

Short-Horizon Insiders and Stock Trades in Personal Portfolios*

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Abstract

We examine whether and how insider investment horizon influences insiders' personal portfolio choices. We observe significantly higher trading activities for short-horizon CEOs compared to those with a longer investment horizon. Short-horizon insiders trade more in own-firm stocks than long-horizon insiders. Short-horizon insiders also trade more in own-firm stocks than expertise stocks, defined based on industry familiarity or local stocks. The trades of short-horizon insiders consistently outperform those of long-horizon insiders in both own-firm and expertise stocks. These results are driven by insiders' purchases rather than their sales. Overall, our findings suggest that short-horizon insiders' trades are more informative compared to those of long-horizon insiders.

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EFM classification codes: 370, 380.

Keywords: Insider personal portfolio, CEO, Investment horizon, Expertise stock, Non-expertise stock.

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1. Introduction

Despite a vast literature on insider trading, little is known about the personal portfolios of corporate insiders. In this paper, we examine whether insiders' investment horizon affects their personal portfolio choices.⁴ The previous literature on the investment horizon mainly focuses on outside investors (Amihud & Mendelson, 1991; Barber & Odean, 2013; Cella et al., 2013). According to investor clientele, short-term investors hold more liquid assets, while long-term investors hold less liquid ones (Amihud & Mendelson, 1991). Regarding retail investors, the literature highlights their preference for familiarity-based investments despite mixed evidence on the payoff (Barber & Odean, 2013). However, the general behavior of retail or outside investors might not perfectly characterize the investment decisions of insiders, who typically include CEOs, board members, top executives, and other managers. Insiders are expected to not only be more wealthy, well-advised, and sophisticated than the typical outside investor but also possess superior information relative to outside investors. Examining the trade composition of insiders, Ben-David et al. (2019) find that insiders trade firms from their own industry (so-called expertise stocks) more frequently and outperform exclusively on their own industry trades. The superior performance is argued to be driven by industry familiarity and expertise rather than the use of private information.

We build on this research and examine the role of expertise investments, defined as industry familiarity, in insiders' own portfolios in relation to insiders' investment horizon.⁵ Our focus is on CEOs, the type of insider usually assumed to have the most private information about the firm. We match insider trading data obtained from the Financial Supervisory Authority in Sweden to our quarterly investor data from Euroclear Sweden, which contains 55 waves of investor holdings covering the period between the first quarter of 2006 and the third quarter of 2019. We first establish that the trading volume of short-horizon insiders is significantly greater

⁴ Following Akbas et al. (2020), we define an insider's investment horizon as the average annual net order flow in the insider's own-company stock over the past 10 years. The annual net order flow is defined as equal shares purchased by the insider minus shares sold by the insider, scaled by the total shares traded. The measure ranges from -1 to +1. Net order flow values of -1 and +1 indicate long-horizon inside trades where the insider is more persistent in selling and buying respectively over time. A net order flow value close to 0 indicates a short-horizon insider trade where the insider switches between buying and selling frequently. Short-horizon insiders are assumed to update their position in a more timely fashion to realize profits.

⁵ As a robustness test, we also define local stocks as expertise stocks, motivated by the large literature on local bias and familiarity-based investments (Coval & Moskowitz, 1999, 2001; Døskeland & Hvide, 2011; Lindblom et al., 2018; Massa & Simonov, 2006; Seasholes & Zhu, 2010).

than that of long-horizon insiders. Short-horizon insiders trade more in their own company stocks than long-horizon insiders. Short-horizon insiders also trade more in their own-firm stocks than their expertise stocks or other stocks. For long-horizon insiders, their trades on expertise stocks are more frequent than their trades on non-expertise stocks. These results are consistent with the idea that short-horizon investors hold more liquidity stocks (Amihud et al., 2006).

Next, we explore whether short-horizon insiders' trades in their own portfolios are information-driven or based on familiarity by examining the profitability of their trades. The existing evidence provides mixed results regarding the abnormal profitability of short-horizon insiders' trades. For instance, Akbas et al. (2020) find that the trades of short-horizon insiders convey more predictive information relative to those of long-horizon insiders. On the other hand, Ben-David et al. (2019) focus on opportunistic industry insiders, i.e., insiders whose trades do not follow a routine (Cohen et al., 2012), and find no evidence that they exploit inside information in their expertise trades. We contribute to this nascent literature by examining whether expertise investments in short-horizon insiders' own portfolios gain abnormal returns relative to their non-expertise investments. To explore this possibility, we use holdings-based portfolios, the calendar-time portfolio approach, and the transaction-based calendar-time portfolio approach.

We first construct portfolios and calculate their value-weighted returns in each quarter based on short-horizon insiders, long-horizon insiders, and trade type portfolios. The trade type portfolios are constructed for each insider group based on insiders' own company stocks, expertise stocks in their portfolios (excluding own-company stocks), and non-expertise stocks in their portfolios. Thus, our first analysis is at the insider-portfolio-quarter level.

To examine the performance of insiders' trades using the calendar-time portfolio approach, we build quarterly return portfolios based on our insider trade groups, assuming insiders hold them during each quarter and rebalance their portfolios at the end of the quarter. We then conduct a two-way sorting analysis where we partition insider trades by type into short-horizon and long-horizon insider trade portfolios. The short-horizon insiders are determined by the median horizon value of the CEOs.⁶ Insiders with an investment horizon value below or equal to the

⁶ In additional analysis, we use the mean value of our horizon measure as a cutoff.

median are classified as short-horizon insiders; insiders with an investment horizon value above the median are long-horizon insiders. Finally, for each type of trade, we take the difference of the returns in the short- and long-horizon insider trade portfolios. We calculate and compare the average raw returns, market-adjusted returns, and Carhart (1997) four-factor alphas in our 3 x 2 - portfolio analysis. Our main results indicate that short-horizon insiders earn about 0.2% more abnormal returns than long-horizon insiders when trading own-firm stocks. In addition, short-horizon insiders earn 0.9% more abnormal returns on own-firm trades than on expertise trades. These findings suggest that short-horizon insiders' trades are information-driven. However, this does not hold for long-horizon insiders, who earn more abnormal returns on their expertise stocks instead. The results indicate that the findings of Ben-David et al. (2019) are mainly driven by long-horizon insiders.

In additional analysis, to examine whether the abnormal profitability—particularly for short-horizon insiders—is driven by purchases or sales, we separate buy and sell transactions as they may reflect different reasons. While insider purchasing might be based on informed trading and signal positive news, insider sales might be related to reasons other than information, such as liquidity needs, tax reasons, or diversification purposes, and they may signal that the firm is not performing well (Lynch & Rothchild, 2000). Consistent with this interpretation, Degryse et al. (2014) document that insiders' purchases are followed by abnormal returns, whereas their selling does not seem to generate abnormal returns. However, there is disagreement in the literature regarding abnormal returns generated by insider purchases. While some studies show that insiders' purchase transactions generate positive abnormal returns (Degryse et al., 2014; Tavakoli et al., 2012), other studies show weak or no evidence of this finding (Cheuk et al., 2006; Van Geyt et al., 2014). This mixed documented evidence motivates us to separate buy and sell transactions when examining short-horizon insiders' trades in expertise stocks.

For the transaction-based portfolio analysis, we identify whether insiders buy or sell the stocks at the end of each quarter by computing the change in the holdings between the two quarters. We adjust the holdings for corporate events such as splits, reverse splits, and so on so that the direction of trade reflects only the insiders' trade decision and is not based merely on corporate actions (our data do not allow us to identify the exact trade date within the quarter). We then partition the trades in the aforementioned holdings-based portfolios into buy and sell portfolios, obtaining a total of 12 portfolios. In this analysis, we use buy and sell portfolios within each category to examine the insider trade profitability in a long vs. short strategy. With the 3 x 2

sorting scheme, we compute and compare the average raw returns, market-adjusted returns, and Fama–French and Carhart four-factor alphas in our 3 rows of insider trade type and 2 columns of short- vs. long-horizon insider trade portfolios. In additional analysis, we apply a calendar-time portfolio approach by averaging the returns on purchases and sales each quarter. We find that the main results are generally driven by short-horizon insiders' purchases, not their sales.

This paper makes several contributions to the literature. First, while it is well documented that individuals tilt their portfolios toward familiar stocks such as stocks of their employers, industry peers, or local companies (Lindblom et al., 2018; Seasholes & Zhu, 2010), the performance of familiarity-based investments provides mixed evidence (Barber & Odean, 2013). Massa & Simonov (2006) find that Swedish investors concentrate holdings in stocks that are most closely related to them, either professionally or geographically, and earn higher returns compared to being diversified. Despite consistent and strong evidence of local bias, Seasholes & Zhu (2010) show that US individuals do not earn superior returns on their local investments. Døskeland & Hvide (2011) document that investors in Norway overweight firms from the industry in which they are employed but underperform on expertise stocks. Ben-David et al. (2019) examine insiders' own portfolios and find that insiders trade firms from their own industry (expertise stocks) more often and earn abnormal returns on own-industry trades. Their results also reveal that the abnormal returns earned on expertise stocks and non-expertise stocks significantly differ, suggesting that insider trading in expertise stocks is not information-driven but rather based on familiarity with the industry. Insiders seem to have an advantage in processing public information on expertise stocks.

Our study adds new insights to the literature by examining the relationship between insiders' investment horizon and familiarity-based investments in their own portfolios. We show that the results of Ben-David et al. (2019) are mainly driven by long-horizon insiders. We also find some evidence that short-horizon insiders trade based on information on their own company stocks. Their trades in their own stocks are more profitable and more informative than long-horizon insiders' trades in their own stocks.

Second, short-horizon insiders and their firms tend to display characteristics that are associated with a greater focus on short-termism (Akbas et al., 2020). Our paper contributes to this knowledge by relating insiders' investment horizon to their portfolio choices. Since future

returns of investments in closely related stocks are likely to be correlated with future returns on human capital, rational investors are expected to hedge by ignoring familiar stocks unless they have an informational advantage that outweighs the diversification disadvantage (Baxter & Jermann, 1997; Cocco et al., 2005; Døskeland & Hvide, 2011; Massa & Simonov, 2006). Insiders are more likely to be considered as more informed and sophisticated among retail investors. By examining whether insiders' own portfolios contain familiarity-based investments and how these portfolios perform, we provide more evidence on whether insiders hedge against human capital.

Third, we study insiders' personal portfolios using a rich dataset. We obtain daily insider trades between 2006 and 2019 from the Swedish Financial Supervisory Authority. We then match insiders (CEOs) to our detailed quarterly Euroclear investor data and obtain a clean dataset of CEOs' own investment portfolios. Our dataset provides direct measures of the expertise and non-expertise stocks of CEOs in Swedish firms. Our final dataset contains insiders' portfolios including all individual stocks held by the insiders during the study period and is constructed based on quarterly ownership data. This dataset allows us to directly measure the proportion of capital invested in familiar stocks and consequently the degree of portfolio diversification.⁷

In previous research, the widely used retail investor data that come from a large discount brokerage firm include the trading records of 78,000 US investors in 1991–1996.⁸ The comprehensive dataset of asset holdings by Swedish households used by Calvet et al. (2007, 2009) dates to the 1999–2002 period. Our detailed analysis of insiders' portfolios based on a more recent period allows us to investigate whether the effects documented by Ben-David et al. (2019) are smaller or larger than those in 1991–1996.

Finally, our findings have implications for outside investors and informativeness in efficient markets. Informational asymmetries enlarge the bid–ask spread and reduce liquidity (Amihud & Mendelson, 1991). Insider trades in own-firm stocks, when disclosed, may signal outsiders

⁷ Our study focuses on direct stockholdings, which we expect to represent a significant proportion of risky assets held by insiders. Calvet et al. (2007) show that the composition of financial portfolios varies with gross wealth. Though mutual funds dominate stocks in most Swedish household portfolios, the fraction of direct stockholdings quickly increases in the top percentile of wealth and is more than half of the richest households' financial wealth.

⁸ See Barber & Odean (2000, 2001), Barber, Odean & Zhu (2009), Dhar & Zhu (2006), Goetzmann & Kumar (2008), Graham & Kumar (2006), Ivkovic, Poterba & Weisbenner (2005), Ivkovic & Weisbenner (2005), Kumar (2009), Kumar & Lim (2008), Seasholes & Zhu (2010), and Ben-David et al. (2019). A detailed description of the data can be found in Barber & Odean (2000).

to follow suit, reduce informational asymmetries, and thus improve liquidity. Akbas et al. (2020) suggest that the trades of short-horizon insiders are more unexpected and more informative than the trades of long-horizon insiders.⁹ This means that the trades of short-horizon insiders can help identify unexpected insider trades, which in turn contributes to establishing a benchmark for expected patterns in insider trading.

The remainder of this paper proceeds as follows. In Section 2, we derive our research hypotheses. Section 3 describes the dataset and the methodology. Section 4 presents the analysis and results, and Section 5 provides our robustness checks and additional analysis. Finally, Section 6 provides concluding remarks.

2. Research Hypotheses

In an efficient market, the informativeness of insider trades is likely to depend on the degree to which the trades are unexpected (Cohen et al., 2012). As the trades of short-horizon insiders are more unexpected and more informed than those of long-horizon insiders (Akbas et al., 2020), the information provided by the unexpected trades of short-horizon insiders is valuable for outside investors. Some, if not all, of these unexpected trades are opportunistic (Bhattacharya, 2014; Cohen et al., 2012); they may eliminate the confidence of outside investors in financial markets, and in extreme cases, lead to market crashes. Observing short-horizon insiders' trades (arguably opportunistic trades) may serve as a complement for or even an alternative to the impact of regulatory mechanisms designed to discourage insider trading, given that empirical evidence on the effectiveness of regulatory mechanisms has been mixed (Adhikari et al., 2022; Seyhun, 1992). In this paper, we elaborate on the links between insider horizon, stock liquidity, and portfolio performance and develop two hypotheses based on the insider investment horizon.

2.1. Insider Horizon, Liquidity, and Stock Trades

The literature shows that investors are heterogeneous regarding their characteristics and investment behaviors when they evaluate stocks. Their investment horizon, i.e., the period for

⁹ Akbas et al. (2020) define an unexpected trade as the deviation between the current month's trading and the average annual net insider order flow across the past 10 years of trading.

which they hold the stock, is a crucial trait that may affect investors' preferences and tends to influence stock liquidity. Short-horizon investors acquire more liquid assets; long-horizon investors hold less liquid assets (Amihud & Mendelson, 1991). This means that short-horizon investors place a higher reservation value on more liquid stocks. This makes short-horizon investors become marginal investors and bid up the stock price (Amihud et al., 2006).

Unlike outside investors, CEOs have access to privileged firm information and may exploit this information asymmetry to extract abnormal returns. These insiders typically have substantial shareholding and their trades can potentially affect the liquidity of the stock. Insiders driven by profits in the immediate future focus on short-termism, capitalize on the firm's internal material information, and trade more actively. If short-horizon insiders trade on information, we should observe that they generally trade more frequently than long-horizon insiders. This should particularly hold for own-firm stocks as private information on own-firm stocks is likely to be greater than for expertise or other stocks. Moreover, short-horizon insiders should trade more own-firm stocks than expertise stocks. Thus, our first set of hypotheses is as follows.

H1: Short-horizon insiders trade more than long-horizon insiders.

H1a: Short-horizon insiders trade own-firm stocks more than long-horizon insiders.

H1b: Short-horizon insiders trade more own-firm stocks than expertise stocks.

We note that our hypothesis does not suggest that the presence of short-horizon insiders improves stock market liquidity. Rather, it proposes more generally that if short-horizon insiders trade more frequently than long-horizon insiders, short-horizon insiders should hold more liquid stocks than long-horizon insiders. Indeed, in the presence of short-horizon insiders who are presumably trading on private information, dealers or market makers may widen bid–ask spreads, which could reduce stock market liquidity.

Next, to further examine the information explanation of short-horizon insiders' trades, we study the performance of insiders' trades.

2.2. Insider Horizon and Information-Driven vs. Familiarity-Based Trading

Insiders' personal investments can be information-driven or familiarity-based. The information hypothesis assumes a case of information asymmetry where insiders receive valuable (positive or negative) information about firms to which they are professionally connected, such as through their employers or industry peers, before outside investors (Coval & Moskowitz, 2001; Korniotis & Kumar, 2013; Seyhun, 1986). Under the familiarity hypothesis, industry insiders have a comparative advantage in processing and interpreting information about firms in the same industry in which they work (Massa & Simonov, 2006).

The literature documents that insiders are able to trade on private information and earn abnormal returns (Cziraki et al., 2014; Fidrmuc et al., 2006; Finnerty, 1976; Jaffe, 1974; Jeng et al., 2003; Mavruk & Seyhun, 2016; Seyhun, 1986), although transaction costs may limit their profitability (Eckbo & Smith, 1998; Lin & Howe, 1990). In a recent study, Ben-David et al. (2019) explore the trading patterns of industry insiders through their personal portfolios and find that industry familiarity is an advantage in stock trading. We add to this literature by exploring the heterogeneity of insiders in their investment horizon. We examine the composition of short- and long-horizon insiders' personal portfolios and their respective performance.

If short-horizon insiders trade based on the superior information that they privately have access to, we expect to observe a larger trading volume in own-company stocks than in other stocks as in H1. Furthermore, short-horizon insiders' trades in own-firm stocks should outperform their trades in both expertise stocks and non-expertise stocks. Finally, short-horizon insiders are expected to outperform their long-horizon counterparts in own-stock trades. Thus, our second set of hypotheses focuses on the portfolio performance of insiders.

H2: Short-horizon insiders' trades in own-firm stocks outperform their trades in expertise stocks.

H2a: Short-horizon insiders' trades in own-firm stocks outperform their trades in non-expertise stocks.

H2b: Short-horizon insiders outperform their long-horizon counterparts in own-stock trades.

The alternative hypothesis is the familiarity-based explanation of insiders' trades. If industry familiarity is an advantage in stock trading, we conjecture that insiders trade more expertise stocks than non-expertise stocks, and such decisions pay off. Moreover, if expertise investments are familiarity-based but not information-driven, we do not expect short-horizon insiders to earn superior returns than long-horizon insiders in expertise trades. Finally, if long-horizon insiders do not trade based on information on their own stocks, the potential abnormal profits on their trades in expertise stocks can be explained by industry familiarity. This is intuitive as it is unlikely that long-horizon insiders have private information on expertise stocks but not on own-company stocks.

3. Data and Method

To examine the effect of the insider investment horizon on insiders' personal portfolios, we focus on CEOs as they are expected to be the most informed insiders. We obtain information on CEOs' own-firm trades from the Swedish Financial Supervisory Authority's database, including the publication date, transaction date, position within the firm, nature of the transaction, transaction amount, the company's ISIN number, and other relevant details.¹⁰ Using this comprehensive dataset, we calculate the investment horizon for 826 CEOs throughout our study period.

Next, we obtain information on the CEOs' personal portfolios from Euroclear Sweden for 55 quarters, spanning from the first quarter of 2006 to the third quarter of 2019. Euroclear Sweden provides data on quarterly stock holdings for all shareholders of firms listed on Swedish stock markets. Our sample firms are primarily listed on the Nasdaq OMX (large, middle, and small-cap) exchange. We merge the horizon data with the portfolio data using the CEO characteristics, age, gender, five-digit zip code, and the ISIN codes of the companies where they are employed. We then obtain stock prices as well as firm and stock characteristics from Capital IQ, and factor returns from Andrea Frazzini's website.¹¹ To proxy for the risk-free rate, we use the Swedish 3-month treasury bill rate, which is collected from Sweden's Central Bank

¹⁰ <https://marknadssok.fi.se/publiceringsklient/en-GB/Search/Start/Insyn> database accessed on June 6, 2024.

¹¹ The factor returns are available at https://pages.stern.nyu.edu/~afrazzin/data_library.htm data accessed on April 10, 2023.

database and converted from an annual rate to a quarterly rate.¹² Our final sample consists of 788 CEOs and 909 stocks.

3.1. CEOs' Investment Horizon

The investment horizon is treated as personality trait of investors that remains constant over time (see Cella et al., 2013), and thus helps us understand the investors' trading style. This assumption is consistent with our dataset, as fewer than 1% of all insiders switch trade type (e.g., from short- to long-horizon, or vice versa). While it is not directly observable, we can measure the investment horizon from an insider's trading history. Following Akbas et al. (2020), we measure the CEOs' investment horizon as the average annual net order flows in their own stocks over the past 10 years (40 quarters).¹³ This measure tells us the CEOs' trading behavior toward round-trip transactions: the higher the tendency toward round-trip transactions, the shorter the investment horizon. Thus, the measure is related to round-trip transactions rather than to trade frequency.

To calculate the horizon, we first calculate each CEO's annual order flow (COF) by scaling the net (four quarters, including the current quarter) trades (purchases minus sales) with the total trades (purchases plus sales) accumulated during the year (four quarters), as shown in Equation (1).

$$COF_{i,j,t} = \frac{\sum_{t=0}^{t-3} (P_{i,j,t} - S_{i,j,t})}{\sum_{t=0}^{t-3} (P_{i,j,t} + S_{i,j,t})}, \quad (1)$$

where $COF_{i,j,t}$ is the annual net order flow of CEO i at firm j in quarter t . $P_{i,j,t}$ and $S_{i,j,t}$ are the purchase and sale of stocks respectively by CEO i at firm j in quarter t . According to Equation (1), for only purchases, the COF value is $P/P = +1$; for only sales, the COF value is $-S/S = -1$; and the COF value is 0 for the same amount of purchases and sales. Thus, the COF value ranges from -1 to +1.

¹² <https://www.riksbank.se/en-gb/statistics/interest-rates-and-exchange-rates/search-interest-rates-and-exchange-rates/> data retrieved on April 5, 2021.

¹³ We calculate CEOs' quarterly HORs since the Euroclear Sweden database contains investors' quarterly holdings data. By contrast, Akbas et al. (2020) calculate the insiders' monthly HORs. We do not multiply by -1, so the HOR values in our study range from 0 to 1. Akbas et al. (2020) multiply by -1, so their HOR values range from -1 to 0. This deviation does not affect the results as we use HOR to classify insiders into short- and long-horizon insiders.

Next, we compute the investment horizon (HOR) as the average COF over the 10 years (40 quarters) preceding the current quarter. The equation for HOR is as follows.

$$HOR_{i,j,t} = \left| \frac{\sum_{t=1}^{t-40} COF_{i,j,t}}{N} \right|, \quad (2)$$

where $HOR_{i,j,t}$ is the investment horizon of CEO i at firm j in quarter t . N is the number of quarters CEOs traded over the last 10 years (max 40 quarters). HOR is the absolute value of the average COF over the last 40 quarters. This means the HOR ranges from 0 to 1. This standardization makes the horizon measure equally applicable to purchases only (which generate a COF of +1) and sales only (which generate a COF of -1).

Following Equation 2, we can see that when CEOs' purchases and sales do not offset each other over time, there is a larger average absolute net order imbalance per year, which generates a longer investment horizon (HOR closer to 1). By contrast, CEOs who quickly offset purchases and sales have a shorter investment horizon (HOR closer to 0). We classify CEOs into short- and long-horizon categories using the median value of HOR, which is equal to 1. Thus, CEOs with HOR values below 1 are considered short-horizon insiders, whereas those with a HOR equal to 1 are long-horizon insiders. In our additional analysis, we vary the cutoff value; for example, we use the average HOR.

3.2. Expertise vs. Non-Expertise Stocks

We define expertise and non-expertise stocks based on industry in our main analysis and use a locality-based classification as an alternative in the robustness analysis.

3.2.1. Industry-Based Classification

We analyze CEOs' trading activities and profitability across their own firm, expertise, and non-expertise stocks. In the baseline analysis, we use an industry-based classification to define expertise and non-expertise stocks following Ben-David et al. (2019) and Døskeland & Hvide (2011). Stocks within the same industry where the CEO works (excluding their own company's stock) are considered expertise stocks, whereas stocks outside the industry are considered non-expertise stocks. We obtain the industry classifications from Capital IQ, which follows the

Global Industry Classification Standard and contains 11 sectors, 24 industry groups, 68 industries, and 157 sub-industries. In our analysis, we use the “24 industry groups” classification, following Ben-David et al. (2019) and Døskeland & Hvide (2011).

3.2.2. Locality-Based Classification

In the robustness analysis, we use locality-based familiarity to classify expertise and non-expertise stocks following other studies (Coval & Moskowitz, 1999, 2001; Massa & Simonov, 2006; Lindblom et al., 2018; Seasholes & Zhu, 2010; Døskeland & Hvide, 2011). A stock is local and hence classified as an expertise stock if the firm’s headquarters are located in the municipality where the CEO lives.

3.3. Descriptive Statistics

Panel A of Table 1 reports the average stock holding and investment values for both short- and long-horizon CEOs, and their mean differences across different stock categories. Long-horizon insiders ($HOR = 1$) account for a significant proportion of the sample. The number of observations in the short-horizon group is almost half of that in the long-horizon group across all categories of stocks. For example, under expertise stocks, the number of observations for short-horizon CEOs is 4,468, whereas the long-horizon group contains 9,254 observations.

Short-horizon CEOs invest significantly more in their own, expertise, and non-expertise stocks, in terms of both stock holdings and value in Swedish kronor, than their long-horizon counterparts. On average, short-horizon CEOs hold more than 77 thousand shares of expertise stocks (equivalent to SEK 3.06 million), which substantially exceeds the long-horizon CEOs’ investments of 28 thousand shares (SEK 0.72 million). In non-expertise stocks, short-horizon CEOs hold, on average, 24,221 shares of various firms, equivalent to SEK 2.64 million more than their long-horizon counterparts. Similarly, short-horizon CEOs, on average, hold 603 thousand shares of their own company stocks, equivalent to SEK 29 million, whereas their long-horizon counterparts hold 315 thousand shares, equivalent to SEK 12 million. These results indicate that short-horizon CEOs engage in more trading activities than long-horizon CEOs in both expertise and non-expertise stocks.

[insert Table 1]

The locality-based classification produces results largely consistent with those obtained from the industry-based classification. We find that short-horizon CEOs invest more in both local and non-local stocks than their long-horizon counterparts. However, the mean difference in investment value in Swedish kronor between short- and long-horizon CEOs is not statistically significant, although this difference is significant in stock holdings. This lack of significance may arise from missing prices or price volatility. We lose a few observations after incorporating the stock price. In the local stocks, on average, short-horizon CEOs hold 33.17 thousand shares of different firms, equivalent to SEK 677 thousand, whereas their long-horizon counterparts hold 22.13 thousand shares of different firms equivalent to SEK 589 thousand. In the non-local stocks, short-horizon CEOs hold 35.11 thousand more shares of different firms, equivalent to SEK 4.16 million, than long-horizon CEOs. These results signify that short-horizon CEOs have more trading activities than their long-horizon counterparts in both local and non-local firms.

Panel B of Table 1 presents the CEO-stock level summary statistics of the variables used in the trading activity analysis. These variables include HOR, Holdings, Value, Market capitalization, Book-to-market ratio, Debt-to-equity ratio, Return on assets, and Beta. HOR is the CEOs' investment horizon calculated from their own stock trading activities defined in Eq. 2 in the previous section. HOR ranges from 0 to 1 and has a mean value of 0.83. Holdings and Value indicate CEOs' holdings in stocks and Swedish kronor, respectively. On average, a CEO holds 72 thousand shares, equivalent to SEK 2 million; these values range from 1 share (SEK 17) to 2.49 million shares (SEK 56.03 million).

The remaining variables are used as control variables, following the previous literature on insider trading (Akbas et al., 2020; Ben-David et al., 2019; Seyhun, 1992). The average Market capitalization of stocks in our final sample is SEK 66.58 billion. The average Book-to-market ratio, Debt-to-equity ratio, Return on assets, and Beta are 0.5997, 1.2210, 0.0340, and 0.7676 respectively in our final sample. We use the 5-year stock beta calculated at the end of each quarter for each stock. All the continuous variables are winsorized at the 1% and 99% levels except for Holdings, Value, and Market capitalization, for which we use natural logarithmic transformations.

3.4. Trading Activity Regression Model

To test our first hypothesis, we examine the role of expertise investments and insiders' horizon in their individual portfolios. For each CEO, we measure their quarterly holdings (the number of stocks held and their market value) in their own company stocks (*Own stock*), in the same industry stocks where the CEO is working (*Expertise stock*), and in other stocks (*Non-expertise stock*). Our model for analyzing CEOs' trading activities is formally given in Equation (3).

$$\begin{aligned} \ln(Holdings)_{ijt} = & \alpha + \beta_1 HOR_{it} + \beta_2 Own\ stock_{ijt} + \beta_3 HOR \times Own\ stock_{ijt} + \\ & \beta_4 Expertise\ stock_{ijt} + \beta_5 HOR \times Expertise\ stock_{ijt} + \\ & \delta Stock\ characteristics_{jt} + \gamma Year\ dummy_t + \varepsilon_{it}, \end{aligned} \quad (3)$$

where i denotes the CEO, j specifies the stock, and t denotes the quarter. We regress the logarithm of the quarterly holdings on the horizon, own-stock dummy (*Own stock*), expertise stock dummy (*Expertise stock*), and the interactions between CEOs' horizon (HOR) and the two stock types. We employ two measures for *Holdings*: the number of stocks held and the value of the stock holdings in Swedish kronor. The unit of analysis in the regressions is the CEO–stock–quarter. We control for firm and stock characteristics including size (measured as the natural logarithm of the stock's market capitalization), book-to-market ratio, debt-to-equity ratio, return on assets, systematic risk (proxied by 5-year beta), and year fixed effects (Akbas et al., 2020; Ben-David et al., 2019; Seyhun, 1992). We use heteroscedasticity-consistent robust standard errors.

3.5. Regression Models for Performance Analysis

Next, we explore whether short-horizon insiders' trades in their individual portfolios are driven by private information or industry familiarity by analyzing the profitability of insider trades by trade type and insider horizon. These analyses allow us to test our second hypothesis. If short-horizon industry insiders are informed traders, they should earn higher returns on the trades of own-firm stocks than non-expertise stocks. In addition, their trades of own-firm stocks should outperform their trades of expertise stocks as they are expected to know the former better than the latter. If short-horizon insider trades in expertise stocks are based on industry familiarity, we expect higher abnormal returns on their expertise stocks than their non-expertise stocks, as

explained by Ben-David et al. (2019). Moreover, short-horizon insiders are expected to perform at par with their long-horizon counterparts. We use the holdings-based and calendar-time portfolios to analyze insiders' performance by their horizon and trade type. Furthermore, in the robustness analysis, we redefine expertise vs. non-expertise stocks based on the CEOs' locality (Lindblom et al., 2018) and re-examine insider performance using the transaction-based portfolio approach Ben-David et al. (2019).

3.5.1. Holdings-Based Portfolio

For our holdings-based portfolio analysis, we form six portfolios based on CEOs' investment horizon and trade type (2 x 3). The unit of analysis in this section is the CEO-portfolio-quarter. The portfolios are constructed by partitioning each CEO's stocks into three trade groups (Own-firm, Expertise, and Non-expertise) under either the short-horizon or long-horizon group depending on the CEO's horizon value in the quarter. The portfolios are held for a quarter and rebalanced at the end of each quarter. The constituents of each of the six portfolios are weighted by their quarter-end market value.

We calculate the average raw returns, market-adjusted returns, and Carhart's (1997) four-factor alphas for our six portfolios, and further compare the difference in the returns between the short- and long-horizon CEO trade portfolios within each type of trade. The portfolio raw return is given by Equation (4).

$$R_{ipt} = \sum_{j=1}^N w_{ijt} R_{ijt}, \quad (4)$$

where i , p , t , and j stand for the CEO, portfolio, quarter, and stock respectively. The value of the quarter indicates the end value of the quarter. R_{ipt} is the return of CEO i from portfolio p in quarter t , R_{ijt} is the return of CEO i from stock j in quarter t , and w_{ijt} denotes the weight of stock j in CEO i 's personal portfolio at the end of quarter t .

Next, we estimate the market-adjusted returns as in Equation (5):

$$AR_{ipt} = R_{ipt} - R_{mt}, \quad (5)$$

where AR_{ipt} is the market-adjusted return of CEO i from portfolio p in quarter t , R_{ipt} is the return of CEO i in quarter t from portfolio p , and R_{mt} is the market return in quarter t .¹⁴ Finally, the Carhart (1997) alphas are estimated based on Equation (6):

$$R_{ipt} - R_{ft} = \alpha_p + \beta_1(R_{mt} - R_{ft}) + \beta_2SMB_t + \beta_3HML_t + \beta_4UMD_t + \varepsilon_{ipt}, \quad (6)$$

where R_{ipt} is the return of CEO i from portfolio p in quarter t . R_{ft} and R_{mt} are the Swedish risk-free rate and the market return, respectively, in quarter t . SMB_t is the difference in the returns of the value-weighted portfolios of small stocks and large stocks in quarter t . HML_t is the difference in the returns of the value-weighted portfolios of high book-to-market stocks and low book-to-market stocks in quarter t . UMD_t is the difference in the returns of value-weighted portfolios of stocks with high and low recent returns in quarter t . All factor returns are obtained from Andrea Frazzini's data library.¹⁵ The risk-free rate is the three-month Swedish Treasury bill rate obtained from the Swedish Central Bank (Riksbanken).

3.5.1. Calendar-Time Portfolio

We transform the holdings-based portfolios to calendar-time portfolios by taking the average returns of all the participating CEOs in each portfolio in each quarter. This converts our unit of analysis into the portfolio-quarter level. After transforming it into the calendar-time portfolio, the dataset contains 54 quarters' portfolio returns for six portfolios.¹⁶ These portfolio returns include raw returns, market-adjusted returns, and Carhart's (1997) four-factor alphas.

3.5.3. Transaction-Based Portfolio

For the transaction-based calendar-time portfolio analysis, since we do not observe the transaction dates directly, we use the change in the stock holdings between two quarters to identify whether a CEO buys or sells a stock during a quarter. Stock holdings are adjusted for corporate events such as splits and reverse splits to remove the effect of corporate actions on

¹⁴ We take an average of 90 days to convert daily market returns to quarterly market returns.

¹⁵ https://pages.stern.nyu.edu/~afrazzin/data_library.htm data retrieved on April 5, 2021. We collect the daily factor returns and convert them to quarterly by taking the average.

¹⁶ We have 55 quarters from the first quarter of 2006 to the third quarter of 2019. Therefore, we have portfolio returns for 54 quarters when excluding the first quarter.

the changes in stock holdings so that the direction of trade reflects the insiders' trade decision. We further partition trades in holdings-based portfolios and calendar-time portfolios based on the transaction (buy or sell) and obtain a total of 12 portfolios for both buy and sell. We examine the profitability of CEOs' trades through a long vs. short strategy for each horizon and trade type. Specifically, we compute and compare the average raw returns, market-adjusted returns, and Carhart's (1997) four-factor alphas for both buy and sell portfolios based on the trade type (own stock, expertise, and non-expertise) and investment horizon (short and long).

4. Baseline Results

4.1. Trading Activities, Expertise Investment, and Insiders' Horizon

Table 2 presents the results of our trading activity analysis based on Equation (3). The regression analyses are at the insider-stock-quarter level. We relate the insiders' trade volume, measured as the natural logarithm of i) the quarterly stock holdings in Panel A and ii) the market value of the quarterly stock holdings in Panel B, to the insider investment horizon. We include indicators for own-firm and expertise stocks as well as the interactions between insider horizon and these two stock types in the regressions. The interaction term is the main variable of interest. We also include firm- and stock-level control variables and year fixed effects in the regressions and use heteroscedasticity-robust standard errors.

[insert Table 2]

We first examine the role of the insider horizon and own-firm trades in the CEOs' individual portfolios (Panel A, column 1). The coefficient of our horizon measure, *HOR*, is negative and significant at the 1% level, indicating that long-horizon insiders trade stocks outside their companies less than those with a short horizon. From an economic perspective, a one-standard-deviation increase in the insider investment horizon is associated with a 5% decrease in the trade volume of other stocks than own (expertise and non-expertise stocks). We also observe a larger volume in own-firm trades compared to other trades for extremely short-horizon insiders (*HOR* = 0). The coefficient of the interaction term between horizon and own-firm stocks is negative and highly significant, suggesting that own-firm trades are lower for long-horizon insiders than for their short-horizon counterparts. This is consistent with H1a. Furthermore, as both coefficients on the horizon and the interaction term are negative, our results indicate lower

trading activities among long-horizon insiders compared to short-horizon insiders, which supports H1.

Next, we refine our trade type classification for stocks outside the CEOs' companies to explore the role of expertise investments. We estimate our full model using Equation 3 and report the results in column 2 of Panel A. The coefficients of *Own stock* and *Expertise stock* are positive and highly significant, implying that short-horizon insiders with a *HOR* of 0 trade more in own-firm and expertise stocks than non-expertise stocks. We also test for the difference between own-firm trades and expertise trades for these insiders and report the results at the bottom of the table. We find support for H1b as short-horizon insiders are shown to trade more own-firm stocks than expertise stocks. The coefficients for the interactions between the horizon and the two trade types are both negative, indicating that the insider horizon decreases the trade wedge between own-firm and outside-industry stocks, and the relative difference between expertise and non-expertise trades. Overall, short-horizon insiders trade more than long-horizon insiders, which supports H1.

In columns 3 and 4 of Panel A, we focus on the role of expertise investments in relation to the insider horizon. We first shift our trade composition analysis to expertise vs. non-expertise stocks, following Ben-David et al. (2019), and exclude own-firm stocks from our sample (column 3). We find that long-horizon insiders trade less than short-horizon insiders in non-expertise stocks. The *HOR* coefficient of -0.11 implies that a one-standard-deviation increase in the insider investment horizon is associated with a 3% decrease in the trade volume of non-expertise stocks. In addition, long-horizon insiders trade less in expertise stocks than short-horizon insiders. The coefficient of the interaction suggests a roughly 6% decrease in the trade volume of expertise stocks in response to an increase of one standard deviation in the horizon, and the expertise trade of extremely short-horizon insiders is about 19% higher than that of long-horizon insiders. In absolute terms, the coefficient of *Expertise stock* well exceeds the coefficient of the interaction, suggesting that insiders in general trade firms from their own industry more than other stocks. Our results are in line with Ben-David et al. (2019) and augment their findings by further exploring the investment horizon dimension of insiders. In column 4 of Panel A, we add back own-firm stocks to the sample, making them part of the reference group when analyzing expertise investments. We observe that expertise stocks are traded less compared to other stocks, and long-horizon insiders trade less than short-horizon insiders. Overall, our results support H1.

Regarding the control variables in the trading activity regressions, the sign and significance of the coefficients are consistent across specifications. While market capitalization and return on assets seem to decrease insider holdings in a stock, book-to-market ratio, debt-to-equity ratio, and beta increase insider holdings in the stock. In Appendix A, we replicate Table 2 using the insider horizon as a dummy variable where 1 indicates the short-horizon insiders and 0 indicates their long-horizon counterparts. We obtain consistent results verifying the robustness of our findings.

In Panel B of Table 2, we revise our analyses using the log market value of the quarterly stock holdings, an alternative measure for the trade volume. The results remain robust for own stock but become weaker for expertise stocks. Short-horizon insiders still trade more than long-horizon insiders and they trade more in their own stocks compared to other stocks. One reason for the weaker results of the expertise stocks could be that the market value of holdings reflects not only active changes (as in the holdings regressions) but also passive changes since the market value of insider holdings can change based on stock price changes, although the insider does not trade the stock.

Overall, we find that short-horizon insiders generally trade more than long-horizon insiders, which is consistent with the idea that short-horizon investors hold more liquid stocks (Amihud et al., 2006; Amihud & Mendelson, 1986b, 1986a). Interestingly, the trade composition in the insiders' personal portfolios is influenced by their investment horizon. The results are suggestive so far and indicate that short-horizon insiders trade on information rather than familiarity and thus trade more in their own stocks than expertise stocks. These results are in contrast with the idea that insiders hedge against human capital (Ben-David et al., 2019; Døskeland & Hvide, 2011; Huberman, 2001; Massa & Simonov, 2006). In a way, our results on insiders, particularly long-horizon insiders, are similar to previous findings on the behavior of individual investors, suggesting that investors tilt their portfolios toward familiar stocks rather than hedging against human capital (Grinblatt & Keloharju, 2001).

To be able to draw stronger conclusions on whether short-horizon insiders trade on information, next, we examine their portfolio returns on own-stock, expertise stocks, and non-expertise stocks and compare these outcomes to those of long-horizon insiders. If short-horizon insiders trade on information, they are expected to earn abnormal returns on their trades.

4.2. Portfolio Performance Analysis of Short- vs. Long-Horizon Insiders

4.2.1. Results from Holdings-Based Portfolios

We examine the performance of insider trades based on the trade type and horizon to shed light on the motivations behind insiders' trading behaviors. We group stocks into two horizon categories (short and long) as defined in Section 2.1 and into three trade categories (own-firm, expertise, and non-expertise) to construct six portfolios. We exclude CEOs' own company stocks from the expertise and non-expertise portfolios. The analyses are at the insider-portfolio-quarter level, meaning that we have three portfolio return observations for each insider in each quarter. Table 3 presents the results. Panel A reports the average raw returns; Panel B shows results from the market-adjusted returns; and Panel C presents results from the Fama–French four (FF4) factor, or Carhart's alpha. In addition to the portfolio returns, in all the panels we test the difference between the returns for short- and long-horizon insiders using the Kolmogorov–Smirnov test and report the D-values. We rely on non-parametric tests for the differences since the samples have a largely uneven number of observations and unequal variances. At the bottom of the panels, we test the differences in portfolio returns of own vs. expertise stocks, own vs. non-expertise stocks, and expertise vs. non-expertise stocks.

[insert Table 3]

In all the panels, regardless of how we adjust the returns, our results are consistent. Two observations induce us to conclude that short-horizon insiders trade on information. First, short-horizon insiders earn more returns than long-horizon insiders when trading on their own stocks (0.1–0.17% per quarter on average) and on expertise stocks (0.06–0.11%). Second, short-horizon insiders earn more returns from trading on their own stocks than from trading on expertise stocks (2.3%) and non-expertise stocks (2.3%). These results support hypotheses H2, H2a, and H2b, and suggest that the results of Ben-David et al. (2019) are mainly driven by long-horizon insiders since short-horizon insiders tend to trade on information.

4.2.2. Results from the Calendar-Time Portfolio Approach

The main results in Table 3 consider the heterogeneity within the insider groups by providing results from insider portfolio quarter analysis. The results eliminate this heterogeneity by

averaging out the returns of the insider groups in a quarter, allowing us to obtain three portfolio return observations in each quarter. We exclude CEOs' own company stocks from the expertise and non-expertise portfolios. Portfolio rebalancing occurs at the end of the quarter. Similar to the previous analysis, Table 4, Panel A reports the average raw returns, Panel B presents results from the market-adjusted returns, and Panel C reports results from Carhart's alpha.

[insert Table 4]

We obtain robust and consistent results both across panels and compared to the analysis reported in Table 3. Focusing on Panel C, the FF4 alpha analysis, we observe that short-horizon insiders earn 0.05% more alpha than long-horizon insiders when trading in their own-firm stock. Short-horizon insiders earn 0.9% more alpha on their own-firm stocks than on expertise stocks.

Overall, short-horizon insiders trade more in their own-firm stocks and gain more from trading their own-firm stocks than expertise stocks or non-expertise stocks. Short-horizon insiders also earn more abnormal returns than long-horizon insiders. These results indicate that while short-horizon insiders trade on information, long-horizon insiders seem to trade on familiarity (their expertise in industry stocks). Thus, the trades of short-horizon insiders seem to be more informative than those of long-horizon insiders, as proposed by Akbas et al. (2020).

One alternative explanation for our results is that outside investors believe that short-horizon insiders trade on private information. This belief may arise particularly when short-horizon trading is frequent rather than rare. Consequently, from the perspective of outside investors, any purchase by short-horizon insiders may be interpreted as a signal of positive information, leading outsiders to act as followers. Such behavior would raise stock prices and generate abnormal returns even if no private information is actually being traded. We examine this alternative explanation in a follow-up paper by analyzing outside investors' trading behavior (see Sarwar, 2025). We find the opposite result: outside investors reduce their trading in stocks with a higher presence of short-horizon insiders.

Another possible channel is that short-horizon insiders become marginal investors and bid up stock prices, independent of trading on private information. However, we can rule out this explanation, particularly in our analysis of own trades, because we include a control group of

long-horizon insiders. It is unlikely that only short-horizon insiders become marginal investors in their own firms while long-horizon insiders do not.

The results from long-horizon insiders are in line with Ben-David et al.'s (2019) findings about the profitability of industry insider trades. The superior returns in expertise trades compared to non-expertise trades can be explained by information-based familiarity (Ben-David et al., 2019; Massa & Simonov, 2006). Long-horizon insiders are familiar with industry stocks and when new information comes about, these long-horizon insiders are better at processing this information since they know more about these industry stocks.

5. Robustness Tests and Additional Analysis

5.1. Results from Local vs. Non-Local Portfolios

In Table 5, we consider a different definition of expertise stocks, using the locality instead of the industry to define expertise stocks. A stock is defined as local if the firm's headquarters are located in the same district (municipality) where the insider lives. The literature on local bias documents that the distance to a firm influences investors' decision-making, although it is unclear whether local bias is information-based or can simply be explained by familiarity (Coval & Moskowitz, 1999, 2001; Døskeland & Hvide, 2011; Lindblom et al., 2018; Massa & Simonov, 2006; Seasholes & Zhu, 2010). Examining the local stocks in the personal portfolios of insiders might provide additional insights to this literature as insiders in one firm are likely to be socially linked to the insiders in another firm within a locality. Table 5 revises the previous analysis by using local vs. non-local stocks in insiders' personal portfolios.

[insert Table 5]

Focusing on Panel C (FF4 alphas), the results from local stocks tend to be weaker than the results from the industry expertise stocks. The difference between the alphas on local trades of short- and long-horizon insiders is significant only at the 10% level and is more favorable toward short-horizon insiders. One reason for this result could be that defining expertise stocks only as local stocks leads to a narrower subset of expertise stocks, some of which end up in the group of non-expertise stocks. However, short-horizon insiders tend to earn 0.9% more alpha on their own-firm stocks than on local stocks, indicating, again, that short-horizon insiders trade on information and have more information on their own-firm stocks than on local stocks.

5.2. Results from Transaction-Based Portfolios

Our evidence on the portfolio performance of short-horizon insiders clearly indicates information-based trading. To examine whether the abnormal performance is driven by purchases or sales, we study the performance of insiders' transaction portfolios. Our holding data are quarterly, so we can only determine whether an insider increases or decreases their weight on a stock in their personal portfolio by calculating the change in the stock position (the number of shares adjusted for splits etc.) between two quarters. Although this measure does not exactly reflect the transaction made in the quarters, it provides us with a measure of active change in the weight placed on a stock between the quarters. Our approach is consistent with previous literature using quarterly holdings data, for example, for mutual fund performance (Pool et al., 2015).

In Appendix B, we revise our insider-portfolio-quarter level analysis for purchase portfolios. The table's structure remains the same: Panel A reports the average raw returns, Panel B shows results from the market-adjusted returns, and Panel C shows results from the FF4 alphas. The results from own-stock purchases remain the same. In the raw returns and market-adjusted returns analysis, short-horizon insiders' purchases of their own stocks outperform those of long-horizon insiders by 1.8%. The results from FF4 alphas are weaker. However, these are consistent with the results from the holdings portfolios in that short-horizon insiders' purchases of own stocks significantly (4.9%) outperform short-horizon insiders' purchases of expertise stocks.

Appendix C shows the results from insiders' sell portfolios. The results are weaker; in particular, we find no difference between the performance of short-horizon and long-horizon insiders' sales of their own stocks. Similarly, there is no difference in performance between the sales of own stocks and expertise stocks for short-horizon insiders. The results suggest that our findings are mainly driven by insiders' purchases, which is consistent with the information story of insider trading. The literature documents that insider purchasing is more likely to be based on informed trading than insider sales, which can be related to reasons other than information such as liquidity needs, tax reasons, or diversification purposes (Degryse et al., 2014; Lynch & Rothchild, 2000).

5.3. Results from the Transaction-Based Calendar-Time Portfolio Approach

Appendix D revises the analysis for calendar-time purchase portfolios by averaging the purchase returns for each purchase portfolio and quarter. The results are persistently robust. Short-horizon insiders' purchases of their own stocks outperform those of long-horizon insiders by 0.2%. Moreover, short-horizon insiders' purchases of their own stocks outperform short-horizon insiders' purchases of expertise stocks by 3.4%. Similar to the insider portfolio quarter analysis, Appendix E shows that the results from the sell portfolios are weaker, confirming again that insiders' sales may not be information-based and could be explained by other reasons, such as liquidity needs. Overall, our additional analyses confirm that short-horizon insiders' trades are based on own-stock information and this is mainly driven by their purchases. Long-horizon insiders' trades on expertise stocks are familiarity-based, confirming the results of Ben-David et al. (2019). These results suggest that short-horizon insiders' purchases are more informative than long-horizon insiders' purchases.

6. Conclusions

We examine the role of expertise investments, defined as industry familiarity, in individual portfolios of CEOs in relation to their investment horizon. We observe that the trading volume of short-horizon insiders is significantly greater than that of long-horizon insiders. Short-horizon insiders trade more in own-company stocks than long-horizon insiders. They also trade more in their own stocks than in expertise stocks. Next, we explore whether short-horizon insiders' trades in their own portfolios are information-driven. We analyze the performance of own-stock, expertise, and non-expertise trades across insiders' horizons using a holdings-based portfolio approach, a calendar-time portfolio approach, and a transaction-based calendar-time portfolio approach. We find that short-horizon insiders outperform long-horizon insiders, indicating that trades by short-horizon insiders are information-driven. Short-horizon insiders' trades in their own stocks outperform short-horizon insiders' trades in expertise stocks. Consistent with the information story, these results are mainly driven by insiders' purchases, not by their sales.

Our results have implications for investors, stock prices, and firms. The trades by long-horizon insiders do not seem to be (superior) information-driven. This result may be in line with the argument that insider trading impairs the functioning of financial markets. However, the trades

by short-horizon insiders seem to be unexpected and opportunistic, indicating some misappropriation that may discourage corporate investment and reduce the efficiency of corporate behavior. Short-horizon insiders tend to trade on superior information, indicating that they gain part of the returns of corporate investments at the expense of outsider shareholders.

The consistent outperformance of short-horizon insiders over long-horizon insiders suggests that the information used by short-horizon insiders originates within the firm rather than being generated by followers of the firm, such as financial analysts or other outsider investors. Thus, when short-horizon insiders trade, the purchases by outside investors, who do not have this private information, are subject to adverse selection. That is, for a given price the shares are available to outsiders when the expected value of the firm is low than when it is high. This is because short-horizon insiders buy up shares when the expected firm value is high rather than when it is low.

This situation likely lowers the confidence of outsider investors in financial markets. If outsider investors know that their purchases are subject to adverse selection, they may be unwilling to pay for the full expected value of the stock and hence the expected value of the firm's future investments. This also has implications for incumbent shareholders who are then unable to obtain the full expected value of the returns from firm investments. This means that trades by short-horizon investors cause outsider investors to discourage firm investments. In other words, outsider investors may influence firm behavior and decrease firm investment to a level below what is expected or economically efficient.

The degree to which firm investment falls depends on whether and how much outsider investors are sophisticated, whether they are aware of the existence of trades by short-horizon insiders, and to what degree they take account of adverse selection in calculating expected returns on their investments. Thus, in future research, we suggest conducting a careful examination of this heterogeneity and how outsider investors respond to short-horizon insiders' trading.

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Tables

Table 1

Descriptive Statistics

This table shows the descriptive statistics of CEOs' horizons, holdings, values (Swedish kronor), and control variables. Panel A presents CEOs' HOR, holdings, and values (Swedish kronor) across own, expertise, non-expertise, local, and non-local stocks, and shows the mean difference (t-statistics in parentheses) between short- and long-horizon CEOs' investments in these stocks. HOR is the average annual net order flow in the CEOs' own-firm stocks over the past 10 years. The range for the CEOs' HOR is 0 to 1. Holdings is the number of stocks held by the CEO of different firms in each quarter. Value is the total investment in Swedish kronor of different firms each quarter. Panel B displays detailed descriptive statistics of the variables used in the holdings regressions. We use Market capitalization, Book-to-market ratio, Debt-to-equity ratio, Return on assets, and Beta as control variables. In Panel B, Holdings and Value are presented in thousand Swedish kronor, whereas Market capitalization is presented in million Swedish kronor. Beta is the 5-year beta of the stocks.

Panel A: Descriptive Statistics of CEOs' Horizon, Holdings in Stocks, and Value of Investment in SEK											
Variable	Horizon	Own stock		Expertise		Non-expertise		Local		Non-local	
		N	Mean	N	Mean	N	Mean	N	Mean	N	Mean
Holdings	Short	3,509	602,793	4,468	77,336	19,135	53,888	4,165	33,167	14,853	62,906
	Long	7,176	314,836	9,254	27,663	37,646	29,667	6,393	22,128	33,417	27,794
	All	10,685	409,402	13,722	43,837	56,781	37,829	10,558	26,483	48,270	38,598
	Short - Long		287,957***		49,673***		24,221***		11,039***		35,112***
			(19.3328)		(10.1206)		(12.7770)		(2.9452)		(15.8513)
Value (thousands)	Short	2,657	28,717	3,785	3,058	14,902	3,921	3,480	677	12,387	5,021
	Long	6,106	12,180	8,119	762	30,601	1,280	5,340	589	28,976	858
	All	8,763	17,194	11,904	1,492	45,503	2,145	8,820	624	41,363	2,105
	Short - Long		16,537***		2,296***		2,641***		88		4,162***
			(12.0625)		(10.2189)		(10.6770)		(1.0996)		(17.2680)

Panel B: Control Variables								
Variable	N	Min	p25	Mean	SD	Median	p75	Max
HOR	53,742	0	0.7255	0.8300	0.2950	1	1	1
Holdings (thousand SEK)	53,742	0.0010	0.5000	72	335	2	10	2,489
Value (thousand SEK)	53,742	0.0170	24	2,004	8,108	95	407	56,027
Market capitalization (million SEK)	53,742	0.0038	3,301	66,578	89,265	24,476	90,570	438,579
Book-to-market ratio	53,742	-0.1598	0.2965	0.5997	0.5065	0.4707	0.7720	4.2119
Debt-to-equity ratio	53,742	-6.4907	0.2522	1.2210	2.6314	0.5831	1.0667	21.4099
Return on assets	53,742	-0.9832	0.0197	0.0340	0.0904	0.0420	0.0674	0.2596
Beta (5 years)	53,742	-1.425	0.5046	0.7676	0.4847	0.7260	0.9819	3.1640

Table 2
Horizon, Trade Type, and Trading Activities

Table 2 shows the trading activity regression results. The dependent variable is the natural logarithm of a CEO's quarterly holdings of a stock, which is measured by the number of stocks held (Panel A), and the market value in SEK of the stock holdings (Panel B) at the end of the quarter. The main independent variables are the CEOs' investment horizon, trade type indicator variables, and the interactions between the horizon and trade types. Horizon is the average annual net order flow in the CEOs' own-firm stocks over the past 10 years, ranging from 0 to 1, where 0 and 1 indicate an extremely short horizon and long horizon, respectively. Own stock is a dummy variable that takes a value of 1 if the traded stock is of the company where the CEO is employed and 0 otherwise. Expertise stock is a dummy variable that takes a value of 1 if the traded stock is in the same industry where the CEO works and 0 otherwise. Columns 1–2 and 4 present the full sample regression results, while column 3 shows the regression results for a subsample of expertise and non-expertise stocks only (i.e., without own-firm stocks). The control variables include log market capitalization, book-to-market ratio, debt-to-equity ratio, return on assets, and beta. Year-fixed effects are included in all models. We use heteroscedasticity-consistent robust standard errors. The symbols ***, **, and * indicate the 1%, 5%, and 10% levels of significance respectively.

Panel A: Trade Activities Based on the Number of Stocks Held at Quarter-End				
Variable	Holdings (1)	Holdings (2)	Holdings (3)	Holdings (4)
HOR	-0.1554*** (-4.7347)	-0.1157*** (-3.1484)	-0.1096*** (-2.9821)	-0.1479*** (-3.6553)
Own stock	4.2178*** (49.3097)	4.2996*** (49.5359)		
HOR × Own stock	-0.9336*** (-9.7239)	-0.9755*** (-10.0138)		
Expertise stock		0.3738*** (5.2246)	0.3766*** (5.2725)	-0.2785*** (-3.8456)
HOR × Expertise stock		-0.1937** (-2.3811)	-0.1937** (-2.3836)	-0.0488 (-0.5930)
Market capitalization	-0.0771*** (-14.0529)	-0.0756*** (-13.7378)	-0.0894*** (-14.8494)	-0.2091*** (-35.6871)
Book-to-market ratio	0.1044*** (4.2749)	0.1149*** (4.7041)	0.1375*** (5.1757)	0.0799*** (3.0210)
Debt-to-equity ratio	0.0342*** (7.8857)	0.0357*** (8.2162)	0.0472*** (10.2901)	0.0374*** (8.2254)
Return on assets	-1.5864*** (-11.4100)	-1.5991*** (-11.5073)	-1.4495*** (-9.4024)	-0.6478*** (-4.1651)
Beta	0.0930*** (3.9406)	0.0903*** (3.8268)	0.1279*** (4.9688)	0.0154 (0.5893)
Constant	8.0667*** (124.2582)	7.9681*** (118.4601)	8.0346*** (111.8386)	9.8551*** (136.5084)

Observations	53,742	53,742	46,931	53,742
R-squared	0.2560	0.2571	0.0361	0.0583
F-test				
Own - Expertise stock		3.9258*** (1461.89)		
Panel B: Trade Activities Based on the Value of Stocks Held at Quarter-End				
Variable	Value (1)	Value (2)	Value (3)	Value (4)
HOR	-0.2597*** (-7.6382)	-0.2339*** (-6.1952)	-0.2243*** (-5.9385)	-0.2131*** (-5.2361)
Own stock	3.8545*** (43.6213)	3.9215*** (43.7871)		
HOR × Own stock	-0.5752*** (-5.8380)	-0.6031*** (-6.0386)		
Expertise stock		0.3046*** (3.9945)	0.3037*** (4.0013)	-0.2919*** (-3.8244)
HOR × Expertise stock		-0.1275 (-1.4791)	-0.1245 (-1.4503)	-0.0376 (-0.4354)
Market capitalization	0.1655*** (29.0154)	0.1670*** (29.2201)	0.1446*** (22.9973)	0.0358*** (5.9250)
Book-to-market ratio	0.0640** (2.5194)	0.0739*** (2.9053)	0.0874*** (3.1894)	0.0405 (1.5074)
Debt-to-equity ratio	0.0059 (1.3288)	0.0073 (1.6373)	0.0197*** (4.1654)	0.0090* (1.9285)
Return on assets	0.4707*** (3.1263)	0.4594*** (3.0528)	0.5711*** (3.4179)	1.3860*** (8.3649)
Beta	0.2532*** (10.3869)	0.2503*** (10.2729)	0.2823*** (10.6010)	0.1777*** (6.7094)
Constant	9.5032*** (140.9107)	9.4210*** (135.2275)	9.5798*** (128.6122)	11.2292*** (154.2402)
Observations	53,742	53,742	46,931	53,742
R-squared	0.2072	0.2081	0.0386	0.0146
F-test				
Own - Expertise stock		3.6169*** (1128.73)		

Table 3
Holdings-Based Portfolios

Table 3 presents the results of the quarterly holdings-based portfolios of CEOs' investments in their own, expertise, and non-expertise stocks. Panels A, B, and C display the raw returns, market-adjusted returns, and Carhart's alphas respectively. We exclude CEOs' own company stocks from the expertise and non-expertise portfolios. Portfolio rebalancing happens at the end of the quarter. Column 1 shows the portfolio returns of all CEOs regardless of their horizon; columns 2 and 3 present the returns for short- and long-horizon CEOs respectively. Column 4 displays the mean difference of the portfolio returns between short- and long-horizon CEOs. For the raw returns and market-adjusted returns, we use the t-test; for Carhart's alpha, we use the chi-squared test to compare the mean difference among the own, expertise, and non-expertise portfolios. We use the Kolmogorov–Smirnov test to compare the mean difference of the portfolios' returns between short- and long-horizon CEOs. The D-values of the Kolmogorov–Smirnov test are presented in parentheses. The symbols ***, **, and * indicate the 1%, 5%, and 10% significance levels respectively.

Panel A: Raw Returns				
Portfolio	All	SH	LH	SH - LH
	(1)	(2)	(3)	(4)
Own	0.0268*** (13.8660)	0.0275*** (8.3923)	0.0265*** (11.1597)	0.0010** (0.0361)
Expertise	0.0070*** (5.9432)	0.0074*** (3.5506)	0.0068*** (4.7653)	0.0006*** (0.0554)
Non-expertise	0.0109*** (9.3416)	0.0106*** (4.7081)	0.0110*** (8.1702)	-0.0004 (0.0264)
Own - Expertise	0.0233*** (9.5195)	0.0231*** (6.0858)	0.0234*** (7.5178)	
Own - Non-expertise	0.0202*** (9.2930)	0.0225*** (5.7923)	0.0192*** (7.3498)	
Expertise – Non expertise	-0.0008 (-0.5325)	0.0019 (0.7165)	-0.0021 (-1.1915)	

Panel B: Market-Adjusted Returns				
Portfolio	All	SH	LH	SH - LH
	(1)	(2)	(3)	(4)
Own	0.0265*** (13.7440)	0.0272*** (8.3184)	0.0262*** (11.0620)	0.0010** (0.0358)
Expertise	0.0067*** (5.6940)	0.0071*** (3.4073)	0.0065*** (4.5614)	0.0006** (0.0458)
Non-expertise	0.0106*** (9.0996)	0.0103*** (4.5747)	0.0107*** (7.9674)	-0.0004 (0.0203)
Own - Expertise	0.0233*** (9.5195)	0.0231*** (6.0858)	0.0234*** (7.5178)	
Own - Non-expertise	0.0202*** (9.2930)	0.0225*** (5.7923)	0.0192*** (7.3498)	
Expertise - Non-expertise	-0.0008 (-0.5325)	0.0019 (0.7165)	-0.0021 (-1.1915)	

Panel C: Carhart's Alpha				
Portfolio	All	SH	LH	SH - LH
	(1)	(2)	(3)	(4)
Own	0.0120*** (5.4167)	0.0132*** (3.6295)	0.0115*** (4.1864)	0.0017*** (0.0688)
Expertise	0.0033** (2.3730)	0.0040* (1.6847)	0.0029* (1.6965)	0.0011* (0.0484)
Non-expertise	0.0053*** (3.8629)	0.0064** (2.4796)	0.0045*** (2.8223)	0.0019** (0.0425)
Own - Expertise	0.0087*** (10.39)	0.0092** (4.32)	0.0086** (6.59)	
Own - Non-expertise	0.0067** (6.23)	0.0068 (2.10)	0.0070** (4.67)	
Expertise - Non-expertise	-0.0020 (0.84)	-0.0024 (0.35)	-0.0016 (0.41)	

Table 4

Calendar-Time Portfolios

Table 4 presents the results of the quarterly calendar-time portfolio returns of CEOs' investments in their own, expertise, and non-expertise stocks. Panels A, B, and C display the raw returns, market-adjusted returns, and Carhart's alphas respectively. We exclude CEOs' own company stocks from the expertise and non-expertise portfolios. Portfolio rebalancing happens at the end of the quarter. Column 1 shows the portfolio returns of all CEOs regardless of their horizon; columns 2 and 3 present the returns for short- and long-horizon CEOs respectively. Column 4 displays the mean difference of the portfolio returns between short- and long-horizon CEOs. For the raw returns and market-adjusted returns, we use the t-test; for Carhart's alpha, we use the chi-squared test to compare the mean difference among the own, expertise, and non-expertise portfolios. We use the Kolmogorov–Smirnov test to compare the mean difference of the portfolios' returns between short- and long-horizon CEOs. The D-values of the Kolmogorov–Smirnov test are presented in parentheses. The symbols ***, **, and * indicate the 1%, 5%, and 10% significance levels respectively.

Panel A: Raw Returns				
Portfolio	All	SH	LH	SH - LH
	(1)	(2)	(3)	(4)
Own	0.0247** (2.4952)	0.0264*** (2.7146)	0.0242** (2.3479)	0.0021*** (0.8636)
Expertise	0.0060* (1.9428)	0.0064* (1.7315)	0.0057* (1.9299)	0.0007*** (0.9703)
Non-expertise	0.0085* (1.7715)	0.0094* (1.7506)	0.0077 (1.6271)	0.0017*** (0.9437)
Own - Expertise	0.0187** (2.6091)	.0199*** (2.8773)	.0185** (2.3468)	
Own - Non-expertise	.0161*** (2.8830)	.0169*** (2.9156)	.0165** (2.6318)	
Expertise - Non-expertise	-.0025 (-1.1981)	-.00299 (-0.8893)	-.0019 (-0.8096)	

Panel B: Market-Adjusted Returns				
Portfolio	All	SH	LH	SH - LH
	(1)	(2)	(3)	(4)
Own	0.0243** (2.5086)	0.0260*** (2.7309)	0.0238** (2.3567)	0.0021*** (0.8676)
Expertise	0.0056* (1.9390)	0.0060* (1.7054)	0.0053* (1.9232)	0.0007*** (0.9697)
Non-expertise	0.0081* (1.7638)	0.0090* (1.7443)	0.0073 (1.6077)	0.0017*** (0.9459)

Own - Expertise	0.0187** (2.6091)	0.0199*** (2.8773)	0.0185** (2.3468)
Own - Non-expertise	0.0162*** (2.8830)	0.0169*** (2.9156)	0.0166** (2.6318)
Expertise - Non-expertise	-0.0026 (-1.1981)	-0.0030 (-0.8893)	-0.0020 (-0.8096)

Panel C: Carhart's Alpha				
Portfolio	All	SH	LH	SH - LH
	(1)	(2)	(3)	(4)
Own	0.0122** (2.3980)	0.0129** (2.2437)	0.0124** (2.1734)	0.0005*** (0.9659)
Expertise	0.0025 (1.2365)	0.0035 (1.2428)	0.0017 (0.8291)	0.0018*** (1.0021)
Non-expertise	0.0034 (1.1754)	0.0045 (1.3748)	0.0025 (0.7904)	0.0020*** (1.0042)
Own - Expertise	0.0097*** (6.93)	0.0094** (5.11)	0.0107** (4.93)	
Own - Non-expertise	0.0088*** (6.72)	0.0084* (3.81)	0.0099** (6.28)	
Expertise - Non-expertise	-0.0009 (0.40)	-0.0010 (0.11)	-0.0008 (0.13)	

Table 5
Local vs. Non-Local Portfolios

Table 5 presents the results of the quarterly holdings-based portfolios of CEOs' investments in their own, local, and non-local stocks. Panels A, B, and C display the raw returns, market-adjusted returns, and Carhart's alphas respectively. We exclude CEOs' own company stocks from the local and non-local portfolios. Portfolio rebalancing happens at the end of the quarter. Column 1 shows the portfolio returns of all CEOs regardless of their horizon; columns 2 and 3 present the returns for short- and long-horizon CEOs respectively. Column 4 displays the mean difference of the portfolio returns between short- and long-horizon CEOs. For the raw returns and market-adjusted returns, we use the t-test; for Carhart's alpha, we use the chi-squared test to compare the mean difference among the own, expertise, and non-expertise portfolios. We use the Kolmogorov–Smirnov test to compare the mean difference of the portfolios' returns between short- and long-horizon CEOs. The D-values of the Kolmogorov–Smirnov test are presented in parentheses. The symbols ***, **, and * indicate the 1%, 5%, and 10% significance levels respectively.

Panel A: Raw Returns				
Portfolio	All	SH	LH	SH - LH
	(1)	(2)	(3)	(4)
Own	0.0268*** (13.8660)	0.0275*** (8.3923)	0.0265*** (11.1597)	0.0010** (0.0361)
Local	0.0119*** (7.4222)	0.0072** (2.4106)	0.0058*** (3.4139)	0.0014 (0.0256)
Non-local	0.0164*** (16.4717)	0.0089*** (4.4426)	0.0118*** (8.4477)	-.0029*** (0.0506)
Own - Local	0.0225*** (6.3617)	0.0191*** (2.9904)	0.0240*** (5.6540)	
Own - Non-local	0.0202*** (9.2470)	0.0255*** (6.7529)	0.0180*** (6.7561)	
Local - Non-local	-0.0003 (-0.1897)	0.0007 (0.2053)	-0.0062*** (-3.0917)	

Panel B: Market-Adjusted Returns				
Portfolio	All	SH	LH	SH - LH

	(1)	(2)	(3)	(4)
Own	0.0265*** (13.7440)	0.0272*** (8.3184)	0.0262*** (11.0620)	0.0010** (0.0358)
Local	0.0115*** (7.2311)	0.0069** (2.3261)	0.0055*** (3.2567)	0.0014 (0.0274)
Non-local	0.0160*** (16.1604)	0.0085*** (4.2865)	0.0115*** (8.2544)	-0.0029*** (0.0484)
Own - Local	0.0225*** (6.3617)	0.0191*** (2.9904)	0.0240*** (5.6540)	
Own - Non-local	0.0202*** (9.2470)	0.0255*** (6.7529)	0.0180*** (6.7561)	
Local - Non-local	-0.0003 (-0.1897)	0.0007 (0.2053)	-0.0062*** (-3.0917)	

Panel C: Carhart's Alpha				
Portfolio	All	SH	LH	SH - LH
Own	0.0120*** (5.4167)	0.0132*** (3.6295)	0.0115*** (4.1864)	0.0017*** (0.0688)
Local	0.0061*** (3.4848)	0.0027 (0.7816)	0.0032 (1.5252)	-0.0005*** (0.1123)
Non-local	0.0068*** (6.3292)	0.0055** (2.3995)	0.0054*** (3.2619)	0.0001*** (0.0865)
Own - Local	0.0059** (4.40)	0.0105* (3.05)	0.0083** (5.76)	
Own - Non-local	0.0052** (4.46)	0.0077* (3.00)	0.0061* (3.38)	
Local - Non-local	-0.0007 (0.10)	-0.0028 (0.26)	-0.0022 (0.66)	

Appendices

Appendix A Horizon, Trade Type, and Trading Activities

Appendix A shows the trading activity regression results. The dependent variable is the natural logarithm of a CEO's quarterly holdings of a stock, which is measured by the number of stocks held (Panel A), and the market value in SEK of the stock holdings (Panel B) at the end of the quarter. The

main independent variables are the CEOs' investment horizon, trade type indicator variables, and the interactions between the horizon and trade types. Horizon is the average annual net order flow in the CEOs' own-firm stocks over the past 10 years, ranging from 0 to 1, where 0 and 1 indicate an extremely short horizon and long horizon, respectively. The Horizon (HOR) is a dummy variable where 1 indicates short-horizon insiders and 0 represents the long-horizon counterparts. Own stock is a dummy variable that takes a value of 1 if the traded stock is of the company where the CEO is employed and 0 otherwise. Expertise stock is a dummy variable that takes a value of 1 if the traded stock is in the same industry where the CEO works and 0 otherwise. Columns 1–2 and 4 present the full sample regression results, while column 3 shows the regression results for a subsample of expertise and non-expertise stocks only (i.e., without own-firm stocks). The control variables include log market capitalization, book-to-market ratio, debt-to-equity ratio, return on assets, and beta. Year-fixed effects are included in all models. We use heteroscedasticity-consistent robust standard errors. The symbols ***, **, and * indicate the 1%, 5%, and 10% levels of significance respectively.

Panel A: Trade Activities Based on the Number of Stocks Held at Quarter-End				
Variable	Holdings (1)	Holdings (2)	Holdings (3)	Holdings (4)
HOR_dummy	0.4025*** (18.4714)	0.3713*** (14.9683)	0.3677*** (14.7932)	0.4174*** (15.8295)
Own stock	3.2846*** (94.6977)	3.3217*** (93.8390)		
HOR × Own stock	0.4895*** (8.0765)	0.5211*** (8.4420)		
Expertise stock		0.1649*** (6.1127)	0.1704*** (6.3093)	-0.3289*** (-12.0863)
HOR × Expertise stock		0.1486*** (2.9254)	0.1423*** (2.8063)	0.0277 (0.5366)
Market capitalization	-0.0739*** (-13.4745)	-0.0722*** (-13.1373)	-0.0846*** (-14.0269)	-0.2051*** (-34.9760)
Book-to-market ratio	0.0923*** (3.7970)	0.1018*** (4.1910)	0.1302*** (4.9052)	0.0725*** (2.7457)
Debt-to-equity ratio	0.0335*** (7.8440)	0.0347*** (8.1510)	0.0462*** (10.2443)	0.0367*** (8.2050)
Return on assets	-1.5979*** (-11.5021)	-1.6158*** (-11.6332)	-1.4820*** (-9.6136)	-0.6766*** (-4.3428)
Beta	0.0976*** (4.1467)	0.0949*** (4.0364)	0.1332*** (5.1963)	0.0205 (0.7824)
Constant	7.7827*** (127.8294)	7.7267*** (125.1519)	7.7819*** (116.2114)	9.5638*** (146.9362)
Observations	53,742	53,742	46,931	53,742
R-squared	0.2622	0.2633	0.0429	0.0642

F-test

Own - Expertise stock

3.1568***

(6262.83)

Panel B: Trade Activities Based on the Value of Stocks Held at Quarter-End

Variable	Value (1)	Value (2)	Value (3)	Value (4)
HOR	0.4630*** (20.7636)	0.4478*** (17.6837)	0.4420*** (17.4274)	0.4550*** (17.2553)
Own stock	3.2968*** (95.7794)	3.3356*** (94.7611)		
HOR $\times$ Own stock	0.2509*** (4.2280)	0.2665*** (4.4022)		
Expertise stock		0.1750*** (6.2050)	0.1796*** (6.3609)	-0.3214*** (-11.3308)
HOR $\times$ Expertise stock		0.0723 (1.3733)	0.0643 (1.2228)	-0.0082 (-0.1540)
Market capitalization	0.1688*** (29.6777)	0.1703*** (29.8850)	0.1491*** (23.7453)	0.0395*** (6.5509)
Book-to-market ratio	0.0525** (2.0786)	0.0620** (2.4499)	0.0797*** (2.9124)	0.0326 (1.2152)
Debt-to-equity ratio	0.0051 (1.1521)	0.0063 (1.4408)	0.0186*** (4.0073)	0.0083* (1.7991)
Return on assets	0.4579*** (3.0485)	0.4444*** (2.9588)	0.5446*** (3.2652)	1.3613*** (8.2152)
Beta	0.2581*** (10.6423)	0.2551*** (10.5184)	0.2878*** (10.8630)	0.1827*** (6.9174)
Constant	9.1126*** (144.9458)	9.0570*** (142.0303)	9.2114*** (132.8964)	10.8746*** (163.8244)
Observations	53,742	53,742	46,931	53,742
R-squared	0.2141	0.2150	0.0463	0.0212

F-Test

Own - Expertise

3.1606***

(6204.84)

Appendix B

Purchase Portfolios

Appendix B presents the results of the quarterly purchases portfolios of CEOs' investment in their own, expertise, and non-expertise stocks. Panels A, B, and C display the raw returns, market-adjusted returns, and Carhart's alphas respectively. We exclude CEOs' own company stocks from the expertise and non-expertise portfolios. Portfolio rebalancing happens at the end of the quarter. Column 1 shows the portfolio returns of all CEOs regardless of their horizon; columns 2 and 3 present the returns for short- and long-horizon CEOs respectively. Column 4 displays the mean difference of the portfolio returns between short- and long-horizon CEOs. For the raw returns and market-adjusted returns, we use the t-test; for Carhart's alpha, we use the chi-squared test to compare the mean difference among the own, expertise, and non-expertise portfolios. We use the Kolmogorov-Smirnov test to compare the mean difference of the portfolios' returns between short- and long-horizon CEOs. The D-values of the Kolmogorov-Smirnov test are presented in parentheses. The symbols ***, **, and * indicate the 1%, 5%, and 10% significance levels respectively.

Panel A: Raw returns				
Portfolio	All	SH	LH	SH - LH
Own	0.0197*** (3.3290)	0.0331*** (2.9797)	0.0151** (2.1643)	0.0180** (0.0971)
Expertise	-0.0062** (-2.2711)	-0.0077 (-1.4788)	-0.0053* (-1.7354)	-0.0024** (0.1274)
Non expertise	-0.0002 (-0.0804)	0.0004 (0.0800)	-0.0004 (-0.1907)	0.0008*** (0.0930)
Own - Expertise	0.0149 (1.0768)	0.0486** (2.2976)	-0.0053 (-0.3057)	
Own – Non-expertise	0.0085 (0.6198)	-0.0165 (-0.7333)	0.0213 (1.2321)	
Expertise – Non-expertise	-0.0072 (-1.4531)	-0.0144 (-1.2561)	-0.0024 (-0.7737)	

Panel B: Market adjusted returns				
Portfolio	All	SH	LH	SH - LH
Own	0.0196*** (3.3141)	0.0329*** (2.9645)	0.0150** (2.1559)	0.0179** (0.1021)
Expertise	-0.0065** (-2.3898)	-0.0080 (-1.5335)	-0.0056* (-1.8493)	-0.0024** (0.1343)
Non expertise	-0.0004	0.0001	-0.0007	0.0008**

	(-0.1988)	(0.0122)	(-0.2899)	(0.0796)
Own - Expertise	0.0149	0.0486**	-0.0053	
	(1.0768)	(2.2976)	(-0.3057)	
Own – Non-expertise	0.0085	-0.0165	0.0213	
	(0.6198)	(-0.7333)	(1.2321)	
Expertise – Non-expertise	-0.0072	-0.0144	-0.0024	
	(-1.4531)	(-1.2561)	(-0.7737)	

Panel C: Carhart Alpha				
Portfolio	All	SH	LH	SH - LH
Own	0.0118*	0.0253*	0.0073	0.0180
	(1.6771)	(1.8988)	(0.8789)	(0.1351)
Expertise	-0.0106***	-0.0137**	-0.0090***	-0.0047***
	(-3.4507)	(-2.3334)	(-2.6014)	(0.4119)
Non expertise	0.0024	0.0050	0.0003	0.0047***
	(0.9704)	(0.9829)	(0.1083)	(0.2076)
Own - Expertise	0.0224***	0.0390***	0.0163*	
	(7.51)	(7.29)	(2.84)	
Own – Non-expertise	0.0094	0.0203	0.0070	
	(1.26)	(1.95)	(0.51)	
Expertise – Non-expertise	-0.013***	-0.0187**	-0.0093*	
	(7.63)	(4.40)	(3.29)	

Appendix C

Sell Portfolios

Appendix B presents the results of the quarterly sell portfolios of CEOs' investment in their own, expertise, and non-expertise stocks. Panels A, B, and C display the raw returns, market-adjusted returns, and Carhart's alphas respectively. We exclude CEOs' own company stocks from the expertise and non-expertise portfolios. Portfolio rebalancing happens at the end of the quarter. Column 1 shows the portfolio returns of all CEOs regardless of their horizon; columns 2 and 3 present the returns for short- and long-horizon CEOs respectively. Column 4 displays the mean difference of the portfolio returns between short- and long-horizon CEOs. For the raw returns and market-adjusted returns, we use the t-

test; for Carhart alpha, we use the chi-squared test to compare the mean difference among the own, expertise, and non-expertise portfolios. We use the Kolmogorov-Smirnov test to compare the mean difference of portfolios' returns between short- and long-horizon CEOs. The D-values of the Kolmogorov-Smirnov test are presented in parentheses. The symbols ***, **, and * indicate the 1%, 5%, and 10% significance levels respectively.

Panel A: Raw returns				
Portfolio	All	SH	LH	SH - LH
Own	0.0218*** (3.3207)	0.0047 (0.5297)	0.0334*** (3.6498)	-0.0287 (0.0837)
Expertise	0.0062*** (2.6650)	-0.0004 (-0.1290)	0.0099*** (3.1541)	-0.0103* (0.0980)
Non expertise	0.0110*** (6.3692)	0.0092*** (2.5930)	0.0120*** (6.3269)	-0.0028* (0.0577)
Own - Expertise	0.0217* (1.7885)	0.0087 (0.5987)	0.0342* (1.7741)	
Own – Non-expertise	0.0076 (0.8804)	0.0064 (0.5413)	0.0085 (0.6924)	
Expertise – Non-expertise	-0.0013 (-0.7000)	-0.0001 (-0.0350)	-0.0020 (-0.8308)	

Panel B: Market adjusted returns				
Portfolio	All	SH	LH	SH - LH
Own	0.0215*** (3.2838)	0.0045 (0.5006)	0.0331*** (3.6230)	-0.0286 (0.0837)
Expertise	0.0059** (2.5394)	-0.0007 (-0.2026)	0.0096*** (3.0487)	-0.0103 (0.0846)
Non expertise	0.0107***	0.0089**	0.0117***	-0.0028

	(6.1974)	(2.5145)	(6.1643)	(0.0500)
Own - Expertise	0.0217*	0.0087	0.0342*	
	(1.7885)	(0.5987)	(1.7741)	
Own – Non-expertise	0.0076	0.0064	0.0085	
	(0.8804)	(0.5413)	(0.6924)	
Expertise – Non-expertise	-0.0013	-0.0001	-0.0020	
	(-0.7000)	(-0.0350)	(-0.8308)	

Panel C: Carhart Alpha				
Portfolio	All	SH	LH	SH - LH
Own	0.0123	-0.0073	0.0256**	-0.0329
	(1.5448)	(-0.6736)	(2.2888)	(0.2669)
Expertise	0.0051*	-0.0024	0.0106***	-0.0130***
	(1.7926)	(-0.6493)	(2.6290)	(0.3372)
Non expertise	0.0086***	0.0065	0.0100***	-0.0035
	(3.9698)	(1.5189)	(4.1220)	(0.0738)
Own - Expertise	0.0072	-0.0049	0.0150	
	(0.73)	(0.16)	(1.77)	
Own – Non-expertise	0.0037	-0.0138	0.0156	
	(0.20)	(1.21)	(2.11)	
Expertise – Non-expertise	-0.0035	-0.0089	0.0006	
	(0.91)	(2.57)	(0.02)	

Appendix D

Calendar-Time Purchase Portfolios

Appendix C presents the results of the quarterly calendar-time purchase portfolios' returns of CEOs' investment in their own, expertise, and non-expertise stocks. Panels A, B, and C display the raw returns, market-adjusted returns, and Carhart's alphas respectively. We exclude CEOs' own company stocks from the expertise and non-expertise portfolios. Portfolio rebalancing happens at the end of the quarter. Column 1 shows the portfolio returns of all CEOs regardless of their horizon; columns 2 and 3 present the returns for short- and long-horizon CEOs respectively. Column 4 displays the mean difference of the portfolio returns between short- and long-horizon CEOs. For the raw returns and market-adjusted

returns, we use the t-test; for Carhart's alpha, we use the chi-squared test to compare the mean difference among the own, expertise, and non-expertise portfolios. We use the Kolmogorov-Smirnov test to compare the mean difference of the portfolios' returns between short- and long-horizon CEOs. The D-values of the Kolmogorov-Smirnov test are presented in parentheses. The symbols ***, **, and * indicate the 1%, 5%, and 10% significance levels respectively.

Panel A: Raw returns				
Portfolio	All	SH	LH	SH - LH
Own	0.0305** (2.4456)	0.0365** (2.0161)	0.0274** (2.0812)	0.0091*** (1.0824)
Expertise	-0.0047 (-1.3126)	-0.0068 (-1.0333)	-0.0034 (-1.3584)	-0.0033*** (0.9967)
Non expertise	-0.0004 (-0.1238)	-0.0020 (-0.4648)	-0.0011 (-0.3625)	-0.0009*** (0.9941)
Own - Expertise	0.0352*** (3.2578)	0.0433** (2.4860)	0.0304** (2.4365)	
Own – Non-expertise	0.0309*** (2.8115)	0.0385** (2.1834)	0.0285** (2.4508)	
Expertise – Non-expertise	-0.0043 (-1.0150)	-0.0048 (-0.6680)	-0.0021 (-0.5776)	

Panel B: Market adjusted returns				
Portfolio	All	SH	LH	SH - LH
Own	0.0301** (2.4501)	0.0362** (2.0079)	0.0270** (2.0793)	0.0091*** (1.0827)
Expertise	-0.0051 (-1.4605)	-0.0072 (-1.1069)	-0.0038 (-1.5548)	-0.0033*** (0.9980)

Non expertise	-0.0008 (-0.2554)	-0.0024 (-0.5729)	-0.0015 (-0.5092)	-0.0009*** (0.9958)
Own - Expertise	0.0352*** (3.2578)	0.0433** (2.4860)	0.0304** (2.4365)	
Own – Non-expertise	0.0309*** (2.8115)	0.0385** (2.1834)	0.0285** (2.4508)	
Expertise – Non-expertise	-0.0043 (-1.0150)	-0.0048 (-0.6680)	-0.0021 (-0.5776)	

Panel C: Carhart Alpha				
Portfolio	All	SH	LH	SH - LH
Own	0.0215** (2.4482)	0.0197 (1.0920)	0.0176* (1.7691)	0.0021*** (0.9853)
Expertise	-0.0093** (-2.5001)	-0.0144** (-2.0556)	-0.0059** (-2.1382)	-0.0085*** (1.0040)
Non expertise	0.0009 (0.3576)	0.0009 (0.2530)	-0.0013 (-0.4612)	0.0022*** (0.9931)
Own - Expertise	0.0308*** (17.25)	0.0341** (3.59)	0.0235** (5.88)	
Own – Non-expertise	0.0206** (4.99)	0.0188 (1.04)	0.0189* (3.36)	
Expertise – Non-expertise	-0.0102** (6.42)	-0.0153** (5.62)	-0.0046 (1.53)	

Appendix E

Calendar-Time Sell Portfolios

Appendix D presents the results of the quarterly calendar-time sell portfolios' returns of CEOs' investment in their own, expertise, and non-expertise stocks. Panels A, B, and C display the raw returns, market-adjusted returns, and Carhart's alphas respectively. We exclude CEOs' own-firm stocks from the expertise and non-expertise portfolios. Portfolio rebalancing happens at the end of the quarter. Column 1 shows the portfolio returns of all CEOs regardless of their horizon; columns 2 and 3 present the returns for short- and long-horizon CEOs respectively. Column 4 displays the mean difference of the portfolio returns between short- and long-horizon CEOs. For the raw returns and market-adjusted returns, we use the t-test; for Carhart's alpha, we use the chi-squared test to compare the mean difference among the own, expertise, and non-expertise portfolios. We use the Kolmogorov-Smirnov test to compare the mean difference of the portfolios' returns between short- and long-horizon CEOs. The D-

values of the Kolmogorov-Smirnov test are presented in parentheses. The symbols ***, **, and * indicate the 1%, 5%, and 10% significance levels respectively.

Panel A: Raw returns				
Portfolio	All	SH	LH	SH - LH
Own	0.0221* (1.9754)	0.0168 (1.0591)	0.0370*** (2.9891)	-0.0202*** (0.9658)
Expertise	0.0040 (1.6505)	-0.0032 (-0.5721)	0.0068*** (3.3199)	-0.0101*** (1.0014)
Non expertise	0.0092*** (3.2124)	0.0089* (1.7303)	0.0093*** (3.5832)	-0.0003*** (0.9747)
Own - Expertise	0.0181 (1.6604)	0.0158 (1.0504)	0.0299** (2.4141)	
Own – Non-expertise	0.0128 (1.3091)	0.0079 (0.5173)	0.0276** (2.2918)	
Expertise – Non-expertise	-0.0052 (-1.6688)	-0.0122 (-1.5949)	-0.0024 (-0.8380)	

Panel B: Market adjusted returns				
Portfolio	All	SH	LH	SH - LH
Own	0.0217* (1.9681)	0.0164 (1.0446)	0.0367*** (3.0046)	-0.0203*** (0.9652)
Expertise	0.0036 (1.5381)	-0.0036 (-0.6426)	0.0065*** (3.2247)	-.0101*** (1.0008)
Non expertise	0.0088*** (3.2152)	0.0086* (1.6929)	0.0089*** (3.5135)	-0.0003*** (0.9770)

Own - Expertise	0.0181 (1.6604)	0.0158 (1.0504)	0.0299** (2.4141)
Own – Non-expertise	0.0128 (1.3091)	0.0079 (0.5173)	0.0276** (2.2918)
Expertise – Non-expertise	-0.0052 (-1.6688)	-0.0122 (-1.5949)	-0.0024 (-0.8380)

Panel C: Carhart Alpha				
Portfolio	All	SH	LH	SH - LH
Own	0.0122 (1.2361)	0.0097 (0.6595)	0.0245** (2.3048)	-0.0148*** (0.9519)
Expertise	0.0030 (1.1428)	-0.0040 (-0.6271)	0.0069*** (3.0228)	-0.0109*** (0.9963)
Non expertise	0.0058** (2.2052)	0.0028 (0.5629)	0.0085*** (3.0295)	-0.0057*** (1.0011)
Own - Expertise	0.0092 (1.64)	0.0137 (0.81)	0.0176* (3.72)	
Own – Non-expertise	0.0064 (0.81)	0.0069 (0.17)	0.0160* (3.33)	
Expertise – Non-expertise	-0.0028 (0.94)	-0.0068 (1.17)	-0.0016 (0.20)	
