all three factors augmented with a momentum factor from Carhart (1997). *t*-statistics are reported in parenthesis. *a* and *b* represent significance at the 1% and 5% levels respectively.

Panel A: All Insiders

alphas	Sequenced Sells	Isolated Sells	Long/ Short	Sequenced Buys	Isolated Buys	Long/ Short	Sequenced Buys − Sells	Isolated Buys − Sells
CAPM	0.22	-0.35^a	0.57^a	0.89^a	1.50^a	0.60^a	0.67^a	1.85^a
	(1.28)	(−2.63)	(4.92)	(4.38)	(8.29)	(4.48)	(3.69)	(13.86)
Fama French	0.14	-0.45^a	0.60^a	0.68^a	1.33^a	0.65^a	0.53^a	1.78^a
	(1.21)	(−5.60)	(5.20)	(4.15)	(9.20)	(4.86)	(3.14)	(13.57)
Carhart	0.18	-0.42^a	0.60^a	0.88^a	1.54^a	0.66^a	0.70^a	1.96^a
	(1.50)	(−5.13)	(5.11)	(5.89)	(12.07)	(4.82)	(4.32)	(16.40)

Panel B: Top executives

alphas	Sequenced Sells	Isolated Sells	Long/ Short	Sequenced Buys	Isolated Buys	Long/ Short	Sequenced Buys − Sells	Isolated Buys − Sells
CAPM	0.23	-0.68^a	0.93^a	1.56^a	2.18^a	0.66^b	1.42^a	2.95^a
	(0.94)	(−3.54)	(4.26)	(5.01)	(8.93)	(2.52)	(4.13)	(12.33)
Fama French	0.18	-0.74^a	0.94^a	1.34^a	2.03^a	0.73^a	1.26^a	2.86^a
	(0.86)	(−4.71)	(4.23)	(4.76)	(9.68)	(2.78)	(3.71)	(11.89)
Carhart	0.23	-0.76^a	1.00^a	1.62^a	2.28	0.71^a	1.48^a	3.13^a
	(1.09)	(−4.77)	(4.47)	(5.99)	(11.87)	(2.69)	(4.39)	(14.02)

Table 7

Portfolio returns within and across sequences.

table shows returns to portfolios formed within and across sequences. Firms with sequenced trades are added and kept in the portfolio for the different time-periods shown in the tables. The portfolio is then rebalanced based on new trades. We report the alphas (in percentage terms) 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 parenthesis. *a* and *b* represent significance at the 1% and 5% levels respectively.

Panel A: All Insiders

	Beginning of sequence to month prior to end of sequence	Beginning of sequence to month when sequence ends	1 month following end of sequence	3 months following end of sequence	Beginning of sequence to 3 months after sequence ends
Sales	0.97^a	0.78^a	-0.89^a	-0.51^a	-0.17^b
	(4.20)	(5.89)	(−6.61)	(−6.24)	(−2.33)
Purchases	−0.25	0.41^b	1.17^a	0.95^a	0.90^a
	(−0.96)	(2.36)	(6.49)	(7.65)	(7.77)

Panel B: Top executives

	Beginning of sequence to month prior to end of sequence	Beginning of sequence to month when sequence ends	1 month following end of sequence	3 months following end of sequence	Beginning of sequence to 3 months after sequence ends
Sales	1.30^a	0.57^b	-1.21^a	-0.84^a	-0.33^b
	(2.93)	(2.34)	(5.15)	(5.93)	(2.51)
Purchases	−0.27	0.48	1.90^a	1.37^a	1.20^a
	(0.53)	(1.60)	(5.70)	(6.62)	(6.01)

Table 8

Trading on informed sequenced trades.

table reports returns to portfolios that are formed one month after the month in which a sequenced trade ends, i.e., after waiting to confirm that a sequence of trades has ended. The firms are the held in the portfolio for one month after which the portfolio is then rebalanced based on newly completed sequenced trades. We report the alphas (in percentage terms) from a regression of portfolio returns on: (1) the market factor (CAPM); (2) the market factor, the return difference between a portfolio of "small" and "big" stocks and the return difference between a portfolio of "high" and "low" book-to-market stocks from Fama and French (1993); (3) all three factors augmented with a momentum factor from Carhart (1997). *t*-statistics are reported in parenthesis. *a*, *b* and *c* represent significance at the 1%, 5% and 10% levels, respectively.

Panel A: All Insiders

alphas	Sequenced Sells	Sequenced Buys	Sequenced Buys − Sells
CAPM	-0.48^{a}	1.12^{a}	1.61^{a}
	(−2.64)	(4.81)	(6.20)
Fama French	-0.54^{a}	0.94^{a}	1.49^{a}
	(−3.78)	(4.45)	(5.85)
Carhart	-0.55^{a}	1.15^{a}	1.71^{a}
	(−3.78)	(5.70)	(6.90)

Panel B: Top executives

alphas	Sequenced Sells	Sequenced Buys	Sequenced Buys − Sells
CAPM	-0.60^{c}	1.68^{a}	2.19^{a}
	(−1.86)	(3.45)	(3.85)
Fama French	-0.64^{b}	1.51^{a}	2.07^{a}
	(−2.06)	(3.19)	(3.62)
Carhart	-0.69^{b}	1.76^{a}	2.37^{a}
	(−2.19)	(3.72)	(4.15)

Table 9

Stock returns in month following isolated and sequenced "routine" trades.

The table reports results of a regression of monthly stock returns on firm characteristics following isolated and sequenced "routine" trades. A "routine" is defined as a trade that occurs in a month where the insider has previously traded in the same month for three consecutive years. Isolated Trade Month takes a value of one in the month following an isolated trade, and zero otherwise. Sequence End Month takes a value of one following the end of a sequence of trades, and zero otherwise. Sequence Month takes a value of one following a sequence but not the end of the sequence, and zero otherwise. Panel A shows the results for "routine" insider sales. Panel B shows the results for "routine" insider purchases. *t*-statistics are reported in parenthesis. *a*, *b*, and *c* represent significance at the 1%, 5% and 10% levels, respectively.

Panel A: Routine Sales Months

	(1)	(2)	(3)
Constant	−0.327		
	(−1.59)		
Isolated Trade Month		−0.724^a	−1.324^a
		(−3.33)	(−9.05)
Sequence End Month		−1.009^a	−1.562^a
		(−4.02)	(−7.77)
Sequence Month		0.583^a	
		(2.61)	
Ln(Market Cap)	−0.165^a	−0.151^a	−0.098^b
	(−3.71)	(−3.40)	(−2.13)
Book Equity/Market Equity	1.129^a	1.213^a	1.217^a
	(2.62)	(2.81)	(2.77)
Prior 1 Year Return	0.462^b	0.489^b	0.475^b
	(2.13)	(2.26)	(2.06)
Prior 1 Month Return	−1.228^c	−1.086	−1.206
	(−1.69)	(−1.49)	(−1.56)
Market Return	78.383^a	78.044^a	−38.011^a
	(57.19)	(57.06)	(−5.78)
Fixed effects	no	no	month
Observations	37,661	37,661	37,661
R-squared	0.120	0.129	0.158

Panel B: Routine Purchase Months

	(1)	(2)	(3)
Constant	0.183		
	(1.18)		
Isolated Trade Month		0.553^{a}	1.041^{a}
		(3.12)	(6.33)
Sequence End Month		0.672^{a}	1.134^{a}
		(2.77)	(4.82)
Sequence Month		-0.679^{a}	
		(−3.75)	
Ln(Market Cap)	-0.168^{a}	-0.190^{a}	-0.159^{a}
	(−3.48)	(−3.89)	(−3.39)
Book Equity/Market Equity	1.126^{a}	1.105^{a}	0.700^{a}
	(4.98)	(4.88)	(3.07)
Prior 1 Year Return	0.244	0.249	0.185
	(0.82)	(0.84)	(0.58)
Prior 1 Month Return	-3.003^{a}	-2.946^{a}	-3.159^{a}
	(−2.71)	(−2.66)	(−2.73)
Market Return	61.461^{a}	61.214^{a}	-40.379^{a}
	(42.04)	(41.89)	(−7.61)
Fixed Effects	no	no	month
Observations	29,018	29,018	29,018
R-squared	0.077	0.097	0.130