

## **Insider Investment Horizon**

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### **ABSTRACT**

We examine the relation between insiders' investment horizons and the informativeness of their trading activity regarding future stock returns. We show that both purchases and sales by short horizon insiders are more informative than those by long horizon insiders. Short horizon insiders better predict earnings surprises and large stock price changes. They also tend to come from firms with weaker corporate governance, be male, hold MBA or non-PhD degrees, and trade less following SEC investigations. The results are robust to alternative definitions of investment horizon, model specifications, and controlling for various characteristics of the insider, the trade, and the firm.

**Key Words:** Insider trading, investment horizon, information asymmetry.

**JEL Classification:** G12, G14, G18

## 1. Introduction

The privilege of corporate insiders' access to material non-public information attracts the attention of various market participants and regulators, who wish to know whether insider trades contain predictive information about forthcoming price movements. However, insiders also trade for various reasons that are not information driven, including their desire for liquidity, diversification, or corporate control. These alternative rationales for insider trading make it challenging for market participants or regulators to detect the subset of insiders or their trades that are more likely to signal private information. Thus, while a large body of literature has studied the information content of insider trading, our understanding of which insider trades are more informative is far from complete, and the informational role of insider trades remains an open question.<sup>1</sup>

This article breaks new ground by introducing the concept of an insider's investment horizon, and examining its connection with the informativeness of insider trades regarding future returns.<sup>2</sup> We define an insider's investment horizon as the average annual turnover in his or her own company's stock in the past. Higher turnover involves making more frequent purchases and sales that tend to offset each other, and indicates that an insider updates his or her positions to realize profits in a more timely manner, signaling a shorter investment horizon. In contrast, lower turnover means that an insider tends to either buy or sell over time, suggesting a longer investment horizon.

For example, William Clay Ford made multiple purchases of Ford stock each year from 1988 to 2005, while never selling a single share. As another case, Bill Gates made hundreds of sales and no purchases in Microsoft stock from 1996 to 2013. His sales occurred randomly in at least three different months each year during that period. On the other hand, consider the insider trading activity of Mr. A over time, plotted in Figure 1. Mr. A was a director of company M, a multinational corporation with a market capitalization of \$2.5 billion at the end of 2014.<sup>3</sup> He switched from buying to selling his company's shares frequently during his 10 years of history in the insider trading data. From their revealed insider trading patterns, we argue that both Mr. Ford and Mr. Gates are more likely to maintain a focus on long term trading goals and, therefore, can be viewed as long horizon insiders. On the other hand, Mr. A is more likely to be interested in short term objectives and therefore should be classified as a short horizon insider.

There are several rationales to expect the trades of insiders with different investment horizons to contain differential information about future short term versus long term stock returns. First, some insiders could be more interested in exploiting their information advantage for short term personal benefits, and might be less concerned with the potential legal

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<sup>1</sup> For example, see Aboody and Lev (2000); Alldredge and Cicero (2015); Berkman, Koch, and Westerholm (2014, 2016); Cheng and Lo (2006); Cicero, Wintoki, and Biggerstaff (2015); Cline, Gokkaya, and Liu (2014); Cohen, Malloy, and Pomorski (2012); Cziraki, De Goeij, and Renneboog (2013); Dai, Parwada, and Zhang (2015); Fidrmuc, Goergen, and Renneboog (2006); Frankel and Li (2004); Hillier, Korczak, and Korczak (2015); Jaffe (1974); Jagolinzer, Larcker, and Taylor (2011); Jeng, Metrick, and Zeckhauser (2003); Jenter (2005); Lakonishok and Lee (2001); Lee, Lemmon, Li, and Sequeira (2012); Lee, Mikkelsen, and Partch (1992); Marin and Olivier (2008); Piotroski and Roulstone (2005); Ravina and Sapienza (2010); Scott and Xu (2004); Seyhun (1986, 1988, 1992); Skaife, Veenman, and Wangerin (2013); and Wang, Shin, and Francis (2012).

<sup>2</sup> Insiders may have different investment horizons because of differences in their personal investment objectives and styles, their own understanding and attitude toward insider trading laws, their compensation contracts, and their desire for greater liquidity, diversification, or corporate control.

<sup>3</sup> The names of this insider and the firm have been disguised to protect the identity of this insider.

consequences of insider trading laws. This group of insiders could be more likely to both purchase and sell the company's stock over time, to realize short term profits. Thus, we may expect their trading activity to contain more predictive information about short term stock returns compared with the trades of long horizon insiders, who are more inclined to only purchase or sell the company's stock over time.

Second, it is possible that short horizon insiders turn over their stocks more frequently due to psychological biases, such as overconfidence, and their trades might reflect these biases rather than information.<sup>4</sup> In this case, short horizon insiders may tend to be less informed when compared to long horizon insiders. On the other hand, one might also argue that long horizon insiders keep purchasing or selling due to similar overconfidence or ego. These psychological biases may make long horizon insiders reluctant to update their personal beliefs about the firm's future prospects, leading to trades that are less informed.

Third, short horizon insiders may focus on short lived information flows that are associated with short term price swings. These price swings may be tied to imminent value-relevant events which necessitate timelier trading to exploit such information. In contrast, long horizon insiders might be more interested in the longer term fundamental prospects of a company, and thus focus their trades on information with a longer shelf life. In this case, although both types of insiders would be informed, the trades of short horizon insiders would be more informative in the short run, while those of long horizon insiders would be more informative in the long run.

Despite the potential importance of this dimension of insider heterogeneity on asset prices, no prior work has investigated the connection between insiders' investment horizons and the nature and information content of their trading activity. In this paper, we conduct several tests to investigate the connection between the investment horizons of insiders and the informativeness of their trades.

We find that both the sales and purchases of short horizon insiders are more informative with regard to one-month-ahead future returns, when compared to long horizon insiders. In particular, a long-short tradable strategy that replicates the purchases and sales of short horizon insiders earns a risk-adjusted return of 2.04% per month. In contrast, a strategy that mimics the trades of long horizon insiders earns just 0.77% per month. In addition, we show that the trades of short horizon insiders contain more predictive information about upcoming large price changes and earnings surprises, relative to the trades of long horizon insiders. This finding indicates that the superior trading performance of short horizon insiders is related to material nonpublic information about imminent events that have a short term impact on the firm's value. Overall, our findings indicate that the personal investment horizon of an insider is a significant determinant of the information content of his or her trades, and the trades of a short horizon insider are more informed than those of a long horizon insider.

We also compare the personal attributes of short horizon versus long horizon insiders, to better understand the nature of their differences. We find that short horizon insiders are more likely to be male and have MBAs, and less likely to hold PhD degrees. Short horizon insiders are also more likely to make non-routine trades (Cohen, Malloy, and Pomorski, 2012), and be persistently opportunistic (Cline, Gokkaya, and Liu, 2014). In addition, they tend to work for firms with greater information asymmetry that is associated with smaller size and higher stock return volatility. They also reside in firms with weaker corporate governance, and they are more

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<sup>4</sup> See Barber and Odean (2000), Odean (1998), and Yan and Zhang (2009).

likely to hold prominent offices such as CEO, CFO, or Chairman of the Board, and thus have better access to material private information.

One might argue that the relative information content of the trades of short horizon versus long horizon insiders could vary over different holding periods. For example, while the trades of short horizon insiders are more informative over one-month holding periods, the trades of long horizon insiders could be more informative over longer holding periods. We investigate this possibility by examining the informativeness of short horizon versus long horizon insiders' trades over the four years following their transactions. We find that the trades of short horizon insiders continue to outperform long horizon insiders for up to one year following their trades. However, there is no evidence of differential trading performance across short horizon versus long horizon insiders in the long run (beyond one year).

Finally, we examine whether short horizon versus long horizon insiders reveal differential sensitivities to litigation risk associated with their insider trades. We find that short horizon insiders make fewer trades following periods of intensified SEC enforcement activity regarding insider trading cases. This finding suggests that short horizon insiders are more reticent about exploiting private information during periods with higher litigation risk following SEC investigations (see Del Guercio, Odders-White, and Ready, 2013).

We assess the robustness of the main findings by using alternative definitions of insider investment horizon, risk-adjusted returns, and regression methodologies. We also control for other attributes of the insider, the trade, or the firm, including measures of firm corporate governance and the insider's investment style, positions held, educational background, gender, and past trading experience. The major conclusions remain robust throughout this analysis. Moreover, these findings also hold at the firm level, such that a larger proportion of *aggregate* buying (selling) across short horizon insiders within a firm is associated with higher (lower) future returns.

The findings of this paper are useful for both investors and regulators to help strip away less valuable information from aggregate insider trading activity, and thereby focus on the subset of insiders whose trades are more informative. This analysis thus contributes to the literature regarding which groups of insiders are more likely to make informed transactions. For example, Cohen, Malloy, and Pomorski (2012) document that routine insiders, who make trades in the same calendar month for a number of years, are unlikely to make informed trades. Cline, Gokkaya, and Liu (2014) find that persistently opportunistic insiders, whose past trades are more informed, continue to make informed trades in the future. The findings in this paper still hold after controlling for these two types of transactions by short term versus long term insiders. We also find that non-routine insiders and persistently opportunistic insiders tend to have a shorter investment horizon. Together, this analysis establishes that an insider's investment horizon represents another important determinant of the informativeness of insider trades.

This paper is also related to the literature on short horizon investors. For example, Bushee (1998) partitions institutional investors based on their past portfolio turnover into transient investors, quasi-indexers, and dedicated investors. His use of institutional portfolio turnover is consistent with our measure of insider investment horizon. He shows that transient (i.e., short horizon) institutional investors are associated with myopic R&D investment behavior. Yan and Zhang (2009) similarly classify institutional investors according to their investment horizons and show that the trading activity of short horizon institutional investors contains more predictive information about short run movements in stock prices. Our paper is the first to introduce the

concept of investor investment horizons to corporate insiders, and shows that insider investment horizons also play a significant role in identifying the information content of insider transactions.

The remainder of the paper is organized as follows. Section 2 provides a literature review. Section 3 describes the data and methodology and explores the differences in characteristics across short horizon versus long horizon insiders, their trades, and their firms. Section 4 investigates the differential short run and long run trading performance between these two types of insiders. Section 5 relates the trades of short horizon and long horizon insiders to the likelihood of future firm-specific informational events. This section also analyzes changes in insider trading behavior following periods of high SEC enforcement activity. Robustness tests are conducted in Section 6, and a final section concludes.

## 2. Literature Review

This paper is related to two strands of literature that study: (1) the informational content of trades made by corporate insiders, and (2) the effect of institutional shareholder investment horizons on firm policies and the informativeness of their transactions.

### 2.1. Insider Trading

A large body of work examines the information content of insider trades. Early studies generally find that both insider purchases and sales are informative (e.g., Jaffe, 1974; Seyhun, 1986). Later work shows that insider purchases are informative, while the bulk of the evidence indicates that insider sales are not informative. For example, Lakonishok and Lee (2001) and Jeng, Metrick, and Zeckhauser (2003) document that insider purchases strongly predict higher future stock returns, while insider sales do not predict negative returns. A few recent studies find that some subsets of insider sales are informative (e.g., see Cohen, Malloy, and Pomorski, 2012, Berkman, Koch, and Westerholm, 2014, and Cicero, Wintoki, and Biggerstaff, 2015, and Berkman, Goldie, Koch, and Wintoki, 2016).

Some authors show that insiders strategically time their trades around firm events (Cheng and Lo, 2006; Huddart, Ke, and Shi, 2007). Others find evidence suggesting that informed traders tend to make their best trades through the accounts of family members (Berkman, Koch, and Westerholm, 2014, Berkman, Goldie, Koch, and Wintoki, 2016). Berkman, Koch, and Westerholm (2016) show that insiders outperform when they buy the stocks of *other* companies where they are not insiders, especially when they have an interlocking board connection.

Prior work also relates insider trading behavior to the characteristics of the firm, the insider, or the trade. This work documents that insider trades are more profitable in companies that are subject to greater information asymmetry, such as firms with smaller size (Lakonishok and Lee, 2001), greater R&D intensity (Aboody and Lev, 2000), low analyst coverage (Frankel and Li, 2004), and less internal control (Jagolinzer, Larcker, and Taylor, 2011; Skaife, Veenman, and Wangerin, 2013). Jenter (2005) finds that top managers tend to be contrarian investors. Hillier, Korczak, and Korczak (2014) show that the unobserved personal attributes of insiders explain only a small portion of the variation in stock returns following insider trades. Cohen, Malloy, and Pomorski (2012) categorize an insider as a routine insider if he or she trades in the same month for a certain number of years. They find that trades by non-routine insiders are informative, while those made by routine insiders are not. Cline, Gokkaya, and Liu (2014) classify insiders as persistently opportunistic (PO) if they earn positive abnormal returns for more than half of their trades during a certain period in the past, and show that PO insiders are more informed.

## 2.2. *Investment Horizon*

Recent research demonstrates that the investment horizon of shareholders plays an important role in determining firm policies and signaling the informativeness of trading activity. In his seminal work, Bushee (1998) categorizes institutional investors according to their investment horizons based on portfolio turnover, into transient investors, quasi-indexers, and dedicated investors. He documents that transient (i.e., short horizon) investors are associated with firm myopic R&D investment behavior. Bushee (2001) further shows that institutions with short investment horizons prefer near-term earnings. Yan and Zhang (2009) find that the trades of short horizon institutional investors predict stock returns in the short run, and they find no evidence of a reversal in the long run. In addition, they document that the trades of short horizon institutional investors are positively associated with future earnings surprises. In contrast, the trades of long horizon institutional investors are not informative.

If short horizon investors make more informed trades, one might expect their presence to improve stock market efficiency. Following this line of inquiry, some prior work also investigates the potential impact of short horizon investors on stock price mispricing, with mixed results. Derrien, Kecskes, and Thesmar (2014) note that investors with longer investment horizons attenuate the effect of stock mispricing on corporate policies, such as investment, equity financing, and payouts. In this case, long horizon (short horizon) investors might operate to prevent (facilitate) timely corrections of stock mispricing. Gaspar et al. (2012) find that firms owned by short horizon investors tend to make more repurchases. However, the market discounts such signals, perhaps due to such investors over-exploiting mispricing opportunities. Short horizon investors may even amplify mispricing. Cella, Ellul, and Giannetti (2013) find that short horizon insiders intensify market turmoil by engaging in heavy sales, which lead to large price declines and subsequent reversals. Cremers and Pareek (2014) argue that overconfident short horizon investors cause large momentum returns and subsequent reversals.

## 3. Data, Methodology, Sample Statistics, and Characteristics of Insiders

### 3.1. *Data and Variable Construction*

We obtain insider transaction data from the Thomson Reuters Insider Filings database. Corporate insiders include officers, directors, and any beneficial owners of more than ten percent of a company's stock. The sample is limited to open market purchases and sales of common stocks. We aggregate all purchases and sales by an insider to obtain net shares bought or sold during a given month, so that the unit of measurement is an insider trading month. Following the previous literature, the final sample excludes small trades where less than 100 shares are traded. Firm financial statement data are taken from Compustat and stock returns data are from CRSP. The main sample spans the period between January 1996 and December 2013.<sup>5</sup>

Motivated by the institutional investor literature, we measure the trading horizon of an insider each month based on the insider's past turnover of his or her own company's shares. Higher turnover indicates that an insider updates his or her positions to realize profits in a more timely manner, signaling a shorter investment horizon. Specifically, for insider  $i$  of firm  $j$  in month  $t$ , the insider's trading horizon is calculated as the average annual net insider order flow

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<sup>5</sup>The starting point of the main sample period begins 10 years after the first available data on insider trading in 1986, because our measure of insider trading horizon requires an identification period of 10 years. We also require each insider to have traded in at least four different years during the past 10 years to ensure that the insider is active.

across all years ( $y$ ) that the insider traded during the previous 10 years (the identification period), as follows:

$$\text{HOR}_{i,j,t} = \left| \frac{\sum_{y=T-10}^{\text{year}(t-1)} \text{IOF}_{i,j,y}}{N} \right| * (-1),$$

where  $\text{IOF}_{i,j,y}$  is the annual net insider order flow of insider  $i$  at firm  $j$  in year  $y$ , defined as  $\frac{P_{i,j,y} - S_{i,j,y}}{P_{i,j,y} + S_{i,j,y}}$ , where  $P$  is the number of shares purchased during year  $y$ ,  $S$  is the number of shares sold, and  $N$  is the number of years the insider traded from year  $T-10$  through month  $t-1$ .<sup>6</sup>

Note that, if a long horizon insider makes only insider purchases in any given year ( $y$ ) over the past ten years, then  $S = 0$  and  $\text{IOF}_{i,j,y} = P/P = +1$ . Alternatively, if a long horizon insider makes only sales,  $P = 0$  and  $\text{IOF}_{i,j,y} = -S/S = -1$ . Instead, if a short horizon insider's purchases and sales exactly offset one another, then  $\text{IOF}_{i,j,y} = 0$ . Thus, the insider's net order flow in any given year,  $\text{IOF}_{i,j,y}$ , may range from -1 to +1. When we average this annual net order flow across the past 10 years, and then take the absolute value of this annual average, the resulting measure ranges from 0 to +1. Finally, multiplying this resulting measure by (-1) makes  $\text{HOR}_{i,j,t}$  range from -1 to 0.

According to this final measure, insiders whose net purchases and sales more closely offset each other over time have a smaller average net order imbalance per year, and thus have a shorter investment horizon (i.e.,  $\text{HOR}_{i,j}$  is closer to 0). In contrast, insiders whose purchases and sales do not offset each other over time have a higher average net order imbalance per year, and thus have a longer investment horizon (i.e.,  $\text{HOR}_{i,j}$  is closer to -1). In the extremes,  $\text{HOR}_{i,j,t}$  equals to -1 for insiders who only buy or sell over the past 10 years, while it equals to 0 for insiders who buy and sell an equal number of shares. Note that the variation in this construct for insider trading horizon offers a straightforward interpretation: a one-unit increase in this measure reflects a change from long term insiders (who only buy or sell) to short term insiders (whose purchases and sales exactly offset one another).

We also measure the *strength* of the signal revealed through an insider's trading activity, by constructing an alternative measure of the insider's order flow during any given month, as a proportion of total trading volume in the stock. Specifically, for insider  $i$  of firm  $j$  in month  $t$ , the insider's trading strength is defined as:

$$\text{STR}_{i,j,t} = \frac{P_{i,j,t} - S_{i,j,t}}{\text{VOL}_{j,t}},$$

where  $P_{i,j,t}$  is the number of shares purchased by insider  $i$  at firm  $j$  in month  $t$ ,  $S_{i,j,t}$  is the number of shares sold, and  $\text{VOL}_{j,t}$  is the total trading volume by all investors in firm  $j$  during month  $t$ .

Next we construct the scaled rank of insider trading strength, as follows. First, each month the cross section of insiders who trade (across all insiders ( $i$ ) and firms ( $j$ )) is ranked into quintiles by the continuous measure of insider trading strength ( $\text{STR}_{i,j,t}$ ), and the individuals in each quintile are assigned the values, 0 – 4. Second, these quintile ranks are divided by 4 to make the scaled rank,  $\text{STR\_RK}$ , range from 0 (for the quintile with strong insider sales) to +1 (for the quintile with strong insider purchases). Hence, a one-unit increase in this scaled rank variable ranges from the quintile of insiders making strong sales to the quintile making strong purchases during month  $t$ .

<sup>6</sup> In Table 9 we document robust results when we use a 5-year or 7-year period to identify insider trading horizon.

Following Cohen, Malloy, and Pomorski (2012), we also consider a number of control variables, including the firm's market capitalization (SIZE), book-to-market ratio (B/M), lagged one month stock return (RET(-1)), and cumulative stock return during the past year, excluding month  $t-1$  (RET(-12, -2)). We also examine other firm attributes that have been shown to be associated with the cross section of stock returns, including asset growth (ASSETGR), profitability (PROFIT), and stock return volatility (RET\_STD). Appendix 1 provides further details regarding the construction of the variables used in the paper.

### 3.2. Sample Statistics

Panel A of Table 1 presents summary statistics for the key variables, while Panel B reports their correlations (Pearson correlations appear below the diagonal and Spearman correlations are above the diagonal). In Panels A and B, we first calculate the cross sectional statistics every month, and then compute the time series means of these cross sectional averages or correlations across all months in the sample.

Panel A of Table 1 indicates that there are 146,159 observations (i.e., insider trading months) with complete data on the main variables over the sample period, 1996 – 2013. The mean and median values for the insider investment horizon are -0.791 and -0.997, respectively. The median value close to -1 indicates that nearly one half of all insiders make only purchases or sales, but not both, over the past ten years. For the remaining insiders there is substantial variation in the investment horizon across the possible values from -1 to 0. The mean trading strength is -3.3 basis points (bp), indicating an average insider with net order flow that is slightly short. This outcome is consistent with the fact that the number of sales per insider is usually larger than the number of purchases, because insiders often obtain shares as a part of their compensation, as well as through open market purchases.

The average book-to-market ratio is 0.527. The typical firm has a market value of 7.2 billion dollars, and firm size ranges from 14 million to 143 billion in market capitalization. In all analysis below, we follow previous work and take the natural log of the firm's book-to-market ratio and market value, to mitigate the influence of skewness. The average lagged one month return prior to insider trades (RET(-1)) is 3%, while the average lagged return over the past year excluding the previous month (RET(-12, -2)) is 26.8%.

In Panel B of Table 1, insider trading horizon has a fairly low correlation with the other key variables. The two variables that have the largest (absolute) correlation with investment horizon are firm size and stock return volatility. These correlations indicate a tendency for firms subject to greater information asymmetry (i.e., smaller size or greater stock return volatility) to have insiders with a shorter investment horizon. In the next subsection, we compare the characteristics among insiders with different investment horizons in more detail.

### 3.3. Characteristics of Short Horizon versus Long Horizon Insiders

This section compares attributes across insiders with different investment horizons. We begin by independently partitioning the main sample along two dimensions: the insider's trading direction (i.e., sales vs. purchases) and investment horizon (i.e., long versus medium versus short horizon). First, an insider trading month is denoted as a sale (or purchase) if the insider makes net sales (or purchases) during this time frame. Second, we make a simple classification of all insiders into three groups by their investment horizons. The first group of insiders only buy or sell during the previous ten-year period (i.e., HOR = -1), and are thus labeled as *long horizon* insiders. Their activity constitutes roughly half of all the insider trading months in the sample. All remaining insiders both purchase and sell their company's stock sometime over the past ten years (i.e., HOR is between -1 and 0), and they are partitioned into two smaller categories.



Insiders in this remaining group with an investment horizon measure below the median (i.e., HOR closer to -1) tend to mostly buy or mostly sell, and are thus labeled as *medium horizon* insiders. Those with an investment horizon above the median (i.e., HOR closer to zero) enter purchases and sales that tend to offset each other, and are thus labeled as *short horizon* insiders.

In Panel A of Table 2, we report the relative frequencies of insider purchases and sales for the resulting three groups of long, medium, and short horizon insiders. First consider the category of long horizon insiders, at the top of Panel A. Column 3 indicates a total of 84,702 insider trading months for these insiders who have only traded in one direction in the past ten years. These long horizon insiders account for 58% of the entire sample of insider trading months, and their activity is comprised of 11% purchases and 89% sales. Second consider the group of medium horizon insiders, in the middle of Panel A. Column 3 reveals a total of 29,573 insider trading months for this group, which account for 20% of the entire sample and are made up of 15% purchases and 85% sales. Third, the last group of short horizon insiders have 31,884 insider trading months, which account for 22% of the sample and include 18% purchases and 82% sales.<sup>7</sup>

In Panel B of Table 2, we explore the differential characteristics of insiders and their firms across the different groups of insiders with long, medium, and short investment horizons. We also report the differences in means for these attributes across short horizon versus long horizon insiders. The top row indicates significant variation in the average trading horizon across these groups of insiders. The trading strength variable in the second row reveals a mean difference across short horizon and long horizon insiders which is significantly negative, indicating that short horizon insiders tend to make stronger selling signals. Short horizon insiders are also associated with firms that are subject to greater information asymmetry, have smaller size and higher stock return volatility.

Next we turn to our proxies for corporate governance, access to firm-specific information, and educational background. We find that short horizon insider trades are associated with weaker corporate governance, as measured by a significantly higher entrenchment index of Bebchuk, Cohen, and Ferrell (2009), although there is no significant difference in the governance index of Gompers, Ishii, and Metrick (2003). We use the insiders' positions held in a firm to proxy for their access to firm-specific material information. We find that short horizon insiders are more likely to be CEOs, CFOs, and Chair of the Board. This evidence implies that short horizon insiders are more likely to hold positions with better access to firm-specific information. We also find that short horizon insiders are more likely to have MBAs, and less likely to have PhDs.

Cohen, Malloy, and Pomorski (2012) classify an insider as a routine insider if he or she traded in the same calendar month in each of the past three years, or an opportunistic (or non-routine) insider otherwise.<sup>8</sup> Cline, Gokkaya, and Liu (2014) categorize an insider as persistently opportunistic (PO), if over half of his or her trades in the past three years have positive abnormal returns. Panel B of Table 2 indicates that short horizon insiders are more likely to be both non-routine insiders and persistently opportunistic insiders. We also find that female insiders are less likely to be short horizon insiders.

Finally, we compare the past *trading experience* of insiders with different investment horizons. We consider two ways to measure an insider's trading experience, including the

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<sup>7</sup> In unreported analysis, we also classify insiders using all trades available from the Thomson database from 1986 through 2013, rather than using the insider's trading history for just the previous ten years. We find similar results.

<sup>8</sup> We use the term, 'non-routine' insiders, to denote the opportunistic insiders in Cohen, Malloy, and Pomorski (2012), in order to avoid confusion with the persistently opportunistic insiders from Cline, Gokkaya, and Liu (2014).

number of years of experience since the insider's first year of trading (*EXP\_YEAR*) and the number of previous trading months (*EXP\_TRADE*) at the time of a trade. The resulting mean values do not change monotonically across all three categories based on insider trading horizon. Still, the evidence indicates that a typical short horizon insider has 0.54 more years of trading experience than long horizon insiders. On the other hand, short horizon insiders are less experienced than long horizon insiders, in terms of the total number of past insider trading months.<sup>9</sup>

In summary, this section documents that over half of the insider trading months in the sample are by long horizon insiders who only buy or sell over the previous ten years. Short horizon insiders are more likely to work at smaller firms and firms with higher stock return volatility. They are also associated with firms characterized by weaker corporate governance, and they have better access to private information about the firm. In addition, they are more likely to be non-routine insiders (Cohen, Malloy, and Pomorski, 2012) and persistently opportunistic insiders (Cline, Gokkaya, and Liu, 2014), and less likely to be female.<sup>10</sup>

#### 4. Main Results: Trading Performance of Short Horizon vs. Long Horizon Insiders

This section examines the trading performance of insiders, conditioned on their trading horizon and trading strength. We measure the insider's trading performance using stock returns during the month following insider trades. A purchase (sale) is considered profitable if the stock involved earns a positive (negative) abnormal return in month  $t+1$ . The objective is to provide a simple way to identify the subset of insiders whose trades convey private information, by analyzing the differential trading performance between long horizon and short horizon insiders.

##### 4.1. Portfolio Approach: Short Run Trading Performance

In this subsection, we compare the short run trading performance of long horizon and short horizon insiders using a  $5 \times 3$  sorting scheme, where stocks are assigned into different portfolios based on the insider's trading strength and trading horizon. For each month ( $t$ ), we begin by considering all insiders who trade. We then sort stocks into five portfolios based on the insider's trading strength, ranging from stocks that experience strong insider selling to those with strong insider purchasing. In addition, we follow the partitioning scheme applied above in Panel A of Table 2, and independently group stocks into three portfolios based on the insider's trading horizon: (i) long horizon insiders ( $HOR = -1$ ), (ii) medium horizon insiders ( $HOR$  below the median, closer to  $-1$ ), and (iii) short horizon insiders ( $HOR$  above the median, closer to  $0$ ). The resulting 15 portfolios from this  $5 \times 3$  partitioning scheme are then held for one month,  $t+1$ .<sup>11</sup>

<sup>9</sup> This latter outcome may reflect a tendency for long horizon insiders to either repeatedly purchase shares over time, perhaps to build a position for corporate control, or repeatedly sell shares for diversification or liquidity purposes.

<sup>10</sup> In Appendix 2, we replicate the analysis in Panel B of Table 2 for the samples of insider sales and purchases separately, and we find similar patterns. In Appendix 3, we explore the association between insider trading horizon and the characteristics of insiders and their firms, using a probit regression framework. Specifically, the dependent variable is a dummy variable that takes a value of one if a trading month is for a short horizon or medium horizon insider who both buys and sells the stock. The independent variables include the standard control variables in Equation (1) in section 4.2, along with the attributes of the insider and the firm. The findings are similar to those in Panel B of Table 2 below.

<sup>11</sup> Since Section 3 shows that long horizon insiders (who only buy or sell,  $HOR = -1$ ) account for roughly half of the trades, in Appendix 4 we also perform  $2 \times 2$  and  $5 \times 2$  sorting analysis based on trading strength (purchases vs. sales, or strong purchases vs. strong sales) and trading horizon (long horizon insiders who only buy or sell versus short horizon insiders who both buy and sell). Results are similar.

Table 3 reports the mean raw returns for these 15 portfolios, as well as the risk-adjusted abnormal returns from the Fama-French four-factor model (Carhart, 1997), estimated across all months in the sample period.<sup>12</sup> First consider the right column of Table 3, which presents the differential performance across the trades of insiders with a short horizon versus those with a long horizon (i.e., SH – LH), for each category by trading strength (STR). This column shows that short horizon insiders outperform long horizon insiders for both purchases and sales. For example, in the month following strong purchases, the Fama-French four factor alphas in the bottom half of Table 3 indicate that short horizon insiders outperform long horizon insiders by an average of 0.78% (t-ratio = 2.91). This difference accumulates to more than 9% per year. Likewise, when short horizon insiders make strong sales, they outperform long horizon insiders by an average of -0.49% per month (t-ratio = -2.07), or roughly 6% per year. Combining strong purchases and strong sales, short horizon insiders earn 1.27% per month more than long horizon insiders (t-ratio = 3.50), for a differential performance of over 15% per year.

Next consider the bottom row of Table 3, which presents the differential performance across the strong purchases minus the strong sales (i.e., SP – SS), for each category by insider trading horizon (HOR). This row shows that strong purchases outperform strong sales for both long horizon and short horizon insiders. For example, the Fama-French four factor alphas in the bottom row indicate that the one-month-ahead return from a hedge portfolio made up of strong purchases minus strong sales by *long horizon insiders* is only 0.77% (t = 3.1). In contrast, the analogous hedge portfolio of purchases minus sales by *short horizon insiders* earns a significantly larger return of 2.04% (t-ratio = 4.0) per month. The differential performance across these two hedge portfolios is again 1.27% (t = 3.50) per month.

The results for insider sales in Table 3 are of special interest. First consider the average raw returns for the 15 portfolios in the top half of Table 3. Note that these 15 portfolio returns are all positive and mostly significant, even for strong insider sales (by long term insiders). However, it is noteworthy that the three portfolios in the top right corner of this 5×3 partitioning scheme have the smallest positive mean raw returns, and they are the only portfolio returns that are not significantly positive. Importantly, these three portfolios represent the stocks sold by medium or short term insiders.

Next consider the analogous risk-adjusted abnormal returns from the Fama-French 4-factor model, in the top right corner of the bottom half of Table 3. We highlight the alphas of these three portfolios, which represent sales by medium or short term insiders. They reveal negative abnormal returns that are at least marginally significant, at -0.34 (t-ratio = 1.88), -0.36 (t-ratio = 1.61), and -0.51 (t-ratio = 2.36). This evidence contrasts with much of the previous literature on insider trading, which generally concludes that insider sales are not informative.<sup>13</sup>

Overall, the portfolio analysis in this subsection indicates that short horizon insiders outperform long horizon insiders. One implication is that investors who make their investment decisions by following only the trades of short horizon insiders can earn roughly 1.27% per month more than those who follow only long horizon insiders. This analysis also documents

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<sup>12</sup> We find similar results when we use the Fama-French 3-factor or 5-factor model (Fama and French, 1997, 2015).

<sup>13</sup> The t-ratios associated with this finding become larger when stocks are assigned to fewer portfolios in a 2×2 or 5×2 sorting analysis, likely due to the higher power gained from a larger number of stocks in each portfolio. For example, in the 2×2 sorting analysis conducted in Panel A of Appendix 4, short horizon insider sales generate a mean monthly abnormal return of -0.36% (t-ratio = -2.7). Similar results are found in the 5×2 sorting analysis of Panel B in Appendix 4.

evidence that both purchases and sales made by short horizon insiders are informative about future stock returns.

#### 4.2. Regression Approach: Short Run Trading Performance

This subsection compares the *short run* trading profitability of short horizon insiders versus long horizon insiders using a panel regression approach. Here we regress the one-month-ahead stock return on the scaled rank of insider trading strength (STR\_RK), insider trading horizon (HOR), their interaction, and other control variables, as follows:

$$\begin{aligned} \text{RET}(+1)_{j,t} = & \alpha + \beta_{\text{STR}} \text{STR\_RK}_{i,j,t} + \beta_{\text{HOR}} \text{HOR}_{i,j,t} \\ & + \beta_{\text{STR}*\text{HOR}} \text{STR\_RK}_{i,j,t} * \text{HOR}_{i,j,t} + \text{Controls}_{i,j,t} + \varepsilon_{i,j,t}. \end{aligned} \quad (1)$$

The dependent variable, RET(+1), is the leading one month stock return. We multiply RET(+1) by 100 to reflect the performance in percentage terms. STR\_RK is the scaled rank of trading strength, and HOR is our measure of insider trading horizon. Monthly fixed effects are included and standard errors are clustered at the firm level.

In Table 4, we present six columns of regression results that include various combinations of the independent variables in Equation (1). In columns 1 to 3, we include different permutations of the main variables of interest (STR\_RK, HOR, and their interaction), along with the main set of control variables (B/M, SIZE, RET(-1), and RET(-12, -2)). Columns 4 to 6 repeat the permutations involving the main variables of interest, while extending the set of control variables to include PROFIT, ASSETGR, and STD\_RET.

In column 1 of Table 4, we only include the scaled rank of insider trading strength (STR\_RK) along with the other control variables. Insider trading strength by itself has significant predictive power with regard to future stock returns, consistent with the previous literature and the portfolio analysis above. For example, in column 1 the coefficient of STR\_RK is 0.80% (t-ratio = 6.24). This coefficient represents the association between a one-unit increase in the scaled rank of insider trading strength and future stock returns. It implies that the quintile of stocks most heavily bought by insiders (i.e., STR\_RK = +1) outperforms the quintile of stocks most heavily sold (i.e., STR\_RK = 0) by 80 basis points in the next month.

In column 2 of Table 4, we extend the model in column 1 to also include the measure of insider trading horizon (HOR) by itself. After adding HOR to this model, the coefficients of insider trading strength and the other independent variables remain robust, while the coefficient of insider trading horizon is close to zero and insignificant. This outcome indicates that the insider's investment horizon, by itself, does not contain any substantive incremental predictive information about future stock returns beyond that provided by the insider's trading strength.

In column 3 of Table 4, we include insider trading strength, insider investment horizon, and their interaction, all of which have significant coefficients. The coefficient of the interaction term ( $\beta_{\text{STR}*\text{HOR}}$ ) tests whether one hedge portfolio, made up of the strong purchases minus the strong sales by *short horizon insiders*, outperforms the analogous hedge portfolio of purchases minus sales by *long horizon insiders*. To see this result, consider the influence of trading strength on future returns implied by Equation (1):  $\frac{\partial \text{RET}(+1)}{\partial \text{STR}} = \beta_{\text{STR}} + \beta_{\text{STR}*\text{HOR}} \text{HOR}$ . This partial derivative shows that, for long horizon insiders (i.e., for HOR = -1), a one-unit increase in insider trading strength from strong sales to strong purchases (i.e., changing STR\_RK from 0 to +1), is associated with a change in RET(+1) of  $(\beta_{\text{STR}} - \beta_{\text{STR}*\text{HOR}})$  percent. In contrast, for short horizon insiders (i.e., for HOR = 0), a change from strong sales to strong purchases is associated with a change in RET(+1) of  $\beta_{\text{STR}}$  percent. Thus,  $\beta_{\text{STR}*\text{HOR}}$  measures the change in  $\frac{\partial \text{RET}(+1)}{\partial \text{STR}}$  when we

consider a change in insider horizon (HOR) from long horizon to short horizon insiders. This coefficient is analogous to the difference between the two hedge portfolio returns in the bottom row of Table 3, comprised of the purchases minus sales by short horizon insiders minus the analogous trades by long horizon insiders, which appears in the bottom right corner of Table 3.<sup>14</sup>

Consider the implications of the significant coefficients,  $\beta_{STR}$ ,  $\beta_{HOR}$ , and  $\beta_{STR*HOR}$  in column 3 of Table 4. The coefficient of the interaction term ( $\beta_{STR*HOR}$ ) indicates that the one-month-ahead return from a hedge portfolio made up of strong purchases minus strong sales by *short horizon insiders* is 1.44% (t-ratio = 4.06) larger than the analogous hedge portfolio of purchases minus sales by *long horizon insiders* (after controlling for other firm attributes). Once again, to see this result observe that the hedge portfolio for strong purchases minus strong sales made by *short horizon insiders* (i.e., for  $HOR = 0$ ) earns  $\beta_{STR} = 1.92\%$  per month (t-ratio = 6.26). However, the analogous hedge portfolio return is reduced to 0.48% per month ( $= \beta_{STR} - \beta_{STR*HOR} = 1.92\% - 1.44\%$ , t-ratio = 3.22) for *long horizon insiders* (i.e., for  $HOR = -1$ ). The difference between these two hedge portfolio returns is  $\beta_{STR*HOR} = 1.44\%$  (t-ratio = 4.06).<sup>15</sup>

We also obtain similar results in columns 4 to 6 of Table 4, when we include the additional control variables in the regression specification. This regression analysis confirms the findings from the portfolio approach. The trades of short horizon insiders significantly outperform the trades of long horizon insiders in the short run. Investors who mimic insider trades can earn significantly higher returns by adhering only to the trades of short horizon insiders, because these trades are more informative.

#### 4.3. Long Run Trading Performance

In this subsection, we further compare the *long run* trading performance of short horizon insiders versus long horizon insiders. The evidence from Sections 4.1 and 4.2 indicates that the trades of short horizon insiders are more informative in the short run (i.e., in month  $t+1$ ). This evidence may reflect a greater penchant for short horizon insiders to profit from their access to private information, in general. On the other hand, it is also possible that insiders with different investment horizons could simply have divergent investment styles or different focuses. For example, short horizon insiders may concentrate on short-lived information with a transient influence on the stock price, while long horizon insiders could focus on long term fundamentals. In that case, long horizon insiders may appear to underperform short horizon insiders in the short run (in month  $t+1$ ), while they eventually outperform in the long run (beyond month  $t+1$ ).

For this analysis of long run insider trading performance, we estimate a revised version of Equation (1) that replaces  $RET(+1)$  as the dependent variable with  $RET(+a,+b)$ , defined as the long run future cumulative return that spans various sub-periods extending further into the future, from month  $t+a$  through month  $t+b$ , as follows:

$$RET(+a,+b)_{j,t} = \alpha + \beta_{STR} STR\_RK_{i,j,t} + \beta_{HOR} HOR_{i,j,t} + \beta_{STR*HOR} STR\_RK_{i,j,t} * HOR_{i,j,t} + Controls_{i,j,t} + \epsilon_{i,j,t}. \quad (2)$$

In each Panel of Table 5, we present six columns of results that analyze insider trading performance over various future periods that extend up to four years later. The first three columns analyze the 5-month return from month  $t+2$  through  $t+6$ , the subsequent 6-month return

<sup>14</sup> The observation that the coefficient of the interaction term ( $\beta_{STR*HOR}$ ) is analogous to the difference between hedge portfolio returns in the bottom right corner of Table 3 demonstrates that  $\beta_{STR*HOR}$  is simply a difference-in-difference test, which controls for the influence of the other control variables in Equation (1).

<sup>15</sup> As expected, the coefficient,  $\beta_{STR*HOR}$  (1.44%, t-ratio = 4.06), is comparable to the difference in hedge portfolio returns in the bottom right corner of Table 3 (1.27%, t-ratio = 3.5).

from month  $t+7$  through  $t+12$ , and the entire 11-month return from month  $t+2$  through  $t+12$ . The last three columns examine longer run future returns that cover 12-month periods spanning the second, third, and fourth years following insider trades. To test the informativeness of insider trades in the long run, Panel A reports the results from a model that only includes STR\_RK and the control variables. Panel B presents results from Equation (2). Similar to Model (1), the control variables include B/M, SIZE, RET(-1), RET(-12, -2), PROFIT, ASSETGR, and STD\_RET. The coefficients of the control variables are similar to those reported in Table 4, and are thus not produced here for brevity.

We begin by discussing the coefficient for the scaled rank of trading strength,  $\beta_{STR}$ , which is significantly positive in the first five columns of Panel A in Table 5. This evidence indicates a significant association between the insider trading strength signal in month  $t$  and long run future returns beyond month  $t+1$ , that continues for up to three years following the insider trades.

Next we turn to the association between insider trading horizon and long run future returns beyond month  $t+1$ , embodied in the three coefficients,  $\beta_{STR}$ ,  $\beta_{HOR}$ , and  $\beta_{STR*HOR}$ , provided in Panel B of Table 5. Similar to Table 4, the coefficient of the interaction term ( $\beta_{STR*HOR}$ ) indicates the differential performance between a hedge portfolio made up of strong purchases minus strong sales by *short horizon insiders* and the analogous hedge portfolio of purchases minus sales by *long horizon insiders*. This differential performance is marginally significant in two of the first three columns of Panel B. In particular, the differential performance in cumulative stock returns for months +2 to +6 is 1.55% (t-ratio = 1.27), for months +7 to +12 is 3.23% (t-ratio = 2.17), and for months +2 to +12 is 4.83% (t-ratio=1.93). To see this result, consider the evidence in column 3, which implies that the hedge portfolio return for strong purchases minus strong sales made by *short horizon insiders* (i.e., for  $HOR = 0$ ) earns  $\beta_{STR} = 6.18\%$  (t-ratio = 2.84) during the eleven months from month +2 to month +12. However, the analogous hedge portfolio return is reduced to 1.35% ( $= \beta_{STR} - \beta_{STR*HOR} = 6.18\% - 4.83\%$ , t-ratio = 1.22) for *long horizon insiders* (i.e., for  $HOR = -1$ ). The difference between these two hedge portfolio returns is  $\beta_{STR*HOR} = 4.83\%$  (t-ratio = 1.93). In columns 4 – 6 of Panel B,  $\beta_{STR*HOR}$  is not significant, suggesting that the trades of short term insiders do not continue to outperform those of long term insiders in the longer run beyond one year.

In summary, Table 5 indicates that the stocks purchased by insiders outperform those sold by insiders for up to three years following the trades, as indicated by the significant estimates of  $\beta_{STR}$  in columns 1 – 5 in Panel A. This evidence suggests that the trading signals of both short horizon and long horizon insiders provide significant predictive information about future stock returns beyond month  $t+1$ , which continues for up to three years following their trades. In addition, there is marginally significant evidence that short horizon insiders continue to outperform long horizon insiders beyond one month, for up to one year later.

Taken as a whole, the analysis in this section provides strong evidence that short horizon insiders earn significantly higher returns than long horizon insiders in the short run (in month  $t+1$ ), both when they buy and when they sell. This evidence indicates that investors who follow insider trades can earn significantly higher returns by focusing on the trades of short horizon insiders, because these trades have more information content with regard to future short run stock returns. In addition, this section provides some evidence that the sales of short horizon insiders predict negative risk-adjusted returns in the short run. Furthermore, the trades of short horizon insiders continue to outperform long horizon insiders in the longer run beyond month  $t+1$ , for up to twelve months following the trades. However, this outperformance does not

continue beyond one year. Importantly, we find no evidence to suggest that insiders with a long trading horizon significantly outperform short horizon insiders over any time frame, either in the short run or the long run.

## 5. Sources of the Information Advantage of Short Term Insiders

We conjecture that short horizon insiders could be more likely than long horizon insiders to trade on short-lived private information about the firm. We investigate this conjecture by examining the relative predictive information contained in the trading activity of short horizon versus long horizon insiders, during the period before the next quarterly earnings announcement. In addition, we analyze insider trades in the ten days prior to large price changes, which presumably reflect the arrival of substantive value-relevant information.

When insiders exploit private information by trading ahead of major events in this fashion, they face litigation risk. Such litigation risk is elevated at times when the SEC is in a mode of heightened enforcement activity against insider trading. Thus, we also examine whether short horizon and long horizon insiders reveal different propensities to limit their trading activity following periods with more SEC investigations against insider trading.

### 5.1. Insider Trading and Earnings Surprises

One of the most important informational events for public firms is the quarterly earnings announcement. Well before the public release of quarterly earnings, insiders have access to this information. Thus, a natural question is whether one source of the outperformance by short horizon insiders is a propensity to trade in the same direction as the next quarterly earnings surprise.

If the private information that motivates insider trading is partially revealed at the next quarterly earnings release, then the insider's trading strength (i.e., the signal of strong insider purchases or sales) should predict (positive or negative) earnings surprises. Furthermore, if short horizon insiders show a greater propensity to trade ahead of earnings information than long horizon insiders, then the insider's trading horizon should also be associated with the sign and magnitude of the forthcoming earnings surprise. We examine these predictions by estimating another revised version of Equation (1) that replaces the dependent variable with a measure of the next quarterly earnings surprise, as follows:

$$\begin{aligned} \text{Surprise}_{j,q} = & \alpha + \beta_{\text{STR}*\text{HOR}} \text{STR\_RK}_{i,j,t} + \beta_{\text{HOR}} \text{HOR}_{i,j,t} \\ & + \beta_{\text{STR}*\text{HOR}} \text{STR\_RK}_{i,j,t} * \text{HOR}_{i,j,t} + \text{Controls}_{i,j,t} + \varepsilon_{i,j,t}, \end{aligned} \quad (3)$$

where  $\text{Surprise}_{j,q}$  is a measure of the earnings surprise at the *next* quarterly earnings announcement that occurs in quarter  $q$ , *following* any insider trades that occur during month  $t$ . This *next* earnings announcement date may occur anytime, beginning one day after the insider trade and extending up to three months after the trade (i.e., until the next quarterly announcement).<sup>16</sup>

We examine two alternative measures of the quarterly earnings surprise. First, we follow Bernard and Thomas (1990) to construct the accounting-based measure of standardized unexpected earnings (SUE) for firm  $j$  in quarter  $q$ , as follows:

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<sup>16</sup> In addition to the control variables in Equation (1), we include the one-quarter lagged earnings surprise. Note that insider trading laws impose a blackout period that restricts insiders from trading around earnings announcements.

$$\text{Surprise}_{j,q} = \text{SUE}_{j,q} = \frac{EPS_{j,q} - EPS_{j,q-4} - \mu_{q-7,q}}{\sigma_{q-7,q}},$$

where  $\mu_{q-7,q}$  and  $\sigma_{q-7,q}$  are the mean and standard deviation of the four-quarter difference in earnings per share,  $(EPS_{i,q} - EPS_{i,q-4})$ , over the past eight quarters. Second, we also follow the asset pricing literature to construct a market-based measure of the 3-day cumulative abnormal return around the earnings announcement,  $\text{CAR}(-1,+1)_{j,q}$ , where day 0 is the earnings announcement date for firm  $j$  in quarter  $q$ . We multiply CAR by 100 to convert this measure to percentage terms.

The results of this panel regression are presented in Table 6. For both the SUE and the CAR, the insider's trading strength and trading horizon are both related to the future earnings surprise in a manner that is consistent with the return analysis in Tables 4 and 5. Here we focus on the coefficient of the interaction term,  $\beta_{\text{STR}*\text{HOR}}$ , which is significantly *positive* in all four columns of Table 6. Similar to the interpretation in Table 4, a positive coefficient ( $\beta_{\text{STR}*\text{HOR}}$ ) indicates that the difference between the earnings surprise following strong purchases versus strong sales by *short horizon* insiders is significantly larger than that for *long horizon* insiders. For example, column 4 of Table 6 indicates that, for *short horizon* insiders (i.e.,  $\text{HOR} = 0$ ), the 3-day CAR following strong purchases is  $\beta_{\text{STR}} = 0.257\%$  higher than the CAR following strong sales (t-ratio = 2.43). In contrast, for *long horizon* insiders (i.e.,  $\text{HOR} = -1$ ), the CAR following strong purchases is roughly the same as the CAR following strong sales (i.e.,  $\beta_{\text{STR}} - \beta_{\text{STR}*\text{HOR}} = 0.257 - 0.256 = 0.001$ , t-ratio = 0.01). Thus, the differential CAR following purchases minus sales by short horizon insiders is 0.256% ( $\beta_{\text{STR}*\text{HOR}} = 0.256$ , t-ratio = 2.14) higher than that for long horizon insiders. Columns 1 and 2 of Table 6 reveal a similar pattern of behavior for the SUE. Overall, these results demonstrate that the trades of short horizon insiders have significantly higher predictive power regarding the next future earnings surprise relative to the trades of long horizon insiders.

## 5.2. Insider Trading and Large Stock Price Changes

Following Ravina and Sapienza (2010), we also examine the relative informativeness of trades by short horizon versus long horizon insiders that are made in the days before large stock price changes. This section presents the results of probit analysis that relates the scaled rank of insider trading strength (STR\_RK), insider trading horizon (HOR), and their interaction to the likelihood of an imminent large increase or decrease in the stock price within the next ten trading days.

The sample of large price change events is identified as follows. First, for each firm ( $j$ ), we compute the three-day cumulative abnormal return (CAR) around every trading day ( $t$ ) in the sample. If the CAR for a given day ( $t$ ) is among the top (bottom) 5% among all trading days in that calendar year, then that day ( $t$ ) is identified as having a large positive (negative) stock price change. This selection criterion leads to roughly 12½ large price increase events and price decrease events, respectively, for each firm ( $j$ ) and for every year (i.e., 252 trading days) in the sample. If such a large price increase (decrease) occurs within 10 days following an insider trade in the stock ( $j$ ), the dummy variable  $+\Delta P$  ( $-\Delta P$ ) is assigned a value of one, and zero otherwise.<sup>17</sup>

For insider  $i$  of firm  $j$  in month  $t$ , the panel probit model is then specified as follows:

$$\Phi^{-1}(+/-\Delta P_{j,t}) = \alpha + \lambda_{\text{STR}} \text{STR\_RK}_{i,j,t} + \lambda_{\text{HOR}} \text{HOR}_{i,j,t}$$

<sup>17</sup> Similar to all analyses above, this test is performed at the monthly level. If an insider makes multiple transactions in a given month, we use the last transaction day as the insider trading day for that month.



$$+ \lambda_{STR*HOR} STR\_RK_{i,j,t} * HOR_{i,j,t} + \text{Controls} + \varepsilon_{i,j,t}, \quad (4)$$

where  $\Phi(\cdot)$  represents the cumulative distribution function for the standard normal distribution.

Table 7 reports the results from this panel probit analysis. Columns 1 and 2 present the probit model coefficients and their respective z-statistics for the analysis of large price increases, while columns 3 and 4 give the analogous results for large price declines. At the bottom of the Table, we present two measures of the marginal *economic effect* of insider trading strength on the likelihood of these events, conditional on the insider's trading horizon, which are implied by this probit model. First,  $\Delta\text{Prob}(\Delta P | \text{HOR} = 0)$  is the implied *change* in the probability of an imminent price change event, across purchases versus sales for *short horizon* insiders (i.e., for  $\text{HOR} = 0$ ). It represents the economic effect of  $\lambda_{STR}$ . Second,  $\Delta\text{Prob}(\Delta P | \text{HOR} = -1)$  is the analogous *change* in the probability for *long horizon* insiders (i.e., for  $\text{HOR} = -1$ ). This measure reflects the economic significance of the difference in coefficients,  $\lambda_{STR} - \lambda_{STR*HOR}$ . Finally, the difference between  $\Delta\text{Prob}(\Delta P | \text{HOR} = 0)$  and  $\Delta\text{Prob}(\Delta P | \text{HOR} = -1)$  captures the economic effect of the coefficient of the interaction term,  $\lambda_{STR*HOR}$ .

In the first two columns of Table 7, the coefficient of the interaction term ( $\lambda_{STR*HOR}$ ) is significantly positive, indicating that the purchases minus sales by short horizon insiders possess significantly greater predictive power regarding an imminent large stock price increase, relative to the analogous trades by long horizon insiders. For instance, in column 2,  $\Delta\text{Prob}(\Delta P | \text{HOR} = 0) = 0.054$  (t-ratio = 5.77), indicating that for *short horizon* insiders purchases are 5.4% more likely than sales to be followed by large stock price increases. In contrast, for *long horizon* insiders, purchases are only 2.5% more likely than sales to be followed by large price increases ( $\Delta\text{Prob}(\Delta P | \text{HOR} = -1) = 0.025$ , t-ratio = 5.24). In this case, the difference in the implied change in probabilities is 2.9% (= 5.4% – 2.5%, z-statistic = 2.50). Columns 3 and 4 show even stronger findings regarding the predictive information about imminent large price declines, following the purchases minus sales of short horizon versus long horizon insiders. Overall, the evidence in Table 7 indicates that trades by short horizon insiders are more informative about imminent large stock price changes, relative to the trades by long horizon insiders.

### 5.3. Insider Trading and SEC Investigations

The analysis above establishes that transactions by short horizon insiders possess significantly greater predictive information than those by long horizon insiders, regarding future stock returns and firm-specific events. This subsection explores whether SEC investigations against illegal insider trading deter trading activity by short horizon insiders to a greater extent than that by long horizon insiders.

Similar to Cohen, Malloy, and Pomorski (2012), for each month  $t$  we first calculate the fraction of all insider transactions in a given month that are made by medium and short horizon insiders (i.e., not by long horizon insiders), since long horizon insiders account for about half of all insider trading months. This proportion is then regressed on the number of SEC insider trading investigations in each of the past three months. If such SEC enforcement activity deters trading by more informed (i.e., short and medium horizon) insiders, when compared to long horizon insiders, then we expect to find a negative relation between this proportion and SEC enforcement activity.

The results are presented in Table 8, and reveal significant negative coefficients on all three monthly lags for the number of SEC investigations. This outcome indicates that medium and short horizon insiders significantly reduce their trading activity during the three months following an increase in SEC enforcement activity. The economic significance of these results is

also large. For example, in column 1 of Table 8, one additional SEC investigation in month  $t-1$  leads to a 3.04% reduction in the proportion of insider transactions entered by medium and short horizon insiders (t-ratio = -8.46). In addition, this negative relationship builds and accumulates over the three months following an increase in SEC activity. Overall, this section documents that, when compared with long horizon insiders, medium and short horizon insiders trade less frequently when the litigation risk associated with their trading activity is relatively high.

Taken as a whole, this section reveals statistically and economically significant evidence indicating that the purchases and sales of short horizon insiders are more likely to predict firm-specific events in the future, relative to the activity of long horizon insiders. These results suggest that short horizon insiders are more aggressive in taking advantage of their privileged access to private information about the firm, which leads to better overall trading performance in the short run. This section also finds that short horizon insiders trade less when SEC investigation intensity is higher, consistent with the idea that exploiting nonpublic information involves higher litigation risk for insiders.

## 6. Robustness Tests

This section performs a battery of additional tests to evaluate the robustness of the main findings in Section 4. First, we control for the characteristics of the insider or the firm, to examine the possibility that these attributes may drive the main findings. Second, we apply different estimation techniques, analyze the sub-periods before and after SOX, and consider various ways to measure the insider's investment horizon. Third, we conduct the analysis across insiders at the firm level, rather than at the finer level of individual insider trading months.

### 6.1. Additional Control Variables

Section 3 above documents a number of significantly different attributes for short horizon versus long horizon insiders. For example, short horizon insiders tend to be associated with: (i) weaker corporate governance due to more entrenched management, (ii) better access to private information (proxied by indicators for CEO, CFO, and Chair of the Board), (iii) a higher (lower) likelihood of holding an MBA (PhD) degree, (iv) a lower probability of being female, (v) more years of experience as an insider but fewer trades as an insider, and (vi) more opportunistic behavior (measured by non-routine insiders as in Cohen, Malloy, and Pomorski, 2012, or by persistently opportunistic (PO) insiders as in Cline, Gokkaya, and Liu, 2014).

We next investigate whether the main findings in this paper might arise from these differential characteristics across short horizon and long horizon insiders, by controlling for each respective attribute in the regression framework of Equation (1). In particular, we add each attribute listed above as a separate control variable, as well as its interaction with insider trading strength, one at a time. The implications for the resulting coefficients of these additional variables and their interaction terms are analogous to the coefficients for insider trading horizon and its interaction with trading strength (i.e.,  $\beta_{STR}$ ,  $\beta_{STR*HOR}$ , and their difference,  $\beta_{STR} - \beta_{STR*HOR}$ ), from Equation (1).<sup>18</sup>

<sup>18</sup> Although the interpretation for the coefficient of the interaction term,  $\beta_{STR*HOR}$ , is still the same as before, the interpretation for  $\beta_{STR}$  and  $\beta_{STR} - \beta_{STR*HOR}$  is slightly different because of the additional interaction terms between these attributes and insider trading strength. That is,  $\beta_{STR}$  ( $\beta_{STR} - \beta_{STR*HOR}$ ) is no longer the return on the hedge portfolio of strong purchases minus strong sales for short (long) horizon insiders. Consider column 1 of Panel A in Table 9 as an example: Now  $\frac{\partial RET(+1)}{\partial STR} = \beta_{STR} + \beta_{STR*HOR} HOR + \beta_{STR*E\_INDEX} E\_INDEX + \beta_{STR*G\_INDEX} G\_INDEX$ .

The results are presented in the different columns of Panel A in Table 9. In every column, we include another characteristic of the insider or the firm, one at a time, because several characteristics are not available for the full main sample (e.g., over half of the main sample is lost in columns 1 and 4). Importantly, throughout Panel A the coefficients for the new variables and their interactions with trading strength are never significant at the .05 level or better.<sup>19</sup>

In these expanded specifications, we are most interested in the results for the interaction between insider trading strength and insider trading horizon ( $\beta_{STR*HOR}$ ). Across all of the columns in Panel A,  $\beta_{STR*HOR}$  is significantly positive. This evidence corroborates the results in Table 4, indicating that short horizon insiders continue to significantly outperform long horizon insiders, whether or not we control for these additional characteristics of the insider or the firm.

## 6.2. Alternative Methodologies, Sub-Periods, and Identification Periods for Insider Horizon

In Panel B of Table 9, we present additional robustness tests that use alternative estimation methodologies, we analyze two sub-periods that cover the pre-SOX and post-SOX regimes, and we consider various ways to construct the measure of insider trading horizon. First, in column 1 of Panel B, we estimate the panel regression in Equation (1) using two-way clustered standard errors based on firm ( $j$ ) and month ( $t$ ). The main findings from Table 4 (i.e.,  $\beta_{STR}$ ,  $\beta_{HOR}$ ,  $\beta_{STR*HOR}$ , and  $\beta_{STR} - \beta_{STR*HOR}$ ) remain robust to this alternative method for adjusting standard errors. Second, column 2 further controls for industry fixed effects using 3-digit SIC codes, to account for the possibility that industry characteristics may be associated with the divergent behavior of short horizon versus long horizon insiders. The results show that controlling for industry fixed effects has little impact on the main findings. Third, column 3 analyzes the future *risk-adjusted* stock return as an alternative dependent variable, to ensure that well-known risk factors are properly controlled for. Specifically, we calculate risk-adjusted returns using the alphas from the Fama-French four-factor model following Brennan, Chordia, and Subrahmanyam (1998). The main results are again unaffected.<sup>20</sup> Fourth, columns 4 and 5 estimate the model over the sub-periods before and after Sarbanes-Oxley, respectively. The results show that the differential trading performance across short versus long horizon insiders is somewhat attenuated after SOX, but this differential behavior remains statistically significant.

Finally, in columns 6 through 9 we assess the robustness of the results to various definitions of insider trading horizon. Column 6 uses a discrete measure of insider trading horizon because long term insiders, who only buy or only sell, account for roughly half of all insider trades. Specifically, we combine the two groups of short and medium term insiders (to include all insiders who both buy and sell the stock sometime over the past 10 years) and compare this expanded group of ‘short horizon’ insiders with the group of long horizon insiders (who only buy or sell). In other words, in column 6 HOR is a dummy variable that takes a value of *zero* if the trade is made by a long horizon insider (who only buys or sells) and one otherwise. For both strong purchases and sales, this expanded group of ‘short horizon’ insiders reveals

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Therefore, for short horizon insiders (HOR=0), the hedge portfolio of strong purchases minus strong sales has a return of  $RET(+1) = \beta_{STR} + \beta_{STR*E\_INDEX} * (\text{mean of } E\_INDEX) + \beta_{STR*G\_INDEX} * (\text{mean of } G\_INDEX)$  percent. Similarly, for long horizon insiders (HOR=-1), the analogous hedge portfolio now has a return of  $RET(+1) = \beta_{STR} - \beta_{STR*HOR} + \beta_{STR*E\_INDEX} * (\text{mean of } E\_INDEX) + \beta_{STR*G\_INDEX} * (\text{mean of } G\_INDEX)$  percent. On the other hand, the differential return between these two hedge portfolios is still the coefficient of the interaction,  $\beta_{STR*HOR}$ .

<sup>19</sup> The coefficient for trading experience is significant at the .10 level (t-ratio = 1.7), in column 7 of Panel A.

<sup>20</sup> In unreported analysis, we also use the Fama-French five-factor model to generate monthly alphas for each firm, as the measure of risk-adjusted stock returns analyzed in Equation (1), with robust results (see Fama and French, 2015).

significantly better trading performance relative to long horizon insiders. Columns 7 and 8 use a five-year and a seven-year identification period, respectively, to calculate the insider's trading horizon. In column 9, we include the current month in the former ten-year identification period to generate the insider's trading horizon. Once again, the main results are robust to these alternative definitions of insider investment horizon.

Overall, these robustness tests show that the main results from Table 4 remain robust when we control for additional attributes of the insider or the firm, apply alternative estimation methodologies, analyze pre-SOX and post-SOX sub-periods, and use various ways to construct the insider's investment horizon.

### 6.3. Insider Trading Horizon and Future Stock Returns at the Firm Level

Table 10 presents the results of an alternative panel regression analysis that is conducted at the firm level, rather than at the finer level of the individual insider trading month. Specifically, for each firm  $j$  in month  $t$ , the model is specified as:

$$\begin{aligned} \text{RET}(+1)_{j,t} = & \alpha + \beta_{\text{STR}} \text{STR\_RK}_{j,t} + \beta_{\text{HOR}} \text{HOR}_{j,t} \\ & + \beta_{\text{STR}*\text{HOR}} \text{STR\_RK}_{j,t} * \text{HOR}_{j,t} + \text{Controls}_{j,t} + \varepsilon_{j,t}. \end{aligned} \quad (5)$$

In this analysis, the trading strength (STR) for firm  $j$  in month  $t$  is constructed as the aggregate net purchases (i.e., shares purchased – shares sold) across all insiders at firm  $j$ , scaled by the total trading volume in firm  $j$  by all investors during month  $t$ . Similar to the insider level analysis in Equation (1), firm-level trading strength is then ranked into quintiles each month (i.e., assigned the values, 0 – 4), and these values are divided by 4 to obtain the scaled rank variable, STR\_RK. Similarly, the firm level measure of insider trading horizon (HOR) is constructed as the trading volume weighted average of the measures of investment horizon, for all insiders at firm  $j$  who trade in month  $t$ . All other variables are as described in Appendix 1. Once again, the sample period covers January 1996 through December 2013, monthly fixed effects are included, and standard errors are clustered at the firm level.

In Table 10, the evidence for  $\beta_{\text{STR}}$ ,  $\beta_{\text{HOR}}$ ,  $\beta_{\text{STR}*\text{HOR}}$ , and  $\beta_{\text{STR}} - \beta_{\text{STR}*\text{HOR}}$  is nearly identical to the analogous results in Table 4. Once again, the implication is that the trades of short horizon insiders are significantly more informative than the analogous trades by long horizon insiders. This evidence is robust, whether we analyze insider trades at the level of individual insider trading months, or whether we aggregate the trading behavior of short horizon versus long horizon insiders across insiders at the same firm.

## 7. Summary and Conclusions

This paper shows that the investment horizon of an insider is significantly associated with the informativeness of insider trades. We follow the literature on institutional investors to construct a measure of insider trading horizon, based on the insider's past turnover in his or her own company's stock. In particular, we define an insider's investment horizon as the average net insider order flow per year, over the previous ten years. This construct is based on the premise that those insiders who tend to mostly buy or mostly sell the company's stock over time have a longer investment horizon in comparison with other insiders, who tend to realize their gains or losses by both buying and selling periodically.

We classify the cross section of insiders by this proxy for insider investment horizon into long horizon insiders, who only purchase or sell over the past ten years, versus medium or short horizon insiders, whose purchases and sales tend to offset one another to varying degrees.

Surprisingly, we find that over half of all insider trades are made by long horizon insiders who only buy or only sell over the previous ten years.

We then examine the relative attributes of short horizon versus long horizon insiders. We find that short horizon insiders are more likely to have better access to valuable firm-specific information (i.e., hold the position of CEO, CFO, or Chairman of the Board), and come from firms with weaker corporate governance and greater information asymmetry (i.e., smaller size and higher stock return volatility). They are also more likely to hold an MBA degree and less likely to hold a PhD degree. They are less likely to be female, and they have more years of experience as an insider, but they trade less frequently. Short horizon insiders also display more opportunistic behavior (i.e., they are more likely to be non-routine insiders as in Cohen, Malloy, and Pomorski, 2012, or persistently opportunistic insiders as in Cline, Gokkaya, and Liu, 2014).

Next we investigate whether the trades of short horizon insiders are more informative than those of long horizon insiders. For both purchases and sales, we find that short horizon insiders outperform long horizon insiders in the short run, for up to twelve months following the insider trades, but not in the long run beyond one year. For example, a tradable strategy that prescribes buying the company shares of short horizon insiders who purchase in a given month, and shorting the stocks of short horizon insiders who sell, earns a risk-adjusted return of 2.04% per month. In contrast, the analogous strategy that mimics the purchases and sales of long horizon insiders earns only 0.77% per month. Furthermore, the difference between these two alternative mean hedge portfolio returns is significant (i.e., 1.27% per month, t-ratio = 3.50).

This outperformance of short horizon versus long horizon insiders manifests itself on both the buy side and the sell side. For example, both purchases and sales made by short horizon insiders predict a significant abnormal return in the same direction as the insider trade over the following month. In contrast, the sales of long horizon insiders do not predict imminent price declines. This outcome differs from much of the prior literature, which generally concludes that insider sales are not informed.

Finally, we investigate the motivation behind the differential trading behavior of short horizon versus long horizon insiders. We find that the trades of short horizon insiders have significantly greater predictive power with respect to the likelihood of forthcoming firm-specific information events, such as quarterly earnings surprises and large stock price changes. This evidence indicates that short horizon insiders are more likely than long horizon insiders to exploit their privileged access to private information in the short run. In light of this result, we also examine whether short horizon insiders are more sensitive to the potential litigation risk that might accompany their penchant for trading ahead of major firm-specific events. We find that short horizon insiders significantly reduce their trading activity in the months following periods of heightened SEC enforcement activity, proxied by an increase in the number of SEC investigations on illegal insider trading.

The main findings in this paper are robust when we control for the differences in attributes across short horizon versus long horizon insiders, their trades, and the firms that they work for. In addition, this evidence holds up when we apply other estimation methodologies, analyze sub-periods, and consider alternative definitions of insider trading horizon. Finally, the results also remain when we conduct the panel regression analysis at the firm level rather than the level of the individual insider trading month.

This paper contributes to our understanding of whether certain subsets of insiders are more likely to be informed. Cohen, Malloy, and Pomorski (2012) show that transactions made by routine insiders, who place their trades in the same calendar month for a certain number of years

in the past, are not informative. Cline, Gokkaya, and Liu (2014) find that persistently opportunistic insiders, who have superior trading performance in the past, tend to continue to earn positive abnormal returns. This study adds to this body of work by showing that an insider's trading horizon also has a bearing on the informativeness of insider transactions. This research also contributes to the broader literature on the importance of shareholder investment horizon with regard to the informativeness of trades. For example, Yan and Zhang (2009) show that the trades of short horizon institutional investors (i.e., with higher turnover) are more informed in the short run.

The results from this paper should be of interest to both market participants and regulators. Transactions made by short horizon insiders can help investors to form better expectations about future stock prices. Regulators may also consider applying more scrutiny to the trading horizons of insiders, which is revealed by their turnover in company shares. The trades of short horizon insiders account for a relatively small portion of all insider transactions, but we show that they are more likely to convey private information.

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**Table 1. Summary Statistics and Correlations**

This table presents the summary statistics (Panel A) and correlations (Panel B: Pearson, below diagonal; Spearman, above diagonal) for the key variables used in this paper. The sample consists of open market insider trades of common stocks from Thomson Reuters Insider Filing. The trades made by one insider are aggregated on a monthly level. The stock return data and financial statements data are from CRSP and Compustat, respectively. HOR is the insider trading horizon measure. STR is monthly net insider order imbalance scaled by total trading volume. All variables are described in Appendix 1. The sample period covers January 1996 through December 2013. The t-statistics are based on Newey-West robust standard errors. Bold numbers in Panel B indicate significance at the .05 level.

## Panel A. Summary Statistics

VARIABLE	MEAN	MEDIAN	STDDEV	MIN	MAX	N
HOR	-0.791	-0.997	0.299	-1.000	-0.001	146,159
STR (bps)	-3.331	-1.137	26.287	-114.103	124.950	146,159
B/M	0.527	0.382	0.533	0.038	3.457	146,159
SIZE (million \$)	7,248.682	1,250.411	20,503.200	13.997	142,882.300	146,159
RET(-1) %	3.013	2.160	12.334	-27.012	45.119	146,159
RET(-12, -2) %	26.777	16.142	54.894	-57.617	270.880	146,159
PROFIT %	38.137	35.420	25.946	-23.188	119.710	146,159
ASSETGR %	19.626	10.838	37.586	-33.175	222.652	146,159
STD_RET %	2.912	2.532	1.577	0.855	9.394	146,159

Table 1, continued

Panel B. Correlations

	HOR	STR	B/M	SIZE	RET(-1)	RET(-12, -2)	PROFIT	ASSETGR	STD_RET
<b>VARIABLE</b>									
HOR		<b>-0.07</b>	<b>0.08</b>	<b>-0.21</b>	-0.01	<b>0.02</b>	<b>-0.04</b>	<b>-0.01</b>	<b>0.10</b>
STR	<b>-0.07</b>		<b>0.02</b>	<b>0.14</b>	<b>-0.12</b>	<b>-0.14</b>	<b>-0.13</b>	0.00	<b>0.07</b>
B/M	<b>0.07</b>	0.01		<b>-0.37</b>	<b>-0.02</b>	<b>-0.22</b>	<b>-0.36</b>	<b>-0.26</b>	<b>-0.02</b>
SIZE	<b>-0.20</b>	<b>0.05</b>	<b>-0.37</b>		<b>0.08</b>	<b>0.15</b>	<b>-0.01</b>	<b>0.15</b>	<b>-0.41</b>
RET(-1)	0.00	<b>-0.04</b>	<b>-0.01</b>	<b>0.05</b>		<b>0.05</b>	<b>0.04</b>	0.00	<b>-0.04</b>
RET(-12, -2)	<b>0.04</b>	<b>-0.06</b>	<b>-0.22</b>	<b>0.09</b>	<b>0.05</b>		<b>0.06</b>	-0.01	0.00
PROFIT	<b>-0.03</b>	<b>-0.07</b>	<b>-0.30</b>	-0.01	<b>0.03</b>	<b>0.06</b>		<b>0.05</b>	<b>0.04</b>
ASSETGR	<b>0.02</b>	<b>0.01</b>	<b>-0.18</b>	<b>0.09</b>	<b>-0.01</b>	<b>-0.03</b>	<b>-0.05</b>		<b>0.04</b>
STD_RET	<b>0.10</b>	<b>0.05</b>	0.01	<b>-0.42</b>	<b>-0.03</b>	<b>0.04</b>	0.01	<b>0.04</b>	

**Table 2. Sample Composition and Characteristics of Insiders and Firms**

This Table presents information about the composition of the main sample of insider trades. Panel A reports the relative frequencies of purchases and sales by insiders with different investment horizons. Panel B presents the characteristics of insiders with different horizons, as well as their firms. The sample consists of open market insider trades of common stocks from Thomson Reuters Insider Filing. The trades made by each insider are aggregated on a monthly level. HOR is the measure of insider trading horizon. STR is the monthly net order flow for each insider, scaled by total trading volume. E\_INDEX is the management entrenchment index from Bebchuk, Cohen, and Ferrell (2009). G\_INDEX is the corporate governance index from Gompers, Ishii, and Metrick (2003). Higher values for E\_INDEX or G\_INDEX indicate weaker corporate governance. CEO, CFO, and CB are indicator variables that take a value of one if the insider holds the office of CEO, CFO, and Chairman of the Board, respectively. MBA and PhD are dummy variables that characterize the insider's education background. NON\_ROUTINE is an indicator variable for opportunistic insiders, following Cohen, Malloy, and Pomorski (2012). PO is an indicator variable for persistently opportunistic insiders, defined as in Cline, Gokkaya, and Liu (2014). FEMALE is a dummy variable that takes a value of one if the insider is female, and zero otherwise. EXP\_YEAR is the number of years of experience since the insider's first year of trading. EXP\_TRADE is the total number of previous trading months for the insider. All other variables are described further in Appendix 1. The sample period covers January 1996 through December 2013. In Panel B, the t-statistics (in round parentheses) are based on Newey-West robust standard errors. The numbers of observations are provided in square brackets. \*, \*\*, and \*\*\* indicate significance at the .10, .05, and .01 levels, respectively.

**Panel A. Relative Frequencies of Purchases and Sales by Insiders with Different Horizons**

<b>Horizon</b>		<b>(1) Sales</b>	<b>(2) Purchases</b>	<b>(3) Total</b>
0	# of insider trading months	75,419	9,283	84,702
Long Horizon	% of total trading months	51.6	6.4	58.0
	% of total for row	89.0	11.0	100
	% of total for column	59.5	47.9	-
1	# of insider trading months	25,144	4,429	29,573
Medium Horizon	% of total trading months	17.2	3.0	20.2
	% of total for row	85.0	15.0	100
	% of total for column	19.8	22.8	-
2	# of insider trading months	26,208	5,676	31,884
Short Horizon	% of total trading months	17.9	3.9	21.8
	% of total for row	82.2	17.8	100
	% of total for column	20.7	29.3	-
<b>Total</b>	# of insider trading months	126,771	19,388	<b>146,159</b>
	% of total trading months	86.7	13.3	<b>100</b>
	% of total for column	100	100	-

Table 2, continued

Panel B. Characteristics of Insiders and Firms for Insiders with Different Horizons

VARIABLE	HOR						Mean Diff SH – LH
	Long		Medium		Short		
HOR	-1.00	[84,702]	-0.74	[29,573]	-0.30	[31,884]	0.70***
(t-ratio)	(N/A)	[# of obs]	(-174.71)		(-54.82)		(126.76)
STR (bps)	-2.49	[84,702]	-2.77	[29,573]	-5.99	[31,884]	-3.50***
	(-4.57)		(-3.05)		(-7.16)		(-8.02)
B/M	0.50	[84,702]	0.55	[29,573]	0.58	[31,884]	0.08***
	(25.24)		(20.42)		(22.71)		(6.35)
SIZE (million \$)	9,644.11	[84,702]	4,879.94	[29,573]	3,230.63	[31,884]	-6,413.48***
	(16.98)		(17.00)		(13.18)		(-15.60)
RET(-1) %	3.04	[84,702]	2.92	[29,573]	3.01	[31,884]	-0.03
	(7.10)		(6.66)		(6.18)		(-0.13)
RET(-12, -2) %	25.12	[84,702]	27.10	[29,573]	30.11	[31,884]	4.99**
	(5.70)		(5.75)		(5.87)		(2.14)
PROFIT %	38.75	[84,702]	37.72	[29,573]	36.81	[31,884]	-1.95***
	(58.21)		(50.90)		(58.22)		(-5.01)
ASSETGR %	19.38	[84,702]	18.97	[29,573]	20.87	[31,884]	1.49
	(10.76)		(11.11)		(10.97)		(1.55)
STD_RET %	2.78	[84,702]	2.99	[29,573]	3.16	[31,884]	0.38***
	(15.23)		(14.74)		(15.10)		(11.58)
E_INDEX	2.28	[37,752]	2.34	[13,462]	2.45	[11,968]	0.18***
	(32.29)		(30.52)		(39.40)		(4.98)
G_INDEX	8.87	[37,468]	8.81	[13,497]	8.94	[12,015]	0.07
	(149.90)		(142.88)		(113.57)		(1.31)
CEO	0.13	[84,702]	0.22	[29,573]	0.21	[31,884]	0.08***
	(33.61)		(24.82)		(23.65)		(10.96)
CFO	0.06	[84,702]	0.07	[29,573]	0.07	[31,884]	0.01***
	(12.74)		(23.27)		(22.34)		(3.09)
CB	0.10	[84,702]	0.15	[29,573]	0.14	[31,884]	0.04***
	(16.33)		(23.37)		(23.73)		(9.50)
MBA	0.28	[57,593]	0.28	[20,516]	0.32	[21,476]	0.04***
	(61.06)		(60.74)		(53.93)		(6.96)
PhD	0.11	[57,593]	0.09	[20,516]	0.08	[21,476]	-0.03***
	(27.46)		(20.93)		(22.83)		(-6.23)
FEMALE	0.07	[70,532]	0.05	[24,849]	0.04	[26,121]	-0.04***
	(15.44)		(15.93)		(9.59)		(-16.60)
NON_ROUTINE	0.65	[45,300]	0.69	[13,631]	0.76	[5,704]	0.11***
	(43.59)		(35.76)		(34.34)		(7.07)
PO	0.42	[74,892]	0.47	[26,327]	0.47	[26,002]	0.04***
	(56.77)		(57.25)		(68.49)		(6.17)
EXP_YEAR	6.72	[84,702]	7.63	[29,573]	7.26	[31,884]	0.54***
	(132.76)		(73.14)		(73.64)		(6.14)
EXP_TRADE	15.85	[84,702]	16.27	[29,573]	11.26	[31,884]	-4.59***
	(22.50)		(19.80)		(22.27)		(-16.08)

**Table 3. Insider Trading Horizon and Future Stock Returns: Portfolio Analysis**

This Table presents results from the sorting analysis. For each month ( $t$ ), stocks are first grouped into five portfolios based on the insiders' trading strength (STR), ranging from strong sales to strong purchases. Then stocks are independently partitioned into three portfolios based on insider trading horizon (HOR), resulting in a total of fifteen portfolios. Each portfolio is then held for one month ( $t+1$ ). In the top half of this Table, we report the resulting monthly equally-weighted average returns in percentage terms (and their t-ratios in parentheses), for all fifteen portfolios. We also provide the average hedge portfolio returns based on two strategies that prescribe: (i) buying the stocks in the strong purchase quintile and shorting the stocks in the strong sale quintile for insiders in each category by trading horizon (SP – SS, in every column), and (ii) buying the stocks traded by short horizon insiders and shorting the stocks traded by long horizon insiders in each category by trading strength (SH – LH, in every row). In the bottom half, we present the analogous monthly alphas for the time series of monthly returns for each portfolio, from the Fama-French 4-factor model. All variables are described in Appendix 1. The t-statistics are based on Newey-West robust standard errors. \*, \*\*, and \*\*\* indicate significance at the .10, .05, and .01 levels, respectively.

STR	HOR			
Average Raw Returns	Long	Medium	Short	SH – LH
Strong Sale	1.15*** (2.99)	0.59 (1.53)	0.65 (1.47)	<b>-0.50**</b> <b>(-2.06)</b>
2	1.01** (2.52)	0.96** (2.28)	0.59 (1.39)	<b>-0.42**</b> <b>(-2.37)</b>
3	0.86** (2.08)	0.88** (2.07)	1.15** (2.68)	<b>0.29</b> <b>(1.34)</b>
4	0.80** (2.07)	0.98** (2.42)	1.10** (2.29)	<b>0.30</b> <b>(1.04)</b>
Strong Purchase	1.63*** (4.27)	2.23*** (4.29)	2.41*** (4.24)	<b>0.78***</b> <b>(3.16)</b>
SP – SS	<b>0.48*</b> <b>(1.95)</b>	<b>1.64***</b> <b>(4.08)</b>	<b>1.76***</b> <b>(4.11)</b>	<b>1.28***</b> <b>(4.08)</b>
Fama-French 4-Factor Alphas	Long	Medium	Short	SH – LH
Strong Sale	0.14 (0.95)	<b>-0.34*</b> <b>(-1.88)</b>	<b>-0.36</b> <b>(-1.61)</b>	<b>-0.49**</b> <b>(-2.07)</b>
2	0.00 (-0.01)	-0.08 (-0.34)	<b>-0.51**</b> <b>(-2.36)</b>	<b>-0.51***</b> <b>(-2.77)</b>
3	-0.1 (-0.65)	-0.27 (-1.52)	0.16 (0.77)	<b>0.26</b> <b>(1.36)</b>
4	-0.06 (-0.32)	0.07 (0.36)	0.27 (0.81)	<b>0.33</b> <b>(1.29)</b>
Strong Purchase	0.91*** (3.48)	1.42*** (3.88)	1.68*** (3.45)	<b>0.78***</b> <b>(2.91)</b>
SP – SS	<b>0.77***</b> <b>(3.08)</b>	<b>1.76***</b> <b>(4.45)</b>	<b>2.04***</b> <b>(3.98)</b>	<b>1.27***</b> <b>(3.50)</b>

**Table 4. Insider Trading Horizon and Future Stock Returns: Regression Analysis**

This Table reports results from the following panel regression model of the future one month stock return on insider trading strength (STR\_RK), insider trading horizon (HOR), their interaction, and other control variables:

$$RET(+1)_{j,t} = \alpha + \beta_{STR} STR\_RK_{i,j,t} + \beta_{HOR} HOR_{i,j,t} + \beta_{STR*HOR} STR\_RK_{i,j,t} * HOR_{i,j,t} + Controls_{i,j,t} + \varepsilon_{i,j,t}. \quad (1)$$

The dependent variable is the future one-month stock return in percentage terms (RET(+1)). The key variables of interest are STR\_RK and the interaction term between STR\_RK and HOR. According to this specification, the effect of insider trading strength on future returns is:  $\frac{\partial RET(+1)}{\partial STR} = \beta_{STR} + \beta_{STR*HOR} HOR$ . This partial derivative shows that, for long term insiders (i.e., for HOR = -1), a one-unit increase in insider trading strength from strong sales to strong purchases (i.e., changing STR\_RK from 0 to +1), is associated with a change in RET(+1) of  $(\beta_{STR} - \beta_{STR*HOR})$  percent. In contrast, for short term insiders (i.e., for HOR = 0), a change from strong sales to strong purchases is associated with a change in RET(+1) of  $\beta_{STR}$  percent. Thus,  $\beta_{STR*HOR}$  tests whether one hedge portfolio, made up of the strong purchases minus the strong sales by *short term insiders*, outperforms the analogous hedge portfolio of purchases minus sales by *long term insiders*. All variables are described in Appendix 1. The sample period covers January 1996 through December 2013. Monthly fixed effects are included, and standard errors are clustered at the firm level. The t-statistics are provided in parentheses. \*, \*\*, and \*\*\* indicate significance at the .10, .05, and .01 levels, respectively.

VARIABLE	(1)	(2)	(3)	(4)	(5)	(6)
STR_RK	0.802*** (6.24)	0.801*** (6.24)	1.920*** (6.26)	0.819*** (6.41)	0.819*** (6.43)	1.916*** (6.18)
HOR		-0.045 (-0.33)	-0.727*** (-3.55)		0.018 (0.13)	-0.650*** (-3.17)
<b>STR_RK * HOR</b>			<b>1.443*** (4.06)</b>			<b>1.414*** (3.98)</b>
B/M	31.063*** (4.22)	31.069*** (4.23)	31.287*** (4.25)	30.757*** (3.77)	30.759*** (3.77)	30.682*** (3.77)
SIZE	-26.261*** (-7.75)	-26.397*** (-7.67)	-26.028*** (-7.54)	-22.643*** (-6.68)	-22.587*** (-6.60)	-22.340*** (-6.51)
RET(-1)	-0.097 (-0.14)	-0.096 (-0.14)	-0.068 (-0.10)	-0.160 (-0.23)	-0.160 (-0.23)	-0.131 (-0.19)
RET(-12, -2)	0.186 (1.58)	0.187 (1.59)	0.195* (1.65)	0.134 (1.11)	0.134 (1.10)	0.142 (1.17)
PROFIT				0.529** (2.39)	0.530** (2.39)	0.508** (2.30)
ASSETGR				-0.983*** (-6.40)	-0.984*** (-6.41)	-0.987*** (-6.42)
STD_RET				5.283 (0.83)	5.279 (0.83)	5.083 (0.80)
<b>Monthly Fixed Effects</b>	Yes	Yes	Yes	Yes	Yes	Yes
<b>Clustered by Firm</b>	Yes	Yes	Yes	Yes	Yes	Yes
<b>N</b>	146,159	146,159	146,159	146,159	146,159	146,159
<b>Adj. R<sup>2</sup></b>	0.154	0.154	0.154	0.155	0.155	0.155

**Table 5. Insider Trading Horizon and Long Term Future Stock Returns**

This Table reports results from the following panel regression model of the future long term stock return on insider trading strength (STR\_RK), insider trading horizon (HOR), their interaction, and other control variables:

$$RET(a,b)_{j,t} = \alpha + \beta_{STR} STR\_RK_{i,j,t} + \beta_{HOR} HOR_{i,j,t} + \beta_{STR*HOR} STR\_RK_{i,j,t} * HOR_{i,j,t} + Controls_{i,j,t} + \varepsilon_{i,j,t}. \quad (2)$$

The dependent variable is the future long term stock return in percentage terms from month  $t+a$  to month  $t+b$  ( $RET(a,b)$ ). The models in Panel A only include STR\_RK and the control variables, while the models in Panel B follow Equation (2) above. For Panel B, the key variables of interest are STR\_RK and the interaction term between STR\_RK and HOR.

According to this specification, the effect of insider trading strength on future returns is:  $\frac{\partial RET(a,b)}{\partial STR} = \beta_{STR} + \beta_{STR*HOR} HOR$ . Similar to Table 4,  $\beta_{STR*HOR}$  tests whether one hedge portfolio, made up of the strong purchases minus the strong sales by *short term insiders*, outperforms the analogous hedge portfolio of purchases minus sales by *long term insiders*. All models include the standard control variables in column 6 of Table 4, including B/M, SIZE, RET(-1), RET(-12, -2), PROFIT, ASSETGR, and STD\_RET. All variables are described in Appendix 1. The sample period covers January 1996 through December 2013. Monthly fixed effects are included, and standard errors are clustered at the firm level. The t-statistics are provided in parentheses. \*, \*\*, and \*\*\* indicate significance at the .10, .05, and .01 levels, respectively.

**Panel A. Insider Trading Strength and Future Stock Returns**

VARIABLE	(1) RET(+2, +6)	(2) RET(+7, +12)	(3) RET(+2, +12)	(4) RET(+13, +24)	(5) RET(+25, +36)	(6) RET(+37, +48)
STR_RK	1.152** (2.51)	1.342** (2.46)	2.428** (2.54)	3.034*** (3.20)	1.893* (1.85)	0.118 (0.10)
<b>Controls</b>	Yes	Yes	Yes	Yes	Yes	Yes
<b>Monthly Fixed Effects</b>	Yes	Yes	Yes	Yes	Yes	Yes
<b>Clustered by Firm</b>	Yes	Yes	Yes	Yes	Yes	Yes
<b>N</b>	139,417	130,503	130,496	113,805	99,402	86,965
<b>Adj. R<sup>2</sup></b>	0.182	0.182	0.153	0.162	0.167	0.163

**Panel B. Insider Trading Horizon, Strength, and Future Stock Returns**

VARIABLE	(1) RET(+2, +6)	(2) RET(+7, +12)	(3) RET(+2, +12)	(4) RET(+13, +24)	(5) RET(+25, +36)	(6) RET(+37, +48)
STR_RK	2.345** (2.21)	3.861*** (3.08)	6.180*** (2.84)	4.364** (2.00)	2.135 (0.87)	-3.696 (-1.13)
HOR	-0.811 (-1.14)	-0.643 (-0.77)	-1.452 (-0.97)	0.777 (0.51)	1.916 (1.00)	4.488 (1.57)
<b>STR_RK * HOR</b>	<b>1.545 (1.27)</b>	<b>3.229** (2.17)</b>	<b>4.830* (1.93)</b>	<b>1.667 (0.64)</b>	<b>0.223 (0.08)</b>	<b>-5.109 (-1.39)</b>
<b>Controls</b>	Yes	Yes	Yes	Yes	Yes	Yes
<b>Monthly Fixed Effects</b>	Yes	Yes	Yes	Yes	Yes	Yes
<b>Clustered by Firm</b>	Yes	Yes	Yes	Yes	Yes	Yes
<b>N</b>	139,417	130,503	130,496	113,805	99,402	86,965
<b>Adj. R<sup>2</sup></b>	0.182	0.182	0.153	0.162	0.167	0.163

**Table 6. Insider Trading Horizon and the Future Earnings Surprise**

This Table reports results from the following panel regression model of the future earnings surprise on insider trading strength (STR\_RK), insider trading horizon (HOR), their interaction, and other control variables:

$$\text{Surprise}_{j,q} = \alpha + \beta_{\text{STR}} \text{STR\_RK}_{i,j,t} + \beta_{\text{HOR}} \text{HOR}_{i,j,t} + \beta_{\text{STR*HOR}} \text{STR\_RK}_{i,j,t} * \text{HOR}_{i,j,t} + \text{Controls}_{i,j,t} + \varepsilon_{i,j,t}. \quad (3)$$

The dependent variable is the firm's future earnings surprise for the next earnings announcement in quarter  $q$ , which occurs after insider trades made during month  $t$ . The earnings surprise is measured in two ways, by standardized unexpected earnings (SUE, in columns 1 and 2), and by the 3-day cumulative abnormal return (CAR, in columns 3 and 4). CAR is multiplied by 100 to convert it to percentage terms. Similar to Table 4, the key variables of interest are STR\_RK and the interaction term between STR\_RK and HOR. According to this specification, the effect of insider trading strength on the future earnings surprise is:  $\frac{\partial \text{Surprise}}{\partial \text{STR}} = \beta_{\text{STR}} + \beta_{\text{STR*HOR}} \text{HOR}$ . This partial derivative shows that, for long term insiders (i.e., for HOR = -1), a one-unit increase in insider trading strength from strong sales to strong purchases (i.e., changing STR\_RK from 0 to +1), is associated with a change in earnings surprise of  $(\beta_{\text{STR}} - \beta_{\text{STR*HOR}})$ . In contrast, for short term insiders (i.e., for HOR = 0), a change from strong sales to strong purchases is associated with a change in earnings surprise of  $\beta_{\text{STR}}$ . Thus,  $\beta_{\text{STR*HOR}}$  captures the difference-in-difference while controlling for other firm attributes. A positive coefficient indicates that the differential upcoming earnings surprise from strong purchases versus strong sales by *short term* insiders is larger than that for *long term* insiders. All variables are described in Appendix 1. The sample covers 1996 through 2013. Monthly fixed effects are included, and standard errors are clustered at the firm level. The t-ratios are provided in parentheses. \*, \*\*, and \*\*\* indicate significance at the .10, .05, and .01 levels, respectively.

VARIABLE	(1) SUE	(2) SUE	(3) CAR	(4) CAR
STR_RK	0.050 (1.36)	0.053 (1.64)	0.264** (2.51)	0.257** (2.43)
HOR	-0.123*** (-4.66)	-0.097*** (-4.34)	-0.188*** (-2.63)	-0.187*** (-2.60)
<b>STR_RK * HOR</b>	<b>0.169*** (3.97)</b>	<b>0.134*** (3.59)</b>	<b>0.262** (2.21)</b>	<b>0.256** (2.14)</b>
B/M	7.184*** (6.93)	5.064*** (6.28)	7.457*** (2.84)	7.541*** (2.85)
SIZE	2.039*** (4.85)	1.492*** (4.23)	-1.595 (-1.41)	-1.563 (-1.38)
RET(-1)	0.704*** (15.54)	0.441*** (10.42)	-0.265* (-1.73)	-0.154 (-0.95)
RET(-12, -2)	0.208*** (12.98)	0.107*** (9.15)	-0.013 (-0.31)	-0.010 (-0.24)
PROFIT	0.312*** (2.85)	-0.094 (-1.08)	1.050*** (4.10)	1.080*** (4.19)
ASSETGR	0.053 (0.99)	0.014 (0.26)	-0.088 (-0.34)	-0.079 (-0.30)
STD_RET	-1.110** (-2.39)	-0.898** (-2.21)	-0.871 (-0.52)	-0.827 (-0.50)
LAG(Surprise)		0.340*** (44.44)		-1.402 (-1.54)
Monthly Fixed Effects	Yes	Yes	Yes	Yes
Clustered by Firm	Yes	Yes	Yes	Yes
N	85,655	84,951	88,032	87,709
Adj. R <sup>2</sup>	0.059	0.163	0.007	0.008



**Table 7. Insider Trading Horizon and Future Large Stock Price Changes**

This Table presents the results of probit regression analysis that relates insider trading strength (STR\_RK), insider trading horizon (HOR), and their interaction to the likelihood of an imminent large stock price change in the next ten trading days. The sample of large price change events is identified as follows. First, for each firm we compute the three-day cumulative abnormal return (CAR) around every trading day during a given year. If the CAR for a given day is among the top (bottom) 5% among all trading days in the year, that day is identified as having a large positive (negative) price change. If such a large price change occurs within 10 days following an insider trade in that stock, the dummy variable + $\Delta P$  (- $\Delta P$ ) is assigned a value of one, and zero otherwise. If an insider trades multiple times in a given month, we use the last transaction day as the insider's trading date for that month. For insider  $i$  of firm  $j$  in month  $t$ , the probit model is specified as follows:

$$\Phi^{-1}(+/-\Delta P_{j,t}) = \alpha + \lambda_{STR} STR\_RK_{i,j,t} + \lambda_{HOR} HOR_{i,j,t} + \lambda_{STR*HOR} STR\_RK_{i,j,t} * HOR_{i,j,t} + Controls + \varepsilon_{i,j,t}. \quad (4)$$

$\Phi(\cdot)$  represents the cumulative distribution function for the standard normal distribution. The *economic effect* of insider trading horizon (HOR) on the likelihood of a large price change is measured in two ways. First,  $\Delta Prob(\Delta P | HOR=0)$  is the *change* in the probability of a large price change, across purchases versus sales made by *short term* insiders. Second,  $\Delta Prob(\Delta P | HOR = -1)$  is the implied *change* in the probability of an imminent large price change event, across purchases versus sales made by *long term* insiders. These two *economic effects* are analogous to the partial derivatives,  $\beta_{STR}$  and  $\beta_{STR} - \beta_{STR*HOR}$ , in the former linear regression models from Equations (1) – (3). Thus,  $\lambda_{STR*HOR}$  captures the difference in changes of probabilities. All variables are described in Appendix 1. The sample period covers January 1996 through December 2013. Monthly fixed effects are included, and standard errors are clustered at the firm level. The z-statistics are shown in parentheses. \*, \*\*, and \*\*\* indicate significance at the .10, .05, and .01 level, respectively.

VARIABLE	(1) + $\Delta P$	(2) + $\Delta P$	(3) - $\Delta P$	(4) - $\Delta P$
STR_RK	0.322*** (9.76)	0.199*** (5.79)	-0.113*** (-3.73)	-0.211*** (-6.74)
HOR	-0.014 (-0.55)	-0.007 (-0.27)	0.100*** (4.47)	0.097*** (4.23)
<b>STR_RK * HOR</b>	<b>0.131*** (3.27)</b>	<b>0.105** (2.50)</b>	<b>-0.182*** (-4.84)</b>	<b>-0.196*** (-5.13)</b>
B/M	1.252* (1.92)	4.480*** (6.02)	0.715 (1.13)	1.959*** (2.80)
SIZE	-2.671*** (-8.89)	2.992*** (8.44)	-2.869*** (-9.70)	0.929*** (2.81)
RET(-1)	-0.701*** (-16.90)	-0.692*** (-17.53)	0.359*** (9.37)	0.361*** (9.65)
RET(-12, -2)	-0.068*** (-7.05)	-0.106*** (-11.23)	0.077*** (9.23)	0.049*** (5.78)
PROFIT		0.023 (1.04)		-0.105*** (-4.68)
ASSETGR		-0.078*** (-5.61)		-0.022 (-1.46)
STD_RET		13.091*** (33.69)		9.337*** (26.60)
$\Delta Prob(\Delta P  $ <b>HOR = -1)</b>	0.051*** (11.42)	0.025*** (5.24)	0.019*** (4.09)	-0.004 (-0.84)
$\Delta Prob(\Delta P  $ <b>HOR = 0)</b>	0.090*** (9.71)	0.054*** (5.77)	-0.032*** (-3.74)	-0.058*** (-6.80)
Monthly Fixed Effects	Yes	Yes	Yes	Yes
Clustered by Firm	Yes	Yes	Yes	Yes
N	146,159	146,159	146,159	146,159
Pseudo R <sup>2</sup>	0.040	0.057	0.039	0.048

**Table 8. Trading by Short versus Long Term Insiders following SEC Investigations**

This Table estimates a time series regression model to analyze whether the relative frequency of insider trading by medium or short term insiders (i.e., who both buy and sell over the previous ten years) is sensitive to the extent of SEC enforcement activity regarding insider trading abuse. The dependent variable is the percentage of all insider trades that are made by short and medium term insiders during month  $t$ . The independent variables of interest are three monthly lagged values on  $INVESTIGATE_{t-k}$ ,  $k = 1 - 3$ , which represent the numbers of SEC investigations against insider trading during months  $t-1$ ,  $t-2$ , and  $t-3$ , respectively. In addition, the model includes  $MKTRET_{t-1}$ , the one-month lagged stock market return, and  $MKTRET_{t-13,t-2}$ , the cumulative stock market return from month  $t-13$  through month  $t-2$ . The model is specified as follows:

$$PCT_t = \alpha + \beta_1 INVESTIGATE_{t-1} + \beta_2 INVESTIGATE_{t-2} + \beta_3 INVESTIGATE_{t-3} + \beta_4 MKTRET_{t-1} + \beta_5 MKTRET_{t-13,t-2} + \varepsilon_t. \quad (5)$$

The sample period is determined by the availability of SEC investigation data, and covers 1997 through 2012. The t-ratios appear in parentheses. \*, \*\*, and \*\*\* indicates statistical significance at the .10, .05, and .01 levels, respectively.

VARIABLE	(1)	(2)	(3)	(4)
$INVESTIGATE_{t-1}$	-0.030*** (-8.46)			-0.015*** (-3.53)
$INVESTIGATE_{t-2}$		-0.036*** (-9.95)		-0.0217*** (-5.69)
$INVESTIGATE_{t-3}$			-0.032*** (-7.69)	-0.014*** (-3.07)
$MKTRET_{t-1}$	-0.243*** (-3.69)	-0.272*** (-4.18)	-0.261*** (-3.40)	-0.263*** (-4.20)
$MKTRET_{t-13,t-2}$	-0.059*** (-3.02)	-0.057*** (-3.05)	-0.053*** (-2.85)	-0.057*** (-3.07)
N	189	188	187	187
Adj. $R^2$	0.300	0.341	0.275	0.443

### Table 9. Insider Trading Horizon and Future Stock Returns: Robustness Tests

This Table conducts a series of robustness tests with regard to the estimation of Equation (1) in Table 4. The dependent variable is the future one-month stock return (RET(+1)) in percentage terms. In Panel A, additional control variables are included. For each additional control variable, we also include its interaction with trading strength (STR\_RK). Column 1 includes two measures of corporate governance: the E\_INDEX (entrenchment index) and the G\_INDEX (governance index). In column 2, we control for the positions held by the insider by including dummy variables for CEO, CFO, and Chairman of the Board (CB). Column 3 includes two dummy variables that characterize the insider's educational background (MBA and PhD). Column 4 further controls for possible differential behavior for routine vs. non-routine insiders, as in Cohen, Malloy, and Pomorski (2012). Column 5 accounts for the presence of persistently opportunistic (PO) insiders, as in Cline, Gokkaya, and Liu (2014). Column 6 controls for the gender of the insider. In column 7, we control for the insider's experience in terms of years trading as an insider (EXP\_YEAR), and the total number of previous insider trading months (EXP\_TRADE).

Panel B presents the results from additional robustness tests that explore alternative methodologies, sub-periods, and definitions of insider trading horizon. In column 1, we cluster the standard errors on both the firm level and the month level. Column 2 includes industry (3-digit SIC code) fixed effects. Column 3 analyzes risk-adjusted abnormal returns (AR(+1)) as the dependent variable, in which stock returns are adjusted for risk factors based on the Fama-French 4-factor model, following the procedure proposed by Brennan, Chordia, and Subrahmanyam (1998). In columns 4 and 5, we conduct sub-period analysis based on the periods before and after implementation of SOX, in 2002. Column 6 uses a dummy variable that combines medium and short term insiders into one group, as an alternative discrete measure of insider trading horizon. In columns 7 and 8, we use alternative 5-year or 7-year identification periods to construct the insider's trading horizon. Column 9 further modifies the identification period for construction of the insider's trading horizon by including the current month ( $t$ ). The sample period covers January 1996 through December 2013. The t-ratios are shown in parentheses. \*, \*\*, and \*\*\* indicates significance at the .10, .05, and .01 level, respectively.

#### Panel A. Additional Control Variables

VARIABLE	(1)	(2)	(3)	(4)	(5)	(6)	(7)
STR_RK	1.644** (2.21)	1.833*** (5.71)	1.734*** (4.54)	1.824** (2.49)	1.890*** (5.20)	1.607*** (4.86)	2.321*** (4.53)
HOR	-0.456 (-1.51)	-0.646*** (-3.13)	-0.518** (-2.16)	-1.004** (-2.24)	-0.785*** (-3.50)	-0.435** (-2.04)	-0.615*** (-2.94)
<b>STR_RK * HOR</b>	<b>1.604*** (3.13)</b>	<b>1.371*** (3.85)</b>	<b>1.260*** (3.01)</b>	<b>1.775** (2.37)</b>	<b>1.591*** (4.08)</b>	<b>1.170*** (3.10)</b>	<b>1.384*** (3.79)</b>
B/M	18.070 (1.35)	30.685*** (3.77)	29.682*** (3.35)	20.946* (1.92)	33.944*** (3.76)	25.894*** (3.13)	31.238*** (3.79)
SIZE	-20.572*** (-3.61)	-22.095*** (-6.43)	-23.963*** (-5.99)	-17.672*** (-3.88)	-22.702*** (-6.28)	-24.200*** (-6.60)	-22.346*** (-6.46)
RET(-1)	-0.644 (-0.78)	-0.110 (-0.16)	-0.509 (-0.57)	0.454 (0.53)	-0.016 (-0.02)	-0.226 (-0.29)	-0.120 (-0.18)
RET(-12, -2)	0.064 (0.27)	0.144 (1.18)	0.161 (1.18)	0.134 (0.77)	0.120 (0.90)	0.124 (0.99)	0.145 (1.20)
PROFIT	0.126 (0.37)	0.511** (2.30)	0.516** (2.10)	0.640** (2.15)	0.424* (1.81)	0.530** (2.26)	0.503** (2.27)
ASSETGR	-1.178*** (-6.52)	-0.989*** (-6.44)	-0.930*** (-5.35)	-0.858*** (-3.98)	-0.952*** (-5.84)	-0.927*** (-5.62)	-0.991*** (-6.46)
STD_RET	14.496 (1.40)	4.752 (0.75)	8.324 (1.17)	10.783 (1.19)	6.227 (0.91)	6.716 (1.00)	5.038 (0.79)
E_INDEX	0.018 (0.16)						
STR_RK * E_INDEX	-0.008 (-0.04)						

Table 9, Panel A continued

G_INDEX	0.033						
	(0.61)						
STR_RK	0.022						
* G_INDEX	(0.25)						
		0.082					
CEO		(0.55)					
STR_RK		0.042					
* CEO		(0.13)					
		-0.245					
CFO		(-1.06)					
STR_RK		0.421					
* CFO		(1.02)					
		0.035					
CB		(0.20)					
STR_RK		0.367					
* CB		(0.93)					
		0.219					
MBA		(1.57)					
STR_RK		-0.160					
* MBA		(-0.66)					
		-0.029					
PhD		(-0.11)					
STR_RK		-0.041					
* PhD		(-0.09)					
				-0.207			
NON_ROUTINE				(-1.05)			
STR_RK				0.299			
* NON_ROUTINE				(0.95)			
						-0.198	
PO						(-1.41)	
STR_RK						0.258	
* PO						(1.12)	
						0.087	
FEMALE						(0.38)	
STR_RK						-0.341	
* FEMALE						(-1.01)	
							0.012
EXP_YEAR							(0.38)
STR_RK							-0.040
* EXP_YEAR							(-0.79)
							0.007*
EXP_TRADE							(1.74)
STR_RK							-0.010
* EXP_TRADE							(-1.30)
<b>Month Fixed Effects</b>	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<b>Clustered by Firm</b>	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<b>N</b>	61,425	146,159	99,585	64,635	127,221	121,502	146,159
<b>Adj. R<sup>2</sup></b>	0.186	0.155	0.173	0.165	0.156	0.167	0.155

Table 9, continued

Panel B. Alternative Regression Methodologies, Sub-Periods, and Identification Periods for Constructing Insider Trading Horizon

VARIABLE	(1) Two-Way Cluster	(2) 3-Digit SIC F.E.	(3) Risk Adj. Return	(4) Pre-SOX 1996-2001	(5) Post-SOX 2002-2013	(6) Discrete Horizon	(7) 5-Year Ident. Period	(8) 7-Year Ident. Period	(9) Alt. Ident.
STR_RK	1.916*** (4.95)	1.845*** (5.91)	2.342*** (6.62)	4.229*** (5.45)	1.041*** (3.19)	0.498*** (3.22)	2.160*** (5.16)	2.067*** (6.00)	2.120*** (6.79)
HOR	-0.650*** (-3.01)	-0.633*** (-3.05)	-0.878*** (-3.82)	-2.041*** (-3.83)	-0.173 (-0.82)	-0.370*** (-2.99)	-0.705*** (-2.62)	-0.671*** (-2.98)	-0.538*** (-2.58)
<b>STR_RK * HOR</b>	<b>1.414*** (3.67)</b>	<b>1.322*** (3.70)</b>	<b>1.588*** (3.95)</b>	<b>3.114*** (3.42)</b>	<b>0.798** (2.16)</b>	<b>0.703*** (3.32)</b>	<b>1.556*** (3.40)</b>	<b>1.508*** (3.89)</b>	<b>1.570*** (4.28)</b>
B/M	30.682** (2.04)	42.505*** (4.58)	13.681 (1.49)	66.168*** (3.04)	18.614** (2.28)	30.615*** (3.76)	26.973*** (3.13)	25.689*** (3.17)	31.394*** (4.04)
SIZE	-22.340*** (-3.44)	-24.939*** (-6.60)	-20.145*** (-5.05)	-29.443*** (-3.87)	-17.157*** (-4.51)	-22.507*** (-6.58)	-21.470*** (-6.01)	-22.051*** (-6.49)	-23.217*** (-6.69)
RET(-1)	-0.131 (-0.09)	-0.217 (-0.32)	-0.185 (-0.28)	0.203 (0.16)	-0.241 (-0.36)	-0.143 (-0.21)	0.331 (0.50)	-0.230 (-0.39)	-0.261 (-0.40)
RET(-12, -2)	0.142 (0.40)	0.147 (1.20)	-0.051 (-0.39)	0.679*** (3.09)	-0.180 (-1.42)	0.140 (1.15)	0.161 (1.24)	0.129 (1.04)	0.169 (1.43)
PROFIT	0.508 (1.45)	0.605** (2.18)	0.644** (2.57)	0.299 (0.53)	0.600*** (2.75)	0.514** (2.32)	0.622*** (2.79)	0.570*** (2.65)	0.545** (2.53)
ASSETGR	-0.987*** (-4.62)	-1.005*** (-6.56)	-0.654*** (-3.91)	-1.028*** (-4.39)	-0.902*** (-4.60)	-0.984*** (-6.41)	-0.868*** (-5.41)	-0.972*** (-6.44)	-1.085*** (-7.26)
STD_RET	5.083 (0.28)	4.441 (0.69)	3.572 (0.50)	2.329 (0.21)	8.844 (1.18)	5.193 (0.82)	3.750 (0.55)	5.821 (0.93)	6.917 (1.12)
<b>Monthly F.E.</b>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<b>Clustered by Firm</b>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<b>N</b>	146,159	146,159	133,696	34,477	111,682	146,159	121,575	142,798	172,623
<b>Adj. R<sup>2</sup></b>	0.155	0.156	0.012	0.124	0.177	0.155	0.152	0.151	0.149

**Table 10. Insider Trading Horizon and Future Stock Returns at the Firm Level**

This Table replicates estimation of Equation (1) from Table 4 at the firm level, instead of at the finer level of the individual insider trading month. Specifically, for each firm ( $j$ ) in month  $t$ , the model is specified as:

$$\text{RET}(+1)_{j,t} = \alpha + \beta_{\text{STR}} \text{STR\_RK}_{j,t} + \beta_{\text{HOR}} \text{HOR}_{j,t} + \beta_{\text{STR*HOR}} \text{STR\_RK}_{j,t} * \text{HOR}_{j,t} + \text{Controls}_{j,t} + \varepsilon_{j,t}. \quad (6)$$

The dependent variable is the future one-month stock return ( $\text{RET}(+1)$ ) in percentage terms for firm  $j$  in month  $t+1$ . In this analysis, the trading strength (STR) for firm  $j$  in month  $t$  is constructed as the aggregate net purchases (i.e., purchases – sales) across all insiders at firm  $j$ , scaled by the total trading volume at firm  $j$  by all investors in month  $t$ . Similar to the insider level analysis in Table 4, firm-level trading strength is then ranked into quintiles each month (i.e., assigned the values, 0 – 4), and these values are divided by 4 to obtain the scaled rank variable, STR\_RK. Similarly, the firm level measure of insider trading horizon (HOR) is constructed as the trading volume weighted average of the measures of investment horizon, for all insiders at firm  $j$  who trade in month  $t$ . All other variables are described in Appendix 1. The sample period covers January 1996 through December 2013. Monthly fixed effects are included, and standard errors are clustered at the firm level. The t-statistics are shown in parentheses. \*, \*\*, and \*\*\* indicate significance at the .10, .05, and .01 levels, respectively.

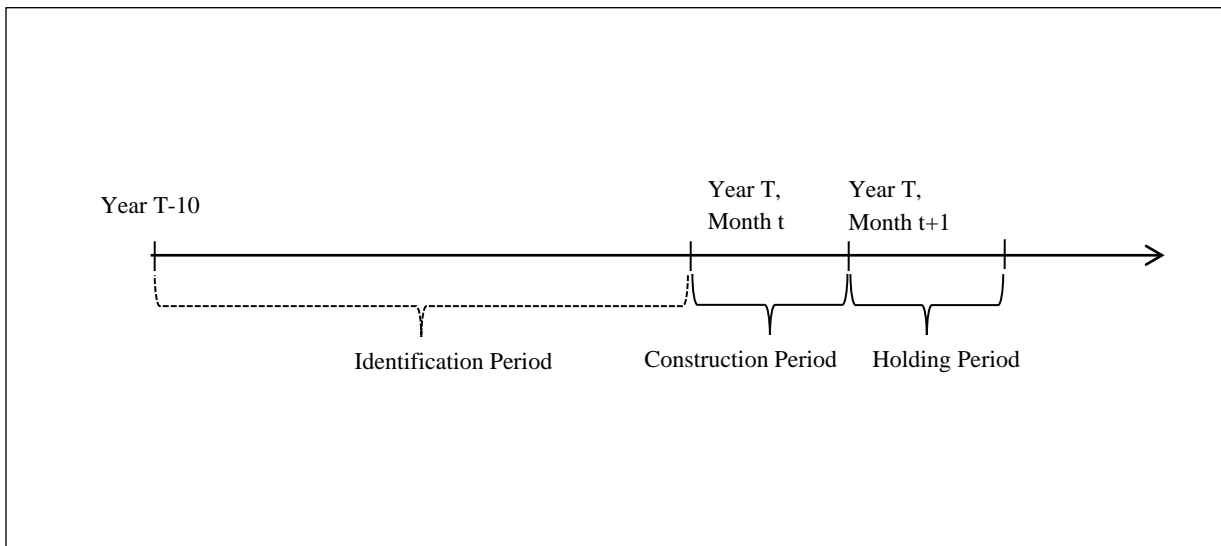
VARIABLE	(1)	(2)	(3)	(4)	(5)	(6)
STR_RK	0.864*** (6.36)	0.861*** (6.35)	2.142*** (5.73)	0.899*** (6.41)	0.897*** (6.40)	2.136*** (5.66)
HOR		-0.121 (-0.75)	-0.948*** (-3.78)		-0.047 (-0.29)	-0.848*** (-3.37)
<b>STR_RK * HOR</b>			<b>1.690*** (3.81)</b>			<b>1.635*** (3.68)</b>
B/M	28.210*** (3.97)	28.232*** (3.98)	28.538*** (4.02)	28.493*** (3.53)	28.500*** (3.53)	28.353*** (3.52)
SIZE	-25.311*** (-8.33)	-25.658*** (-8.30)	-25.523*** (-8.27)	-22.157*** (-6.98)	-22.293*** (-6.94)	-22.337*** (-6.96)
RET(-1)	-0.105 (-0.17)	-0.102 (-0.16)	-0.079 (-0.13)	-0.191 (-0.31)	-0.190 (-0.30)	-0.166 (-0.27)
RET(-12, -2)	0.180* (1.68)	0.184* (1.71)	0.192* (1.79)	0.136 (1.22)	0.137 (1.23)	0.146 (1.31)
PROFIT				0.673*** (3.01)	0.672*** (3.00)	0.637*** (2.85)
ASSETGR				-0.984*** (-6.10)	-0.982*** (-6.08)	-0.987*** (-6.11)
STD_RET				3.223 (0.56)	3.232 (0.56)	2.959 (0.51)
<b>Monthly Fixed Effects</b>	Yes	Yes	Yes	Yes	Yes	Yes
<b>Clustered by Firm</b>	Yes	Yes	Yes	Yes	Yes	Yes
<b>N</b>	91,803	91,803	91,803	91,803	91,803	91,803
<b>Adj. R<sup>2</sup></b>	0.145	0.145	0.146	0.146	0.146	0.146

**Figure 1. Plot of Trading Activity by Insider A from Company M**



**Figure 2. Identification Period, Portfolio Construction Period, and Holding Period**

This figure depicts the timing of the identification period for construction of the measure of insider trading horizon, the portfolio construction period, and the holding period. The identification period refers to the time window during which previous insider transactions are used to calculate the measure of insider investment horizon. The portfolio construction period is the month ( $t$ ) when insiders trade. At the end the trading month ( $t$ ), portfolios are constructed based on the measures of insider trading strength and investment horizon. The holding period is the following month ( $t+1$ ).



## Appendix 1. Descriptions and Construction of the Key Variables

Variable Name	Description & Construction
ASSETGR	Annual asset growth. $(AT_t - AT_{t-1})/AT_{t-1}$ , where AT is asset.
AR(+1)	AR(+1) is the leading one month ( $t+1$ ) risk-adjusted abnormal stock return (i.e., FF4 Alpha). The risk-adjustment is based on the Fama-French three-factor model augmented with a momentum factor. The adjustment procedure closely follows Brennan, Chordia, and Subrahmanyam (1998). For each firm in a given month, $AR = RET - (rf + \beta_1 * MKT\_RF + \beta_2 * SMB + \beta_3 * HML + \beta_4 * UMD)$ , where RET is the raw monthly stock return in the current month; rf is the risk-free rate; MKT_RF, SMB, and HML are the Fama-French three factors; UMD is the momentum factor. $\beta_1, \beta_2, \beta_3, \beta_4$ are the factor loadings estimated using monthly data over the previous 36 months based on the Fama-French three-factor model augmented with the momentum factor. We require at least 24 months of non-missing data for the estimation.
B/M	The book-to-market ratio. We take the natural log in the analysis.
CAR	Three-day cumulative abnormal return. It is calculated as $\frac{1}{3} \sum_{t=-1}^{+1} (RET_{i,t} - VWRETD_t)$ , where $RET_{i,t}$ is the stock return for firm $i$ on day $t$ ; $VWRETD_t$ is the value-weighted market return; and $t=0$ is the event date.
HOR	The insider trading horizon measure. For insider $i$ of firm $j$ in month $t$ , the insider's trading horizon is calculated as the average annual net insider order flow across all years that the insider traded during the previous 10 years (the identification period), as follows: $HOR_{i,j,t} = \frac{ \sum_{y=T-10}^{year(t-1)} IOF_{i,j,y} }{N} * (-1)$ , where $IOF_{i,j,y}$ is the annual net insider order flow of insider $i$ at firm $j$ in year $y$ , defined as $\frac{P_{i,j,y} - S_{i,j,y}}{P_{i,j,y} + S_{i,j,y}}$ , and where $P$ is the number of shares purchased during year $y$ , $S$ is the number of shares sold, and $N$ is the number of years the insider traded, from year $T-10$ through month $t-1$ .
PROFIT	Firm profitability measured by gross profitability. $(SALES - COGS)/AT$ .
RET(+1)	RET(+1) is the leading one month ( $t+1$ ) monthly stock raw return.
RET(-12, -2)	RET(-12, -2) is the cumulative stock return from month $t-12$ to $t-2$ .
RET(-1)	RET(-1) is the stock raw return from month $t-1$ .
SIZE	Market capitalization (SIZE) is the number of shares (SHROUT) multiples price per share (abs (PRC)). We take the natural log in the analysis.
STD_RET	Volatility of daily stock returns in month $t$ .
STR	The insider trading strength measure. For insider $i$ of firm $j$ in month $t$ , it is defined as: $STR_{i,j,t} = \frac{P_{i,j,t} - S_{i,j,t}}{VOL_{j,t}}$ , where $P_{i,j,t}$ is the number of shares purchased by insider $i$ at firm $j$ in month $t$ , $S_{i,j,t}$ is the number of shares sold, and $VOL_{j,t}$ is the total trading volume by all investors in firm $j$ during month $t$ .
STR_RK	The ranks of STR, ranging from 0 to 1. In each month $t$ , STR is ranked in quintiles from 0 to 4. Then, the ranks are scaled by 4 to get STR_RK.
SUE	Standardized unexpected earnings (SUE) for firm $j$ in quarter $q$ calculated following Bernard and Thomas (1990). $SUE_{j,q} = \frac{EPS_{j,q} - EPS_{j,q-4} - \mu_{q-7,q}}{\sigma_{q-7,q}}$ , where $\mu_{q-7,q}$ and $\sigma_{q-7,q}$ are the mean and standard deviation of $(EPS_{i,q} - EPS_{i,q-4})$ , respectively, over the past eight quarters.



## **Appendix 2. Sample Composition and Characteristics of the Insider and Firm**

This table replicates Panel A of Table 2 for insider purchases and sales separately. HOR is the insider trading horizon measure. STR is monthly net trade (order imbalance) by each insider scaled by the total shares traded by all investors. E\_INDEX is the management entrenchment index from Bebchuk, Cohen, and Ferrell (2009). G\_INDEX is the corporate governance index from Gompers, Ishii, and Metrick (2003). Higher E\_INDEX or G\_INDEX indicates weaker corporate governance. CEO, CFO, and CB are indicator variables for CEO, CFO, and Chairman of the Board, respectively. MBA and PhD are dummy variables of insider education background. NON\_ROUNTINE is an indicator variable for opportunistic insiders following Cohen, Malloy, and Pomorski (2012). PO is an indicator variable for persistently opportunistic insiders defined as Cline, Gokkaya, and Liu (2014). FEMALE is a dummy variable that takes a value of one if the insider is female and zero otherwise. EXP\_YEAR and EXP\_TRADE are measures of experience measured by time and trades. EXP\_YEAR is the number of years since the first year of trading. EXP\_TRADE is the total number of previous trading months. All other variables are described in Appendix 1. The sample period covers January 1996 through December 2013. The t-statistics (in round parentheses) are based on Newey-West robust standard errors. The numbers of observations are in square parentheses. \* indicates significance at the .10 level; \*\* at the .05 level; and \*\*\* at the .01 level.

## Appendix 2, continued

## Panel A. Sample of Insider Purchases

VARIABLES	HOR						Mean Diff
	Long		Medium		Short		SH – LH
HOR	-1.00	[9,283]	-0.73	[4,429]	-0.29	[5,676]	0.71***
(t-ratio)	(N/A)	[# of obs]	(-130.67)		(-43.34)		(105.11)
STR (bps)	20.45	[9,283]	21.99	[4,429]	14.77	[5,676]	-5.68***
	(10.10)		(8.62)		(8.47)		(-6.65)
B/M	0.83	[9,283]	0.85	[4,429]	0.78	[5,676]	-0.04**
	(16.77)		(14.94)		(16.07)		(-2.04)
SIZE (million \$)	2,929.82	[9,283]	1,386.49	[4,429]	2,660.88	[5,676]	-268.94
	(9.09)		(7.07)		(4.76)		(-0.62)
RET(-1) %	-1.13	[9,283]	-1.25	[4,429]	-1.82	[5,676]	-0.69*
	(-1.86)		(-1.80)		(-2.43)		(-1.91)
RET(-12, -2) %	8.73	[9,283]	5.82	[4,429]	3.66	[5,676]	-5.06***
	(1.99)		(1.16)		(0.72)		(-2.95)
PROFIT %	29.10	[9,283]	32.09	[4,429]	34.67	[5,676]	5.57***
	(43.85)		(34.38)		(46.28)		(9.64)
ASSETGR %	13.41	[9,283]	14.63	[4,429]	19.58	[5,676]	6.17**
	(8.69)		(7.82)		(5.97)		(2.38)
STD_RET %	3.46	[9,283]	3.72	[4,429]	3.83	[5,676]	0.37***
	(16.12)		(16.12)		(15.98)		(3.60)
E_INDEX	2.28	[2,939]	2.37	[1,270]	2.31	[1,709]	0.05
	(36.14)		(25.95)		(43.78)		(0.65)
G_INDEX	8.81	[3,016]	8.83	[1,279]	8.80	[1,739]	-0.01
	(52.56)		(63.13)		(57.99)		(-0.06)
CEO	0.21	[9,283]	0.29	[4,429]	0.28	[5,676]	0.07***
	(13.01)		(14.85)		(25.50)		(3.57)
CFO	0.03	[9,283]	0.04	[4,429]	0.05	[5,676]	0.02***
	(8.92)		(11.24)		(11.24)		(3.85)
CB	0.15	[9,283]	0.16	[4,429]	0.18	[5,676]	0.03*
	(17.57)		(13.96)		(16.07)		(1.72)
MBA	0.25	[5,644]	0.29	[2,609]	0.31	[3,425]	0.05***
	(23.22)		(20.01)		(26.31)		(3.03)
PhD	0.09	[5,644]	0.06	[2,609]	0.07	[3,425]	-0.02***
	(14.00)		(10.43)		(11.42)		(-2.62)
FEMALE	0.06	[7,017]	0.03	[3,308]	0.02	[4,237]	-0.03***
	(10.94)		(8.45)		(6.20)		(-5.25)
NON_ROUTINE	0.58	[4,385]	0.66	[1,667]	0.74	[847]	0.16***
	(27.16)		(22.29)		(21.65)		(4.48)
PO	0.41	[7,905]	0.46	[3,872]	0.49	[4,595]	0.07***
	(23.49)		(27.19)		(27.45)		(2.89)
EXP_YEAR	6.43	[9,283]	7.43	[4,429]	7.32	[5,676]	0.89***
	(117.14)		(49.26)		(60.21)		(9.19)
EXP_TRADE	16.17	[9,283]	16.40	[4,429]	11.47	[5,676]	-4.70***
	(24.02)		(18.14)		(33.14)		(-8.50)

## Appendix 2, continued

## Panel B. Sample of Insider Sales

VARIABLES	HOR						Mean Diff
	Long		Medium		Short		SH – LH
HOR	-1.00	[75,419]	-0.75	[25,144]	-0.30	[26,208]	0.70***
(t-ratio)	(N/A)	[# of obs]	(-175.75)		(-56.33)		(128.82)
STR (bps)	-6.89	[75,419]	-9.16	[25,144]	-12.22	[26,208]	-5.33***
	(-10.40)		(-10.11)		(-11.86)		(-11.39)
B/M	0.44	[75,419]	0.49	[25,144]	0.52	[26,208]	0.07***
	(22.16)		(20.10)		(24.44)		(6.96)
SIZE (million \$)	10,792.03	[75,419]	5,587.38	[25,144]	3,572.75	[26,208]	-7,219.29***
	(16.17)		(16.78)		(14.09)		(-13.74)
RET(-1) %	3.85	[75,419]	4.10	[25,144]	4.69	[26,208]	0.83***
	(7.93)		(8.59)		(9.48)		(6.28)
RET(-12, -2) %	28.71	[75,419]	32.49	[25,144]	38.18	[26,208]	9.47***
	(5.65)		(6.11)		(7.29)		(4.89)
PROFIT %	40.40	[75,419]	38.76	[25,144]	37.46	[26,208]	-2.95***
	(49.99)		(49.19)		(51.49)		(-7.93)
ASSETGR %	20.41	[75,419]	19.85	[25,144]	20.96	[26,208]	0.56
	(10.20)		(10.90)		(12.89)		(0.58)
STD_RET %	2.67	[75,419]	2.81	[25,144]	2.95	[26,208]	0.27***
	(15.68)		(15.75)		(16.73)		(17.07)
E_INDEX	2.26	[34,813]	2.33	[12,192]	2.48	[10,259]	0.23***
	(29.77)		(29.40)		(34.94)		(7.64)
G_INDEX	8.85	[34,452]	8.82	[12,218]	8.97	[10,276]	0.12**
	(129.71)		(133.83)		(125.36)		(2.13)
CEO	0.12	[75,419]	0.20	[25,144]	0.19	[26,208]	0.07***
	(34.48)		(22.18)		(18.11)		(7.69)
CFO	0.06	[75,419]	0.07	[25,144]	0.08	[26,208]	0.01***
	(14.05)		(22.98)		(26.53)		(3.44)
CB	0.10	[75,419]	0.15	[25,144]	0.13	[26,208]	0.04***
	(13.84)		(24.04)		(20.55)		(6.60)
MBA	0.28	[51,949]	0.27	[17,907]	0.31	[18,051]	0.03***
	(66.96)		(53.48)		(42.65)		(5.38)
PhD	0.12	[51,949]	0.10	[17,907]	0.08	[18,051]	-0.03***
	(24.81)		(18.05)		(21.02)		(-5.66)
FEMALE	0.08	[63,515]	0.05	[21,541]	0.04	[21,884]	-0.04***
	(14.35)		(15.74)		(9.17)		(-15.15)
NON_ROUTINE	0.66	[40,915]	0.70	[11,964]	0.75	[4,857]	0.09***
	(39.98)		(34.76)		(30.47)		(5.94)
PO	0.43	[66,987]	0.46	[22,455]	0.46	[21,407]	0.03***
	(45.15)		(48.10)		(63.96)		(3.42)
EXP_YEAR	6.76	[75,419]	7.67	[25,144]	7.24	[26,208]	0.48***
	(130.05)		(76.49)		(71.42)		(4.56)
EXP_TRADE	15.84	[75,419]	16.27	[25,144]	11.18	[26,208]	-4.67***
	(21.27)		(19.21)		(19.13)		(-17.26)

### Appendix 3. Insider Horizon and Insider/Firm Characteristics: Probit Regressions

This table relates insider transactions to insider level and firm level characteristics using probit regressions. The dependent variable is an indicator that takes a value of one if a trade is made by a short or medium term insider (i.e., not a long term insider). E\_INDEX is the management entrenchment index from Bebchuk, Cohen, and Ferrell (2009). G\_INDEX is the corporate governance index from Gompers, Ishii, and Metrick (2003). Higher values of E\_INDEX or G\_INDEX indicate weaker corporate governance. CEO, CFO, and CB are indicator variables for CEO, CFO, and Chairman of the Board, respectively. MBA and PhD are dummy variables of insiders' education background. NON\_ROUNTINE is an indicator variable for opportunistic insiders following Cohen, Malloy, and Pomorski (2012). PO is an indicator variable for persistently opportunistic insiders defined as Cline, Gokkaya, and Liu (2014). FEMALE is a dummy variable that takes a value of one if the insider is female and zero otherwise. EXP\_YEAR is the number of years since the first year trading. EXP\_TRADE is the total number of previous trading months. All other independent variables are described in Appendix 1. The sample period covers January 1993 through December 2013. Monthly fixed effects are included. Standard errors are clustered at the firm level. t-statistics are shown in parentheses. \*, \*\*, and \*\*\* indicates statistical significance at the .10, .05, and .01 level, respectively.

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)
B/M	-2.358 (-0.70)	-2.927 (-0.89)	-0.536 (-0.29)	-1.442 (-0.65)	0.750 (0.25)	-1.938 (-0.94)	-6.794*** (-3.68)
SIZE	-17.265*** (-9.69)	-17.394*** (-9.90)	-13.319*** (-14.04)	-14.184*** (-12.63)	-11.367*** (-8.14)	-13.625*** (-13.14)	-14.607*** (-15.84)
RET(-1)	0.041 (0.63)	0.060 (0.94)	0.121*** (3.53)	0.148*** (3.42)	0.007 (0.13)	0.160*** (4.03)	0.107*** (3.09)
RET(-13,-2)	0.135*** (5.73)	0.139*** (5.78)	0.106*** (8.44)	0.120*** (7.76)	0.060*** (3.02)	0.115*** (8.02)	0.100*** (8.00)
PROFIT	-0.280*** (-2.73)	-0.294*** (-2.89)	-0.179*** (-2.99)	-0.190** (-2.54)	-0.210** (-2.36)	-0.174** (-2.57)	-0.182*** (-3.08)
ASSETGR	0.066* (1.66)	0.070* (1.81)	0.065** (2.31)	0.039 (1.32)	0.053 (1.50)	0.063** (2.11)	0.136*** (4.91)
STDRET	1.030 (0.83)	0.815 (0.66)	-0.235 (-0.36)	-0.279 (-0.35)	-1.710 (-1.59)	-0.031 (-0.04)	0.823 (1.30)
E_INDEX	0.044** (2.35)						
G_INDEX		0.014 (1.61)					
CEO			0.285*** (8.27)				
CFO			0.140*** (3.69)				
CB			0.133*** (3.24)				
MBA				0.075** (2.30)			
PhD				-0.123** (-2.13)			
NON_ROUTINE					0.144*** (3.68)		
PO					0.031 (1.05)		
FEMALE						-0.302*** (-5.79)	
EXP_YEAR							0.123*** (22.06)
EXP_TRADE							-0.014*** (-7.63)
Monthly Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Clustered by Firm	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	63,182	62,980	146,159	99,585	63,814	121,502	146,159
Pseudo R <sup>2</sup>	0.043	0.039	0.053	0.049	0.037	0.048	0.079

## Appendix 4. Insider Investment Horizon and Future Stock Returns: Portfolio Analysis Using Two Horizon Groups

This Table presents the results from a 2 by 2 or 5 by 2 portfolio approach, respectively, based on trading strength and insider investment horizon. In Panel A (or B), for each month ( $t$ ), the stocks are first grouped into two (or five) portfolios, ranging from sales to purchases (or strong sales to strong purchases) based on insider trading strength, STR. We further independently sort on stocks into two groups based on whether the transaction is made by a long horizon insider (who only buys or sells over the previous ten years) or a short term insider (who both buys and sells). We then hold each portfolio during the next month,  $t+1$ . We report the average monthly results based on equally-weighted portfolio returns. All variables are described in Appendix 1. The t-statistics are based on Newey-West robust standard errors. \* indicates significance at the .10 level; \*\* at the .05 level; and \*\*\* at the .01 level.

### Panel A. 2×2 Sorting Analysis

STR	HOR		
Average Raw Return	Long	Short	SH – LH
SALES	0.87** (2.22)	0.67* (1.68)	<b>-0.21*</b> <b>(-1.67)</b>
PURCHASES	1.85*** (4.49)	2.57*** (4.48)	<b>0.71***</b> <b>(3.34)</b>
<b>P – S</b>	<b>0.98***</b> <b>(2.64)</b>	<b>1.90***</b> <b>(4.29)</b>	<b>0.92***</b> <b>(4.11)</b>
Fama-French 4-Factor Alphas	Long	Short	SH – LH
SALES	-0.09 (-0.79)	<u><b>-0.36**</b></u> <u><b>(-2.74)</b></u>	<b>-0.27**</b> <b>(-2.36)</b>
PURCHASES	1.07*** (4.30)	1.72*** (4.44)	<b>0.65***</b> <b>(3.48)</b>
<b>P – S</b>	<b>1.16***</b> <b>(4.26)</b>	<b>2.08***</b> <b>(4.96)</b>	<b>0.92***</b> <b>(4.10)</b>

## Appendix 4, continued

## Panel B. 5×2 Sorting Analysis

STR	HOR		
Average Raw Return	Long	Short	SH – LH
STRONG SALE	1.15*** (2.99)	0.62 (1.54)	<b>-0.53***</b> <b>(-2.97)</b>
2	1.01** (2.52)	0.78* (1.89)	<b>-0.23</b> <b>(-1.51)</b>
3	0.86** (2.08)	1.03** (2.48)	<b>0.16</b> <b>(1.05)</b>
4	0.80** (2.07)	1.08*** (2.60)	<b>0.28*</b> <b>(1.72)</b>
STRONG PURCHASE	1.63*** (4.27)	2.28*** (4.32)	<b>0.65***</b> <b>(3.30)</b>
SP – SS	<b>0.48*</b> <b>(1.95)</b>	<b>1.66***</b> <b>(4.49)</b>	<b>1.18***</b> <b>(4.72)</b>
Fama-French 4-Factor Alphas	Long	Short	SH – LH
STRONG SALE	0.14 (0.95)	<b>-0.35**</b> <b>(-2.1)</b>	<b>-0.49***</b> <b>(-2.8)</b>
2	0.00 (-0.01)	-0.28 (-1.39)	<b>-0.28*</b> <b>(-1.76)</b>
3	-0.10 (-0.65)	-0.06 (-0.39)	<b>0.05</b> <b>(0.32)</b>
4	-0.06 (-0.32)	0.2 (0.90)	<b>0.26</b> <b>(1.63)</b>
STRONG PURCHASE	0.91** (3.48)	1.52*** (3.83)	<b>0.61***</b> <b>(3.47)</b>
SP – SS	<b>0.77***</b> <b>(3.08)</b>	<b>1.87***</b> <b>(4.55)</b>	<b>1.10***</b> <b>(4.31)</b>