

# **Why Do Insiders Trade?**

## **Evidence Based on Unique Data on Swedish Insiders**

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## Why Do Insiders Trade? Evidence Based on Unique Data on Swedish Insiders

**Abstract:** In this paper, we examine if corporate insiders have other motives for trading besides exploitation of private information. Our results show that insiders' portfolio re-balancing objectives, tax considerations and behavioral biases play the most important role in their trading decisions. We also find that insiders who have allocated a great (small) proportion of their wealth to insider stock sell more (less) before bad news earnings disclosures. Finally, insider selling is informative for future returns among those insiders who have the greatest proportion of wealth allocated to insider stocks.

JEL Classification: M41, G10, K22

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### 1. Introduction

Many studies, both in accounting and finance, examine whether insiders' trading activity is informative regarding future return on stocks (e.g. Jaffe, 1974; Seyhun, 1986; Lin and Howe, 1990; Jeng et al., 2003; Ke et al., 2003 and Huddart et al., 2007). An underlying hypothesis tested in these studies is whether insider trades are driven by insiders' superior information about the prospects of their firm and whether these trades are informative in generating abnormal returns<sup>1</sup>. However, it is also widely recognized in the literature that insiders may trade for reasons other than maximizing stock returns (e.g. Ke et al., 2003; Huddart and Ke, 2007 and Huddart et al., 2007). For instance, insiders may sell their insider stocks in an attempt to better diversify their holdings and because of personal liquidity needs.

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<sup>1</sup> Ex ante, it is not actually for certain that insiders earn abnormal stock returns by trading in the stock of their insider firm. First, insider legislation imposes significant limits on insider trading. Second, insiders' legal use of their insider information does not yield abnormal returns if stock prices fully reflect that information (strong market efficiency). In other words, insider trading is informative for future returns if insider legislation and enforcement allow insiders to utilize specific information in their trading *and* strong form market efficiency does not hold.

However, research on alternative motives for insider trading is largely impeded by data limitations. For instance, direct tests of portfolio diversification/re-balancing and liquidity hypotheses require comprehensive data on insiders' personal wealth and income in addition to data on their stockholdings in their insider firm and in other firms. Such data, to the best of our knowledge, have so far been unavailable.

In this paper, we utilize unique data on Swedish insiders to explore the various motives underlying insiders' decisions to trade their insider stocks. In particular, we examine whether insiders' diversification and other personal reasons have an incremental role relative to their information advantage in explaining their trading behavior. Our data comprise detailed information on all Swedish insiders' personal wealth including their holdings in their insider and outsider stocks and their other wealth. Moreover, the data include information on insiders' salaries and other taxable income as well as gender. Furthermore, in our study we are able to control for several other potential factors affecting insider trading, such as the number of granted stocks and options, the number of stock acquired through the exercise of options and earnings announcements. This comprehensive data set allows a thorough investigation of the incremental role of the various motives for insider trading proposed in the literature.

We find strong support for the portfolio diversification/re-balancing hypothesis. That is, insiders with unbalanced portfolios (towards insider stock) relative to their average holdings over the sample period have a higher propensity to sell their insider stocks and they sell in larger trade sizes than insiders with less unbalanced portfolios. Regarding the behavioral biases in insiders' trading decisions, we find that insiders tend to hold on to their losing insider stocks (the disposition effect) and that male insiders trade more frequently than female insiders (overconfidence). These interesting findings suggest that insiders exhibit similar behavioral biases as regular investors (Shefrin and

Statman, 1985; Odean, 1998 and Grinblatt and Keloharju, 2001). We also find that tax burden associated with the selling of insider stock holdings deters insiders from selling these stocks, thereby supporting the result reported by Jin and Kothari (2008) for CEOs' selling of vested equity.

Our results further show that insiders' information advantage and portfolio re-balancing objectives have an interaction effect in their selling decisions. Specifically, consistent with Huddart et al. (2007), we find that, on average, insiders avoid selling before bad news earnings announcements. However, among those insiders who actually sell before bad news earnings announcements, insiders who have allocated a greater (smaller) proportion of their wealth to insider stock sell more (less) before bad news earnings disclosures. Furthermore, our results show that insider selling is the most informative for future returns among those insiders who have allocated a relatively large proportion of their wealth to insider stock or who have the largest insider holdings. These later results suggest that insiders having the strongest economic incentives successfully time their selling to maximize their returns.

In sum, our paper contributes to the literature on insider trading by showing that insiders do not trade solely on the basis of their superior information relative to other market participants. Insiders trade, especially sell, for many personal reasons, such as for portfolio diversification needs. They even seem to show some of the behavioral biases that have been reported to occur among regular investors. We believe that our results are of interest for academics, practitioners and policymakers. For instance, returns for stock market trading strategies that are based on monitoring what insiders are doing are likely to be affected by insider trades made for other reasons than information asymmetry.

The remainder of this paper is divided into five sections. In Section 2, we review the relevant literature on the determinants of insider trading. Section 3 describes the data, discusses their features and presents the methodology and research design. Section 4 contains our results of the analyses on insiders' motives to trade. Finally, we provide concluding remarks in Section 5.

## **2. Review on the determinants of insider trading**

In this section, we review the relevant accounting and finance literature to identify potential determinants of insider trading. The earlier literature abounds in research reporting that insider trading is driven by insiders' superior information about the prospects of their firm. However, it has been suggested in other contexts that various personal motives may affect insiders' and regular investors' trading decisions. Most of these personal motives pertain to insider selling, but some of them also apply to the buying of insider stocks. Jin and Kothari (2008) provide an excellent discussion on various determinants of CEO insiders' decision to sell their vested equity. Appendix 2 summarizes the determinants of insider trading that we incorporate in our analyses.

### **2.1. Insiders' portfolio re-balancing and liquidity needs**

Despite the lack of the empirical evidence, it has been suggested in the literature that some insider trading is due to insiders' portfolio re-balancing objectives and liquidity needs (e.g. Ke et al., 2003 and Huddart et al., 2007). According to the 'portfolio diversification hypothesis' insiders sell to diversify the risk related to their wealth, because insider stockholdings often constitute a great part of their total wealth. There

are many reasons why insider stockholdings constitute a great part of an insider's total wealth. For example, an insider may have been required to make a significant investment in the stock of her firm for incentive purposes or large increases in the stock price of the firm may have significantly increased the value of her insider stockholding. Selling of insider stocks is a natural way for insiders to diversify the risk related to their wealth when company policy (and the insider legislation) allows stocks to be sold. The level of an insider's personal liquidity is another likely motive for insider selling. If an insider needs money for personal consumption or other investments, selling insider stocks is a way to raise funds.

## 2.2. Behavioral reasons

### 2.2.1. Overconfidence

In the empirical finance literature, it has been reported that males are more overconfident than females in their investment decisions, which is also reflected in their trading behavior. For instance, Barber and Odean (2001) find that male investors trade significantly more than female investors. Relying on psychological research, they argue that men will generally be more overconfident about their ability to make financial decisions than women. Even though these results are reported for regular investors, they may also apply to insider investors' trading activity.

Aside from the research on male investors' overconfidence, there is another body of literature exploring managerial overconfidence. For instance, Malmendier and Tate (2004) and Jin and Kothari (2008) maintain that managers tend to be overconfident in that they are more optimistic and confident regarding the firm's prospects than the

market as reflected in the current stock price. Supporting this view, Jin and Kothari (2008) report that CEOs' overconfidence discourages them from selling vested equity.

### 2.2.2. Disposition effect

The disposition effect is based on the prospect theory originally suggested by Kahneman and Tversky (1979). Prospect theory can be used to describe how investors evaluate potential losses and gains in their investment decisions. Shefrin and Statman (1985) applied prospect theory to investment decisions by referring to investors' tendency to hold on to losing stocks too long and selling winning stocks too soon. Evidence on the individual investors' disposition effect has also been reported by Odean (1998) and Grinblatt and Keloharju (2001). Frazzini (2006) discovers the same type of behavior in the trading of U.S. mutual fund managers. In addition, Heath et al. (1999) find similar results in the exercise of executive stock options.

### 2.3. Tax considerations

There are two tax-based reasons that potentially affect insiders' selling, because they have been reported to affect regular investors' selling. First, Shefrin and Statman (1985) propose that although investors are reluctant to sell their losing stocks, they do so at the end of the year, because the end of the year is the deadline for realizing these losses and to gain from tax benefits. Similar results are also reported by Grinblatt and Keloharju (2001, 2004). Second, Jin and Kothari (2008) report that the tax burden associated with the selling of the vested stocks deters CEOs from selling their equity. In other words, CEOs postpone taxable capital gains by not selling their profitable vested equity.

Although we explore the selling behavior of insiders (of all types) who have acquired their insider stocks through different ways including open market purchases, these two tax-based reasons may also affect insider selling behavior.

#### 2.4. Insiders' exploitation of their private information

In the literature on insider trading, it has consistently been reported that insiders can earn abnormal returns on their insider stocks due to their informational advantage over other investors (e.g. Jaffe, 1974; Seyhun, 1986; Lin and Howe, 1990; Jeng et al., 2003; Ke et al., 2003 and Huddart et al., 2007). For instance, Ke et al. (2003) report that insiders trade on foreknowledge of accounting disclosures as much as two years prior to the disclosure. Also, Huddart et al. (2007) find that insiders condition their trades on foreknowledge of accounting disclosures. Lakonishok and Lee (2001) report that insider trading is informative for future returns, but that the information from insiders' trading activities comes mainly from purchases. Regarding non-US studies, insiders have been reported to earn abnormal returns at least on the Toronto Stock Exchange (Baesel and Stein, 1979), the London Stock Exchange (Pope et al., 1990) and the Stockholm Stock Exchange (Nilsson, 2003 and Wahlström, 2003), but not on the Oslo Stock Exchange (Eckbo and Smith, 1998)<sup>2</sup>.

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<sup>2</sup> Interestingly, Eckbo and Smith (1998) report that Norwegian insiders cannot earn abnormal returns, although Nilsson (2003) and Wahlström (2003) report that insiders from another Scandinavian country, i.e. Sweden, can do so. Eckbo and Smith (1998) state that their result could be due to the fact that insiders, in a market like the Oslo Stock Exchange, only rarely possess insider information, or they prefer to maintain corporate control benefits rather than trade on insider information. We have identified at least the following reasons that are likely to lead to this situation in Norway. First, major Norwegian firms are state-owned firms such as oil firms, and the state as a majority owner may limit or at least strictly control the trading of corporate insiders. Second, the other but state-owned Norwegian firms are typically family-owned firms where insiders are likely to maintain corporate control benefits rather than trading on their stocks. Third, the industry structure of the Norwegian stock market is dominated by oil and other natural resources and commodity sectors. Therefore, the fluctuations of the world market prices of natural resources increase the volatility of the stock prices of Norwegian firms. Consequently, Norwegian insiders may on average possess less value relevant private information than their peers in other countries.

In addition to having private information on the future price-relevant events of the firm, insiders can earn abnormal returns by identifying valuation errors made by outsiders. Specifically, insiders can utilize outsiders' biased views of the intrinsic value of the firm by trading against investor sentiment implying that insiders are contrarian traders. Prior research has consistently reported that insiders are indeed contrarian investors (e.g. Seyhun, 1992; Lakonishok and Lee, 2001 and Piotroski and Roulstone, 2005).

## 2.5. Other factors affecting insider trading

In addition to the reasons discussed above, there are other potential reasons for insider trading. First, Ofek and Yermack (2000) report that when corporate executives receive new grants of stocks and options or exercise stock options, they tend to sell their existing stocks. Second, Noe (1999) and Huddart et al. (2007) report that insiders' trading activity increases (decreases) after (before) the earnings of their insider firm are published. Third, Bettis et al. (2001) find that insiders can hedge their stock ownership positions in a firm through zero-cost collars and equity swaps, which may decrease the likelihood that insiders sell their insider stocks. Fourth, insiders who have already invested a great part of their wealth in their insider stocks may not have room in their portfolio to buy more of these stocks. Fifth, labor contracts between the firm and its management may restrict management's trading. Sixth, insiders who are insiders in several firms e.g. those serving as board members may have less need to sell for diversification reasons and more room in their portfolio to buy more insider stocks as opposed to other insiders.

### 3. Data, variable measurement and empirical methodology

#### 3.1. Data sources

We employ comprehensive data on Swedish insiders obtained from the following sources. Daily insider transactions data comprising all the details of each insider's transactions (an insider's name, the name of the firm traded, the number of shares traded and the day on which the transaction was made) as well as data on stocks and executive options granted, executive options exercised and trading on options are obtained from *Finansinspektionen* (The Swedish Financial Supervisory Authority)<sup>3</sup>. Data on insiders' insider and other (outsider) stockholdings are from the *NCSD* (The Nordic Central Securities Depository Group)<sup>4</sup>, which maintains an electronic database on the ownership of all Swedish stocks. For each investor, this data include the ownership records of all stocks owned at the end of December and at the end of July each year, i.e. the data are recorded at six-month intervals. Data on insiders' other wealth (real estate, mutual funds, bank holdings and investments in debt securities) and taxable income come from the Swedish tax authorities and are reported on an annual basis<sup>5</sup>. Finally, we retrieve the

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<sup>3</sup> Swedish insiders are not required to file their granted executive options, although some of them do so on a voluntary basis. Therefore, we have data only on the voluntarily-reported granted executive options. All insiders are, however, required to file the stocks they receive through the exercises of options.

<sup>4</sup> As an official securities depository and clearing organization, NCSD ([www.ncsd.eu](http://www.ncsd.eu)) plays a crucial role in the Nordic financial system. NCSD currently includes VPC and APK, the Swedish and Finnish Central Securities Depositories, to which all actors on the Nordic capital markets are directly or indirectly affiliated. NCSD is responsible for providing services to issuers, intermediaries and investors, as regards the issue and administration of financial instruments as well as clearing and settlement of trades on these markets.

<sup>5</sup> Data on other wealth obtained from the tax authorities includes the tax-based values of insider and outsider stockholdings. Therefore, the variable for total wealth overstates the true value of an insider's other wealth to some extent. Accordingly, one of our variables measuring the proportion of an insider's wealth that she has invested in her insider stock, i.e.  $PORTF2^*_{ijt}$  (the market value of an insider  $i$ 's holdings in insider firm  $j$  divided by the value of her total wealth), is underestimated. However, we feel that use of the variable  $PORTF2^*_{ijt}$  in addition to our other measure of the proportion of an insider's wealth that she has invested in her insider stock, i.e. the variable  $PORTFI^*_{ijt}$  (the market value of an insider  $i$ 's holdings in insider firm  $j$  divided by the total market value of her holdings in all insider and

daily stock prices and earnings announcement days from the Thomson Datastream. If the data for a given firm were missing in the Thomson Datastream, we retrieved the missing data from files kindly provided by the Stockholm Stock Exchange (Nasdaq OMX–Stockholm). The data cover the period from January 2000 to December 2005. The high quality of our data is best illustrated by the fact that the NCSO stockholdings data are the (only) official record to prove ownership of the stock of Swedish firms. Moreover, all the data from the Swedish tax authorities comes from the official state tax records.

Following earlier studies on insider trading (e.g. Ke et al., 2003 and Frankel and Li, 2004) we include open market purchases and sales by CEOs, board members and other officers and directors of the firm in our data set of insider trades. Therefore, non-open market transactions such as option exercises, transactions related to bonuses, pension and other benefit program transactions, gifts and transactions made by controlling owners (ownership greater than 10 percent) are not regarded as insider trades<sup>6</sup>. In the final data set there are 297 firms, 1,723 insiders and 5,227 insider transactions comprising 2,579 sell transactions and 2,648 buy transactions.

The final dataset is amazing in its detail, given our purpose to explore the motives for insiders' decisions to buy and sell. The data allow us to identify not only the value of an insider's holdings in her insider stock, but also her other (outsider) stockholdings and her other wealth. This allows us to directly measure the proportion of an insider's wealth allocated in insider stock when testing the portfolio diversification hypothesis. Also, we can measure the amount of an insider's income including salary and other taxable income to test whether the level of insiders' personal liquidity affects their selling decisions. We concede that an insider's liquidity includes components other than

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outsider stocks) sheds more light on the role of diversification-driven insider trading. As we report in Section 5, all our results are qualitatively similar for both of these variables.

<sup>6</sup> We also exclude very small trades (size of trade < 10,000 SEK). 1 SEK is equal to 0.14 USD.

taxable income. For instance, insiders having the same amount of income may have different amounts of necessary personal expenses such as housing costs or other living costs. Moreover, an insider having a family may incur greater expenses. Therefore, the taxable income, even though it includes all taxable income, is a biased measure of the actual level of an insider's liquidity. The transactions data also allows us to identify an insider's gender.

Table 1 reports summary statistics on the insiders in our sample. The majority of the insiders are male and middle-aged. Roughly half of the insiders are board members and CEOs, and the other half are individuals in other positions, such as officers. Table 2 reports summary statistics on insiders' taxable income, wealth and trading activity in their insider stocks<sup>7</sup>. The statistics show that the insider stockholdings constitute a major part of insiders' total wealth. Insiders have, on average, 4.91 outsider stocks and 1.23 insider stocks in their portfolios. However, the mean value of the insider stockholdings is more than 30 times greater than that of the outsider stockholdings, suggesting that insiders have only moderately diversified their stock portfolios. Consistent with earlier studies analyzing US data (e.g. Lakonishok and Lee, 2001), Swedish insiders' sell transactions are greater than their buy transactions. Finally, insiders made, on average, 2.39 buy and 2.56 sell transactions during the sample period of 6 years. In other words, an average insider has traded roughly once a year during the sample period. However, the maximum values of the number of insider transactions indicate that the most active insiders have traded very actively during the period. In Sweden, insiders are required to hold on to insider stocks acquired for at least 3 months after the purchase. In the US, insiders cannot make more than two round-trip transactions a year without incurring a

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<sup>7</sup> Since an insider's income and wealth change over time, the distributions of these variables are based on pooling insider-year observations in Table 2. Distributions of the number of sell and buy transactions are based on insiders' trading frequencies during the sample period.

penalty. Appendix 1 briefly discusses the Swedish insider legislation and compares it with that in the USA.

(Insert Table 1 about here)

(Insert Table 2 about here)

### 3.2. Sample construction

We construct the sample used in the empirical analyses as follows. First, we identify all days when an insider  $i$  trades on her insider stock  $j$ <sup>8</sup>. For each insider  $i$  and stock  $j$ , we then construct a time-series of all trading days over the sample period. These time-series include trading days when there is insider trading and days when there is no insider trading. Our initial sample is obviously large, as it contains time-series for all trading days for all insiders and all insider stocks over the sample period. There are 2.3 million observations (i.e. trading days) in the initial sample. Of these days, there are 2,648 trading days with insider buying and 2,579 days with insider selling. These figures show that, since insiders trade infrequently in their insider stocks, a substantial part of the observations in the initial sample are days with no insider trading for a given insider and a given stock. In order to mitigate the influence on our results of the large number of non-trading days, we construct our final sample using the matched-pair procedure used e.g. by Noe (1999). The matched-pair research design ensures that the statistical significance of any association between insider trading and the independent variables is not simply an artifact of running a regression with an extremely large

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<sup>8</sup> In the case of multiple insider trades on the same day for a given insider, we net all these trades.

number of observations. Specifically, for each day when there is an insider sell (buy) transaction for a given firm, we randomly choose a day without an insider sell (buy) transaction from all trading days over the sample period for that firm. The resulting sample has an equal number of days with a sell (buy) transaction and days without a sell (buy) transaction.

### 3.3. Variable measurement

#### 3.3.1. Dependent variables

We construct four variables measuring insiders' decisions to sell and buy their insider stocks as well as the size of their sale and purchase transactions. Specifically, we construct the variables  $SELL_{ijt}$ ,  $SELLVALUE_{ijt}$ ,  $BUY_{ijt}$  and  $BUYVALUE_{ijt}$  from our insider transactions data as follows:  $SELL_{ijt}$  is a dummy variable with a value of one if insider  $i$  sells stocks of firm  $j$  (where she is an insider) on day  $t$ , otherwise zero;  $SELLVALUE_{ijt}$  is the market value of the sold stocks if insider  $i$  sells stocks of firm  $j$  on day  $t$ , otherwise zero;  $BUY_{ijt}$  is a dummy variable with a value of one if insider  $i$  buys stocks of firm  $j$  on day  $t$ , otherwise zero and  $BUYVALUE_{ijt}$  is the market value of the purchased stocks if insider  $i$  buys stocks of firm  $j$  on day  $t$ , otherwise zero. We deflate the variables  $SELLVALUE_{ijt}$  and  $BUYVALUE_{ijt}$  by the value of insider holdings (and, alternatively, by the value of all stock holdings and by the value of total wealth) as described in the end of Section 3.3.2.

#### 3.3.2. Independent variables

In this subsection, we describe our variables measuring the various determinants of insider trading discussed in Section 2. Appendix 2 summarizes these variables and their construction.

**Degree of portfolio diversification.** A test of the portfolio diversification hypothesis requires a measure for the degree of an insider's portfolio diversification, i.e. the proportion of an insider's wealth that she has invested in her insider stock. Given our data on each insider's personal wealth, we construct variables directly measuring an insider's degree of portfolio diversification. First, we define the variable  $PORTFI^*_{ijt}$  as a ratio of the market value of each insiders' holdings in her insider stock<sup>9</sup> to the value of her total wealth (the market value of her holdings in all insider and outsider stocks and the value of her other wealth) at 6-month intervals. For each insider  $i$  and her insider firm  $j$ , we then calculate the mean value of  $PORTFI^*_{ijt}$  over the sample period. Finally, for each day  $t$ , insider  $i$  and her insider firm  $j$ , we calculate the variable  $PORTFI_{ijt}$  as a difference between  $PORTFI^*_{ijt}$  and its time-series mean. We calculate the variable  $PORTF2_{ijt}$  in the same way except that we divide the market value of insider  $i$ 's holdings in insider firm  $j$  by the market value of her holdings in insider and outsider stocks on day  $t$ .

In essence,  $PORTFI_{ijt}$  and  $PORTF2_{ijt}$  are mean-adjusted variables measuring the extent to which the proportion of an insider  $i$ 's wealth invested in her insider stock  $j$  on a day  $t$  deviates from its long-term level. The greater the variables  $PORTFI_{ijt}$  and  $PORTF2_{ijt}$  the greater is the degree of an insider's under-diversification at a given point in time, thereby increasing both the likelihood that she will sell her insider stocks (logistic regressions) and the size of a sell transaction (tobit regressions). By using the

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<sup>9</sup> We control for insiders' use of derivatives to hedge their insider stock holdings by deducting the market value of the hedged proportion of holdings from the total holdings. Since we do not have detailed information on the parameters of each option, we have used an option delta value of 0.6 to calculate the proportion of an insider position hedged through derivatives, because several studies report that executive stock options typically have a delta of around 0.6 (e.g. Jensen and Murphy, 1990).

mean-adjusted wealth ratios we can also control for the fact that the great proportion of wealth invested in the insider stock may mechanically increase the likelihood of selling these stocks. We replicated all our analyses by using the ratios of insider holdings to total wealth ( $PORTF1^*_{ijt}$ ) and to stock wealth ( $PORTF2^*_{ijt}$ ) as such without this mean-adjustment and these results are similar to those reported in the paper.

**Personal liquidity.** We measure the level of an insider's personal liquidity as the sum of her annual salary and other taxable income obtained from her tax filings ( $INCOME_{it}$ ).

**Overconfidence.** We use two measures for insiders' overconfidence. First, based on Barber and Odean (2001), we use an insider's gender ( $GENDER_i$ ) as a measure of over-confidence.  $GENDER_i$  is a dummy variable with a value of one, if insider  $i$  is male, otherwise zero. Second, we measure CEO insiders' overconfidence ( $OVERCONF_{ij}$ ) as in Malmendier and Tate (2004) and Jin and Kothari (2008) by manually searching for articles referring to CEOs in the leading Swedish business journals (*Affärsvärlden*, *Dagens Industri*, *Veckans Affärer* and the business sections of the newspapers *Dagens Nyheter* and *Svenska Dagbladet*).

**Disposition effect and tax-loss selling.** We follow Grinblatt and Keloharju (2001) to construct the variables measuring the disposition effect ( $LOSS\_MOD_{ijt}$ ,  $LOSS\_LARGE_{ijt}$ ) and tax-loss selling ( $LOSS\_MOD\_DEC_{ijt}$  and  $LOSS\_LARGE\_DEC_{ijt}$ ). The capital losses and profits needed to construct these variables are calculated as follows: For each day, we calculate the net position (capital gain or loss) of each insider's holdings in her insider stock as a difference between the current market value of holdings and the known initial purchasing price of the holdings. Every time she buys more stocks or sells existing stocks, we recalculate her holdings accordingly. We also adjust holdings for stock splits and stock dividends. If an insider owns stocks of the firm

before she becomes an insider in that firm, or if she receives stocks through gifts or from her company as a part of the compensation plans, we cannot calculate the net position of the holdings, because the initial purchasing price of these stocks is unknown. In these cases, we set the net position equal at zero until she has sold all the stocks with unknown purchasing price and has purchased new stocks at a known price for the first time.<sup>10</sup> For each day, the net position of an insider's holdings indicates the paper gains or losses in her holdings. When an insider sells her insider stocks, she realizes all or part of the capital gains or losses depending on which proportion of the holdings she sells.

By comparing the size of the paper and realized losses on days when an insider sells her insider stocks vs. days when she does not sell, we can ascertain whether the disposition effect and tax-loss selling affect insider selling. A negative relation between insider selling and the variables measuring moderate or large paper or realized losses in the insider holdings (the variables  $LOSS\_MOD_{ijt}$  and  $LOSS\_LARGE_{ijt}$ ) would be an indication on whether insiders hold on to losing stocks. Accordingly, a positive relation between insider selling and the capital losses during the last five trading days of December would be an indication of insiders' tendency to sell their losing insider stocks in December<sup>11</sup>.

**Tax burden.** We follow Jin and Kothari (2008) to measure the tax burden associated with selling insider stocks ( $TAXBURDEN_{ijt}$ ). Specifically, we divide the total tax liability of the stocks owned by an insider by their current market value, where tax liability is the taxable gains times the capital gain tax rate (30 percent)<sup>12</sup>. We calculate

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<sup>10</sup> The cases when the initial purchasing stock price is unknown create bias in our measures of capital losses, because we do not observe all capital losses due to missing purchasing prices. However, the bias is towards reducing the significance of these variables in our empirical analyses.

<sup>11</sup> We have also used a window of the last ten trading days of December, and obtain results that are qualitatively similar to those based on the use of a five-trading-days window.

<sup>12</sup> While we include the tax-basis of granted stocks, stock acquired from the ESO exercises and purchased stocks in our measure of tax burden, Jin and Kothari (2008) also include the tax-basis of ESOs in their measure of the total tax burden. Unfortunately, our data do not contain information on the parameters of ESOs that would be needed to calculate the tax-basis of ESOs. Therefore, our measure for tax burden is

tax burden on a daily basis like we calculate the variables measuring the disposition effect and tax-loss selling described above.

**Future abnormal stock return.** We measure insiders' ability to generate abnormal stock returns from their trading with the variable  $LEADRET_{jt}$ , which is defined as the market-adjusted buy-and-hold stock return for the 18-month period following an insider trade that takes place on day  $t$  for firm  $j$ . We use an 18-month horizon for future returns, because earlier research reports that insiders take positions based on longer-term information (Lakonishok and Lee 2001 and Ke et al. 2003). We have also used a 12-month horizon for future returns, and obtain results that are qualitatively similar to those based on 18-month returns.

**Past abnormal stock return.** We measure insiders' tendency to follow contrarian strategy with the variable  $LAGRET_{jt}$ , which is defined as the market-adjusted buy-and-hold stock return for the 6-month period prior to day  $t$  for firm  $j$ .

**Control variables.** We include in our models several control variables that are also likely to affect insiders' trading decisions. We measure an increase in the selling pressure due to the new stocks received from stock grants ( $STOCKS_{ijt}$ ), stocks acquired through the exercise of executive stock options ( $EXERCISE_{ijt}$ ) and the market value of the underlying insider stocks of the executive stock options ( $OPTIONS_{ijt}$ ). We also include two dummy variables to control for the differential trading activity before and after earnings announcements ( $PRE_{jt}$  and  $POST_{jt}$ ). We also control for the short-term stock returns around the day when an insider trade takes place ( $RET_{jt}$ ,  $LEAD\_k_{jt}$ , and  $LAG\_k_{jt}$ ). We control for the effect of the differences in labor contracts among firms

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biased towards not reflecting the total amount of the tax burden. Because of this downward bias in the level of tax burden, we choose to use a dummy variable as a measure of the tax burden (taking a value of one, if there is a tax burden associated with stock holdings, otherwise zero). We have also conducted all our analyses using the continuous variable of the level of the tax burden. The results from univariate analysis show that the level of tax burden is significantly higher on days with insider sell transactions than on days without them ( $p < 0.018$ ). In tobit regressions, the parameter estimate for the level of the tax burden is significantly negative ( $p < 0.035$ ), while it is only marginally significant ( $p < 0.100$ ) in logistic regressions.

with firm-specific dummy variables ( $FIRM_{sj}$ ) and with a dummy variable for those insiders having a direct labor contract with a firm vs. board members ( $EXEC_{ijt}$ ). We also control for the effect of the number of firms in which a given insider is an insider ( $NINS_{it}$ ). In addition, we control for the mechanical relation between insider trading and the size of the insider holdings ( $VALUE_{ijt}$ ), i.e. insiders having a greater insider holdings may trade more frequently and in larger lot sizes simply because of the greater size of their insider holdings. Finally, we include in our models five yearly dummy variables for years 2000 to 2004 ( $YEAR_y$ ) to control for time-specific effects.

We divide all the variables that are measured in SEK ( $SELLVALUE_{ijt}$ ,  $BUYVALUE_{ijt}$ ,  $INCOME_{it}$ ,  $STOCKS_{ijt}$ ,  $EXERCISE_{ijt}$  and  $OPTIONS_{ijt}$ ) by the market value of an insider  $i$ 's insider holdings in firm  $j$  on day  $t$ <sup>13</sup>.

### 3.4. Preliminary data analysis

Table 3 presents descriptive statistics of the variables used in the empirical analyses based on all 5,227 observations of insider transactions. The results show that there is substantial variation in our two measures of the degree of portfolio-diversification ( $PORTF1_{ijt}$  and  $PORTF2_{ijt}$ ) needed in empirical analyses. The median value of future abnormal returns ( $LEADRET_{jt}$ ) is zero as expected given that our initial sample covers all listed firms. The mean value of future abnormal returns, however, is positive indicating that insider holdings are biased towards well-performing stocks.

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<sup>13</sup> We also divided the variables measured in SEK by the value of all stock holdings and by the value of total wealth, and the results of using these deflators are qualitatively similar to those reported in the paper. Regarding the variables  $STOCKS_{ijt}$ ,  $EXERCISE_{ijt}$  and  $OPTIONS_{ijt}$ , we have re-estimated all our regressions by using dummy variables with a value of one if the corresponding continuous variable is greater than zero, otherwise zero. These results are similar to those based on the continuous variables.

(Insert Table 3 about here)

Table 4 reports the results of unconditional univariate analyses of the various determinants of insider trading. This is accomplished by testing whether the mean values of the variables measuring the hypothesized reasons for insider selling and buying are significantly different between the 2,579 (2,648) days with insider sell (buy) transactions and the other 2,579 (2,648) days without insider sell (buy) transactions in our matched-pair sample. The results reported in Table 4 largely support the view that insiders have many other reasons for trading besides exploitation of private information. For instance, both of our measures of the level of an insider's portfolio diversification ( $PORTF1_{ijt}$  and  $PORTF2_{ijt}$ ) are significantly greater on days with insider sell transactions than on days without them. The results also indicate that male insiders sell and buy significantly more frequently than female insiders ( $GENDER_i$ ). In addition, insiders' moderate ( $LOSS\_MOD_{it}$ ) and large ( $LOSS\_LARGE_{it}$ ) capital losses and the tax burden associated with selling insider stocks ( $TAXBURDEN_{ijt}$ ) are significantly greater on days they do not sell than on days they sell.

Regarding the insiders' use of their private information, the results reported in Table 4 show that the future abnormal returns on an insider stock ( $LEADRET_{jt}$ ) are significantly smaller (greater) after insiders sell (buy) than on other days. This result suggests that insiders can time their trading successfully. In addition, greater future abnormal returns follow insider buying than selling. Insider purchases are associated with positive returns, but sales are not associated with negative returns. The magnitudes of the abnormal returns following insider transactions reported here are comparable to those reported in earlier studies.

(Insert Table 4 about here)

### 3.5. Model specifications

An important issue is to develop a model enabling us to utilize our detailed insider data. Earlier research on insider trading has mainly used variables such as net purchasing ratios to measure insiders' aggregate trading behavior. Since we have access to data on an individual insider-level, we do not aggregate the insider transactions data. Instead, we model both an insider's decision to trade (buy and sell) and the decisions concerning the size of a trade conditional on the determinants of trading. First, we model an insider's unobservable propensity to sell and buy her insider stocks in logistic regressions.<sup>14</sup> Second, we model the size of an insider's buy and sell transaction given that she has made a trade in tobit regressions. In other words, we regress the propensity to trade (logistic regressions) and the magnitude of the trade (tobit regressions) on the variables hypothesized to affect insider trading. An advantage of this research design is that it allows us to explore the joint role of alternative motives for insider trading, as we can include in our model several independent variables including control variables. For the sake of brevity, we report the results of our regression analyses only for logistic regressions, because tobit regressions give qualitatively similar results.

Denote an insider  $i$ 's unobservable propensity to sell stock of firm  $j$  at day  $t$  by  $prop_{sell_{ijt}}^*$  and the corresponding propensity to buy by  $prop_{buy_{ijt}}^*$ . We assume that exogenous variables  $X_{ijt}$  ( $Z_{ijt}$ ) affect the propensity to sell (buy) stocks according to the following linear functional form:  $prop_{sell_{ijt}}^* = \beta'X_{ijt} + \varepsilon_{ijt}$

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<sup>14</sup> This approach for explaining regular investors' trading decisions is used by e.g. Grinblatt and Keloharju (2001).

( $propbuy_{ijt}^* = \beta'Z_{ijt} + \omega_{ijt}$ ). Since we do not observe these propensities to sell and buy, but rather whether or not an insider trades and the size of the trade made, our observable variables are:

$$(1a) \quad SELL_{ijt} = \begin{cases} 0, & \text{if } prop_{sell}_{ijt}^* \leq 0 \\ 1, & \text{if } prop_{sell}_{ijt}^* > 0 \end{cases}$$

$$(1b) \quad BUY_{ijt} = \begin{cases} 0, & \text{if } prop_{buy}_{ijt}^* \leq 0 \\ 1, & \text{if } prop_{buy}_{ijt}^* > 0 \end{cases}$$

$$(2a) \quad SELLVALUE_{ijt} = \begin{cases} 0, & \text{if } prop_{sell}_{ijt}^* \leq 0 \\ prop_{sell}_{ijt}^*, & \text{if } prop_{sell}_{ijt}^* > 0 \end{cases}$$

$$(2b) \quad BUYVALUE_{ijt} = \begin{cases} 0, & \text{if } prop_{buy}_{ijt}^* \leq 0 \\ prop_{buy}_{ijt}^*, & \text{if } prop_{buy}_{ijt}^* > 0 \end{cases}$$

Assuming that the error terms  $\varepsilon_{ijt}$  and  $\omega_{ijt}$  follow a standardized logistic distribution (e.g. Green, 2003), we obtain the familiar logit models from Models (1a) and (1b) as follows:

$$(1a') \quad \text{logit}(P(SELL_{ijt} = 1 | X_{ijt})) = \Lambda(\beta'X_{ijt})$$

$$(1b') \quad \text{logit}(P(BUY_{ijt} = 1 | Z_{ijt})) = \Lambda(\beta'Z_{ijt}),$$

where  $\Lambda(\cdot)$  denotes the cumulative logistic distribution. In Models (2a) and (2b) we assume that the error terms follow a normal distribution rendering conventional tobit models.

For insider selling, we estimate the following conditional mean equations in the logistic and tobit models:

Model (3):

$$\begin{aligned}
\beta'X_{ijt} = & \alpha_0 + \beta_1 PORTF_{ijt} + \beta_2 INCOME_{it} + \beta_3 GENDER_i + \beta_4 OVERCONF_i \\
& + \beta_5 TAXBURDEN_{ijt} + \beta_6 LOSS\_MOD_{ijt} + \beta_7 LOSS\_LARGE_{ijt} \\
& + \beta_8 LOSS\_MOD\_DEC_{ijt} + \beta_9 LOSS\_LARGE\_DEC_{ijt} + \beta_{10} LEADRET_{jt} \\
& + \beta_{11} LAGRET_{jt} + \beta_{12} STOCKS_{ijt} + \beta_{13} EXERCISE_{ijt} + \beta_{14} OPTIONS_{ijt} \\
& + \beta_{15} VALUE_{ijt} + \beta_{16} PRE_{jt} + \beta_{17} POST_{jt} + \beta_{18} RET_{jt} + \sum_{k=1}^5 \gamma_k LEAD\_k_{jt} \\
& + \sum_{k=1}^5 \lambda_k LAG\_k_{jt} + \sum_{y=2000}^{2004} \mu_y YEAR\_y + \sum_{s=1}^{296} \delta_s FIRM\_s_j + \delta EXEC_{ijt} + \varphi NINS_{it},
\end{aligned}$$

where the independent variables are as described above in Section 3.3.2. and in Appendix 2. Note that  $PORTF_{ijt}$  in Model (3) is either  $PORTF1_{ijt}$  or  $PORTF2_{ijt}$  described in Section 3.3.2. and in Appendix 2.

For insider buying, we estimate the following conditional mean equations in the logistics and tobit models:

Model (4):

$$\begin{aligned}
\beta'X_{ijt} = & \alpha_0 + \beta_1 PORTF_{ijt} + \beta_2 GENDER_i + \beta_3 OVERCONF_i \\
& + \beta_4 LEADRET_{jt} + \beta_5 LAGRET_{jt} + \beta_6 PRE_{jt} + \beta_7 POST_{jt} + \beta_8 RET_{jt} \\
& + \sum_{k=1}^5 \gamma_k LEAD\_k_{jt} + \sum_{k=1}^5 \lambda_k LAG\_k_{jt} + \sum_{y=2000}^{2004} \mu_y YEAR\_y \\
& + \sum_{s=1}^{296} \delta_s FIRM\_s_j + \delta EXEC_{ijt} + \varphi NINS_{it},
\end{aligned}$$

where the dependent and independent variables<sup>15</sup> are as described above in Section 3.3.2. and in Appendix 2.  $PORTF_{ijt}$  in Model (4) is either  $PORTF1_{ijt}$  or  $PORTF2_{ijt}$  described in Section 3.3.2. and in Appendix 2.

#### 4. Empirical analysis of insiders' motives to buy and sell

##### 4.1. Portfolio-diversification as a motive for insider selling

Table 5 reports the results of estimating logit models to explore the incremental effects of the various motives for insider trading. Panel A of Table 5 reports the results for insider selling. The estimated parameters for the diversification measures based on total wealth ( $PORTF1_{ijt}$ ) and stock wealth ( $PORTF2_{ijt}$ ) are significantly positive supporting the portfolio-diversification hypothesis. In other words, insiders with unbalanced portfolios (towards insider stock) relative to their average holdings over the sample period have a higher propensity to sell their insider stocks than insiders with less unbalanced portfolios.

We provide further insights into the diversification-driven selling by exploring how insiders trade on their outsider stocks in connection with insider selling and how their total wealth changes around sales of insider stocks<sup>16</sup>. If insiders sell for reasons of diversification, there should be a permanent downward shift in the proportion of an insider's wealth invested in her insider stock after insider selling. If they sell not only their insider stocks but also outsider stocks, it is less likely that there will be a decrease

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<sup>15</sup> We also include in Models (3) and (4) the market value of equity ( $MV_{jt}$ ), the price-to-earnings ( $PE_{jt}$ ) and the price-to-book ratios of the firm ( $PB_{jt}$ ), because insiders may trade on the basis of the relative valuation of their insider stock. Moreover, Jin and Kothari (2008) suggest that the size of the firm and the price-to-book ratio control for potential differences in the labor market contracts between firms and CEOs. Due to the missing data for the earnings and book values of equity in Thomson Datastream, we lose several firms when including these variables. However, the results for this sub-sample are qualitatively similar to those for the full sample reported in the paper.

<sup>16</sup> We thank the referee for raising this issue.

in the relative proportion of their insider and outsider stock holdings. Figure 1 shows that the proportion of an insider's total and stock wealth invested in the insider stock permanently decreases after an insider sell transaction<sup>17</sup>. This result supports the view that insiders sell their insider stocks to reduce the proportion of their wealth invested in their insider stocks. This can also be seen in Figure 2 showing the SEK values of insider stock holdings and outside wealth around an insider sell transaction<sup>18</sup>. The figure shows that the SEK value of insider holdings decreases after insider selling, whereas the SEK value of the outside wealth increases. Both Figures 1 and 2 also show that the portfolio re-balancing continues after an insider sale indicating consequent sales of insider stocks.

#### 4.2. Other motives for insider selling

Panel A of Table 5 also reports the results for other motives for insider selling. Regarding the role of insiders' overconfidence in their trading decisions, we find that male insiders exhibit a greater propensity to sell than do female insiders ( $GENDER_i$ ). This finding indicates that Barber and Odean's (2001) findings on the disparate trading behavior between male and female investors also apply to insider investors. The measure of the degree of CEO insiders' overconfidence ( $OVERCONF_{ij}$ ) is not, however, related to insider selling<sup>19</sup>. The results also show that the tax burden associated with selling insider stocks ( $TAXBURDEN_{ijt}$ ) deters insiders from selling these stocks. In other words, Jin and Kothari's (2008) results on the negative effect of the tax burden

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<sup>17</sup> The untabulated results from the t-tests show that the changes in the diversification variables reported in Figure 1 are significantly negative at the 0.001 level of significance.

<sup>18</sup> The values are the median SEK values of the holdings for our sample of all 2,579 insider sale transactions. We report median rather than mean values to avoid the effect of a few extreme values of the holdings. The results based the mean values are qualitatively similar to those reported in the paper.

<sup>19</sup> We also estimate Model (3) for the subsample containing only CEO insiders, but the variable  $OVERCONF_i$  remains insignificant in these regressions.

associated with the selling of vested stocks on CEOs' willingness to sell their vested equity seem also to apply to broader categories of insiders.

Our results show that the level of an insider's personal liquidity increases her selling decisions ( $INCOME_{it}$ ), but this result is only marginally significant ( $p < 0.100$ ). We find clear evidence for the disposition effect ( $LOSS\_MOD_{ijt}$  and  $LOSS\_LARGE_{ijt}$ ), i.e. insiders tend to hold on to losing insider stocks (Shefrin and Statman, 1985; Odean, 1998 and Grinblatt and Keloharju, 2001). Hence, overall, insiders would appear exhibit the same behavioral biases in their selling (overconfidence and the disposition effect) reported for regular investors in other studies. Finally, we find evidence for insiders' tendency to realize their capital losses in the end of the year ( $LOSS\_MOD\_DEC_{ijt}$  and  $LOSS\_LARGE\_DEC_{ijt}$ ).

Regarding the other variables, our results reported in panel A of Table 5 show that insiders' ability to time their selling ( $LEADRET_{jt}$ ) remains even after controlling for the other determinants of selling. The results also show that insiders are contrarian investors ( $LAGRET_{jt}$ ) as has been reported, for example, by Piotroski and Roulstone (2005). Consistent with the results reported by Ofek and Yermack (2000) and Piotroski and Roulstone (2005), our results show that insiders tend to sell their stocks after they have received new stocks through new grants of stocks ( $STOCKS_{ijt}$ ) or through option exercises ( $EXERCISE_{ijt}$ ). However, we do not find evidence that insiders sell their stocks after receiving new executive stock options ( $OPTIONS_{ijt}$ ).

Insiders with the greatest insider holdings in terms of the SEK value of holdings ( $VALUE_{ijt}$ ) sell more frequently. Consistent with Noe (1999) and Huddart et al. (2007) we find that insiders sell less before earnings announcement days and they sell more after earnings announcement days ( $PRE_{ijt}$  and  $POST_{ijt}$ ). In sum, the results reported in panel A of Table 5 show that insiders sell their insider stocks for many personal reasons

and they do not sell solely based on their superior information relative to other market participants.

We next provide some insight into the economic significance of our results by reporting marginal changes in an insider's probability to sell her insider stocks as a result of changing the levels of the explanatory variables in Model (3). The marginal effects show the marginal changes in the probability of selling for a unit increase in each explanatory variable while holding the other explanatory variables at their mean values.<sup>20</sup> In panel A of Table 5, the variables with the greatest marginal effects include *LOSS\_LARGE\_DEC<sub>ijt</sub>* (0.752), *STOCKS<sub>ijt</sub>* (0.363), *LOSS\_LARGE<sub>ijt</sub>* (-0.334), *EXERCISE<sub>ijt</sub>* (0.278), *TAXBURDEN<sub>ijt</sub>* (-0.288) and *PORTF1<sub>ijt</sub>* (0.261). Therefore, for example, a one unit increase in the measure of the degree of portfolio-diversification increases the probability of selling insider stock by 26.1 percent.

(Insert Table 5 about here)

(Insert Figures 1 and 2 about here)

#### 4.3. Motives for insider buying

Panel B of Table 5 reports the results of exploring the reasons for insider buying. As expected, under-diversification decreases insiders' propensity to buy more insider stocks (*PORTF1<sub>ijt</sub>* or *PORTF2<sub>ijt</sub>*). Regarding insiders' overconfidence (*GENDER<sub>i</sub>*), the

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<sup>20</sup> In a logit model, the marginal effect (ME) is the derivative of the cumulative density function with respect to the corresponding explanatory variable as follows:

$$ME = \frac{\partial E[y|X]}{\partial X} = \frac{\exp(x'\beta)}{(1 + \exp(x'\beta))^2} \beta, \text{ where } \beta \text{ is a vector of the parameter estimates of the model and } X \text{ is}$$

the vector of explanatory variables.  $\frac{\exp(x'\beta)}{(1 + \exp(x'\beta))^2}$  is evaluated at the mean of X.

results show that, as in the case of insider selling, male insiders have a greater propensity to buy than female insiders. The estimated parameter for future abnormal returns ( $LEADRET_{jt}$ ) is not significant, although the relation between insider buying and future abnormal return was significant in the unconditional analyses in Table 4. In other words, the other determinants of insider buying subsume, at least to some extent, the effect of insiders' ability to time their buying. This may reflect the fact that insiders may be more cautious when timing their purchases than when timing their sales because of the risk of regulatory scrutiny (e.g. Seyhun, 1998). In addition, it should be noted that even though insiders cannot time the buying of their insider stocks when controlling for other determinants of buying, the results reported in Table 4 show that the stocks insiders buy have high positive abnormal returns on non-trading days, too. In other words, insiders tend to buy stocks that perform so well that the optimal timing of the purchases of these stocks is not a crucial issue to ensure positive returns<sup>21</sup>.

The results reported in panel B of Table 5 also indicate that CEO insiders' overconfidence ( $OVERCONF_{ij}$ ) increases their propensity to buy. In addition, insiders buy less before earnings announcement days and they buy more after earnings announcement days. We also calculate the marginal changes in the probability of buying insider stocks for a unit increase in each explanatory variable while holding the other explanatory variables at their mean values. The variables with the greatest marginal effects in the logistic model in panel B of Table 5 include  $OVERCONF_{ij}$  (0.237),  $PRE_{jt}$  (-0.195),  $POST_{jt}$  (0.150) and  $GENDER_i$  (0.120).

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<sup>21</sup> We also directly test whether the future profitability of the firms' insiders buy is greater than that of the firms they sell. In other words, we compare the future profitability across the firms insiders buy and the firms they sell. We calculate the future profitability as a percentage change in the return-to-equity ratio (ROE) from the latest published annual financial report to the next annual financial report to be published. The results indicate that the future profitability of the firms insiders buy is significantly greater than that of the firms they sell ( $t=2.58$ ,  $p<0.010$ ).

#### 4.4. Interactions between portfolio re-balancing objectives and the use of superior information

##### 4.4.1. Insider selling before earnings announcements

While it has consistently been reported that insider trading activity decreases before earnings announcements because of the potential political and litigation costs of such trading, there is nevertheless some insider trading before earnings announcements (e.g. Huddart et al., 2007). In our sample, 9.6 percent of the insider trades occur before quarterly earnings announcements. Insiders may trade profitably before earnings announcements if the profits from such trading exceed the potential political and litigation costs. In other words, an insider may use her private information to re-balance her portfolio before a bad news earnings announcement if the savings from avoiding the likely losses in her insider stockholdings due to an imminent drop in the stock price are large relative to potential political and litigation costs.

The increased legal penalties for selling prior to a bad news earnings announcement may also offset the gains from such trading. That would prevent selling prior to bad news earnings announcements. However, penalties for illegal insider trading are only incurred if such trading is detected and the court imposes penalties. In fact, as Seyhun (1998) points out, the stiffening criminal penalties for insider trading have made it less likely that suspicious insider trading meets the definition of illegal trading. This paradox is due to the fact that the burden of proof has increased.

To examine insiders' trading behavior prior to earnings announcements, we re-estimate the logistic and tobit regression models for insider selling (Model 3) by including in our models two new explanatory variables:  $EANEG_{jt}$ , which is a dummy

variable with a value of one if market-adjusted buy-and-hold return over days -1 to +1 relative to the earnings announcement day (i.e. the event-period abnormal return) for the firm  $j$  is negative, otherwise zero<sup>22</sup> and an interaction variable between this dummy variable and the proportion of an insider's total wealth invested in her insider stock ( $PORTF1*_{ijt} \times EANEG_{jt}$ )<sup>23</sup>. Out of the 5,158 observations of sell transactions in our sample, 871 occur during a twenty-trading-day window prior to quarterly earnings announcement. Out of these 871 observations, 296 observations are days with insider sell transactions and the remaining 575 observations are days with no transactions. We estimate the re-specified logit and tobit models with the subsample of these 871 observations for insider selling occurring during the twenty-trading-day window prior to quarterly earnings announcement day.

The untabulated results from these regressions show that the estimated parameter for the variable  $EANEG_{jt}$  is significantly negative in both logistic and tobit regressions ( $p < 0.050$ ) indicating that insiders sell less before bad news than good news earnings announcements. Most importantly, the estimated parameter for the interaction variable  $PORTF1*_{ijt} \times EANEG_{jt}$  is significantly positive ( $p < 0.001$ ). This result indicates that even though negative news implies less insider selling in general, insiders' willingness to sell prior to bad news earnings announcements increases in proportion to the wealth invested in the insider stock. In other words, insiders who have invested a great proportion of their wealth in their insider stocks are, on average, more prone to sell before bad news earnings announcements, most likely because the expected savings from avoiding the likely losses on their insider stockholdings are great. The fear of losses seems to be a significant factor affecting the decision. This behavior is consistent

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<sup>22</sup> The use of a two-day return window is based on Morse (1981), Noe (1999) and Huddart et al. (2007).

<sup>23</sup> We re-estimate Model (3) also with the interaction variable  $PORTF2*_{ijt} \times EANEG_{jt}$ , and obtain similar results.

with the prospect theory proposed by Kahneman and Tversk (1979). In addition, the results for a tobit regression show that the size of insiders' sell transactions made before bad news earnings announcements also increases in proportion to the wealth invested in the insider stocks<sup>24</sup>.

(Insert Table 6 about here)

The reasoning for insider selling prior to bad news earnings announcements described above also implies that an insider should buy before a good news earnings announcement. We also test this hypothesis, but do not find support for it. This asymmetric insiders' trading behavior before bad and good news announcements may reflect the fact that selling before bad news earnings announcements prevents losses, whereas the decision not to buy before good news earnings announcements results in reduced profits. Hence, the fear of losses in existing insider holdings may be stronger than the greed for new profits, as suggested by the prospect theory of Kahneman and Tversk (1979).

#### 4.4.2. Future abnormal stock returns and insider selling

Lakonishok and Lee (2001) report that insider selling does not predict future long-term returns. However, Scott and Xu (2004) report that large (small) insider sales that also account for large (small) percentages of an insider's holdings in her insider firm predict significantly negative (positive) future long-term returns. These findings, together with the results reported in Table 5, raise the question of whether insider

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<sup>24</sup> Since the model includes the size of an insider holding as a control variable, this result is not due to the fact that insiders with a greater amount of wealth simply trade in larger units.

selling due to portfolio re-balancing objectives affects the predictive power of insider selling for future returns. Obviously, insiders who have allocated a great proportion of their wealth to insider stock have strong economic incentives to time their selling decisions better than those who have allocated a small proportion of their wealth to insider stock. Conversely, insiders may sell for the sake of portfolio re-balancing even if they anticipate positive abnormal returns for the insider stock<sup>25</sup>. This alternative reasoning implies that the extent to which insider selling predicts future returns should be negatively related to the amount of an insider's wealth invested in insider stock.

We address the above-mentioned issues by re-estimating Model (3) with the interaction variable between the proportion of an insider's total wealth invested in her insider stock and the future long-term abnormal returns ( $PORTF1^*_{ijt} \times LEADRET_{jt}$ )<sup>26</sup>. The untabulated results of these estimations show that the interaction variable  $PORTF1^*_{ijt} \times LEADRET_{jt}$  is significantly negative both in logistic and tobit regressions ( $p < 0.001$ ). These findings suggest that insiders who have allocated a great proportion of their wealth to insider stock are better at timing their selling as opposed to those who have allocated a small proportion of their wealth to insider stock.

We conclude our analyses on the future abnormal returns by calculating the average 18-months abnormal returns after an insider sell transaction ( $LEADRET_{jt}$ ) in the four categories of the proportion of an insider's wealth invested in her insider stock ( $PORTF1^*_{ijt}$  and  $PORTF2^*_{ijt}$ ) and the market value of her insider holdings ( $VALUE_{ijt}$ ). The untabulated results show that significantly negative (positive) long-term abnormal

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<sup>25</sup> Even though insiders have an information advantage relative to other market participants, it should be noted that insiders also always carry some level of risk in their investments in their insider stocks. If insiders had perfect knowledge about the future stock returns, they would not sell their stocks in the case of positive future returns. This, however, is an unrealistic assumption, because stock prices move for many reasons that insiders cannot predict. For instance, changes in the macro-economic or industry conditions are largely unpredictable for insiders. Also, there are unexpected changes even in the operating environment of the firm.

<sup>26</sup> We re-estimate Model (3) also with the interaction variable  $PORTF2^*_{ijt} \times LEADRET_{jt}$ , and obtain similar results.

returns follow those sell transactions that are made by insiders with the largest (smallest) proportion of their wealth invested in their insider stocks. In addition, negative abnormal returns follow the sales made by insiders with the greatest SEK value of insider holdings.

## **5. Conclusions**

In this paper, we utilize unique data on Swedish insiders to explore various personal motives behind their trading decisions. Our data comprise detailed information on insiders' wealth (holdings in their insider and outsider stocks and other wealth), taxable income (salaries and other income) and gender. This data set allows us to investigate empirically whether insiders' portfolio diversification/re-balancing needs and other personal motives for trading have an incremental role with respect to their superior information when explaining their trading behavior. We contribute to insider trading studies that usually assume that insiders trade solely on the basis of their superior information relative to other market participants.

Our main results can be summarized as follows. We find strong support for the view that insiders sell for diversification objectives. Our results also show that the tax burden associated with selling insider stocks deters insiders from selling these stocks. This result indicates that Jin and Kothari's (2008) results on CEOs reluctance to realize the tax burden associated with their vested equity apply to all insiders. We also find that insiders hold on to their losing insider stocks (disposition effect) and that male insiders trade more frequently than female insiders (overconfidence). These are interesting findings, as they indicate that behavioral biases such as the disposition effect and overconfidence also hold true for insider investors.

Consistent with Huddart et al. (2007), we find that, on average, insiders sell less before a bad news earnings announcement. However, among those insiders who sell before bad news earnings announcements, we find that insiders who have allocated a great (small) proportion of their wealth in the insider stock sell more (less) before the bad news earnings disclosures. We interpret this finding as evidence that insiders trade prior to bad news earnings disclosures if the expected savings due to avoiding the likely losses are greater than the expected legal and political costs of such trading. Finally, we find that insider selling is informative for future returns among those insiders who have the greatest proportion of wealth allocated to insider stocks and thereby have the greatest economic incentives to time their selling. All these results are robust for the use of various control variables.

We feel that the results of this paper have important implications for researchers, investors and regulators analyzing insider trading, because they show that insiders trade not only because they have an information advantage relative to other market participants, but also for other more personal reasons.

## **Appendix 1.** Swedish insider legislation

This appendix briefly discusses the Swedish insider legislation and its key milestones and compares it with that in the USA. The current insider legislation in Sweden is from January 2001, when the previous legislation was replaced by the Insider Penal Act (2000:1086) and the Act Concerning Reporting Obligations for Certain Financial Instruments (2000:1087). The US insider legislation was the basis for the present Swedish legislation. Consequently, the Swedish insider legislation is quite close to that of the USA although some differences persist, one of them being the penalties. The Insider Trading and Securities Fraud Enforcement Act of 1988 stipulates a maximum of ten years in prison for committing insider trading crimes in the USA, while the maximum penalty in Sweden is four years' imprisonment. The main difference between the US and Swedish legislation is that illegal insider trading is both a criminal and civil offence in the USA but only a criminal offence in Sweden. This means that the US Security and Exchange Commission (SEC) has a civil enforcement authority that the corresponding Swedish Financial Supervisory Authority (SFSA) lacks. The key milestones of the development of the Swedish insider legislation are as follows:

- 1985. The first law in Sweden prohibiting insider trading was passed. Trading in securities while in possession of non-public, company-related information became illegal. The penalty for violating the law was from six months to two years in prison.
- 1989. Sweden got its first conviction for illegal insider trading.
- 1991. Insider regulations were tightened. A first step in harmonizing Swedish insider legislation with international laws. The European Union Directive on the Regulation of Insider Trading (EEC Directive 89/592) was incorporated into Swedish law. The maximum term of imprisonment was raised from two to four years.

- 1997. Insider trading was further restricted by the addition of a short-term trading rule to the Insider Act. With a few exceptions, such as decreasing stock price, insiders are not allowed to divest themselves of their investments earlier than three months following acquisition.
- 2001. Two new insider laws were introduced. The previous legislation was replaced by the Insider Penal Act (2000:1086) and the Act Concerning Reporting Obligations for Certain Financial Instruments (2000:1087). The penalty in the normal case was toughened. Previous administrative fines were replaced by imprisonment. The maximum prison sentence in the normal case of two years was retained however. It now became illegal to divulge inside information.
- 2005. The Market Abuse Penal Act (2005:377) complying with EEC Directive 2003/6/EC was enacted.

## Appendix 2. Determinants of insider trading and variables measuring these determinants

Determinant	Variable	Description
Diversification need	$PORTF1_{ijt}$	The ratio of the market value of insider $i$ 's holdings in insider stock $j$ to the value of her total wealth (the market value of her holdings in all insider and outsider stocks and the value of her other wealth) on day $t$ minus the time-series mean of this ratio calculated over the sample period for insider $i$ and her insider stock $j$ .
	$PORTF2_{ijt}$	The ratio of the market value of insider $i$ 's holdings in insider stock $j$ to the market value of her holdings in all insider and outsider stocks on day $t$ minus the time-series mean of this ratio calculated over the sample period for insider $i$ and her insider stock $j$ .
Over-confidence	$GENDER_i$	A dummy variable with a value of one, if insider $i$ is male, otherwise zero.
	$OVERCONF_{ij}$	The value of the measure of the CEO insiders' overconfidence based on Malmendier and Tate (2004) and Jin and Kothari (2008), if insider $i$ is a CEO of firm $j$ , otherwise zero.
Liquidity need	$INCOME_{it}$	Insider $i$ 's annual income (salary and other taxable income) on day $t$ .
Disposition effect	$LOSS\_MOD_{ijt}$	A dummy variable with a value of one, if capital losses in an insider $i$ 's holdings in insider firm $j$ are moderate (<50 percent) on day $t$ , otherwise zero.
	$LOSS\_LARGE_{ijt}$	A dummy variable with a value of one, if capital losses in an insider $i$ 's holdings in insider firm $j$ are large (>50 percent) on day $t$ , otherwise zero.
Tax burden	$TAXBURDEN_{ijt}$	A dummy variable with a value of one, if there is a tax burden associated with an insider $i$ 's holdings in insider firm $j$ on day $t$ , otherwise zero. Tax burden is the ratio of the total SEK tax liability of these stocks by their current market value, where tax liability is the taxable gains times the capital gain tax rate (30 percent).
Tax-loss selling	$LOSS\_MOD\_DEC_{ijt}$	A dummy variable with a value of one, if capital losses are moderate and day $t$ is from the last five trading days of December, otherwise zero.
	$LOSS\_LARGE\_DEC_{ijt}$	A dummy variable with a value of one, if capital losses are large and day $t$ is from the last five trading days of December, otherwise zero.
Future returns	$LEADRET_{jt}$	The market-adjusted buy-and-hold stock return for the 18-month period after day $t$ for firm $j$ .
Past returns	$LAGRET_{jt}$	The market-adjusted buy-and-hold stock return for the 6-month period prior to day $t$ for firm $j$ .
Control variables	$STOCKS_{ijt}$	The market value of new insider stocks of firm $j$ granted to insider $i$ during a six-month period prior to day $t$ .

$EXERCISE_{ijt}$	The market value of new insider stocks of firm $j$ that insider $i$ has acquired through the exercise of executive stock options during a six-month period prior to day $t$ .
$OPTIONS_{ijt}$	The market value of the underlying insider stock of the executive stock options of firm $j$ granted to insider $i$ during a six-month period prior to day $t$ .
$VALUE_{ijt}$	The market value of insider $i$ 's holdings in insider stock $j$ on day $t$ .
$PRE_{jt}$	A dummy variable with a value of one, if day $t$ falls within a twenty-trading-day window prior to quarterly earnings announcement day for firm $j$ , otherwise zero.
$POST_{jt}$	A dummy variable with a value of one if day $t$ falls within a twenty-trading-day window after quarterly earnings announcement day for firm $j$ , otherwise zero.
$RET_{jt}$	The market-adjusted daily stock return for firm $j$ on day $t$ .
$LEAD_{kjt}$	The market-adjusted daily stock return for firm $j$ for each trading day during a five-trading-day period after day $t$ , i.e. $k \in (1,2,3,4,5)$ .
$LAG_{kjt}$	The market-adjusted daily stock return for firm $j$ for each trading day during a five-trading-day period prior to day $t$ , i.e. $k \in (1,2,3,4,5)$ .
$YEAR_y$	The five yearly dummy variables for years 2000 to 2004.
$FIRM_sj$	Dummy variables for each firm.
$EXEC_{ijt}$	A dummy variable with a value of one, if insider $i$ is a CEO or another executive in the firm $j$ on day $t$ , and zero if she is a board member.
$NINS_{it}$	A square root of the number firms in which an insider $i$ is an insider on day $t$ .
$PE_{jt}$	The ratio of the closing stock price for firm $j$ at the end of a calendar month prior to day $t$ to annual earnings from the previous fiscal year.
$PB_{jt}$	The ratio of the closing stock price for firm $j$ at the end of a calendar month prior to day $t$ to the book value of equity from the previous fiscal year.
$MV_{jt}$	Closing stock price for firm $j$ at the end of a calendar month prior to day $t$ multiplied by the number of shares outstanding.

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Notes:

We construct the variable  $OVERCONF_{ij}$  by calculating the number of articles describing a given CEO as confident, optimistic or conservative and construct the variable measuring CEOs' overconfidence as in Malmendier and Tate (2004). When classifying the articles, we use the same key words as Malmendier and Tate (2004), but we naturally translated them into Swedish. The variable  $OVERCONF_{ij}$  is a dummy variable with a value of one, if the number of articles that portray the CEO insider as confident or optimistic is greater than the number of articles that portray her as not confident, not optimistic, reliable, cautious, conservative, practical, frugal or steady, otherwise zero.

For CEOs with no articles found and for other insiders but CEOs, we code the variable with a value of zero. We deflate the variables  $INCOME_{it}$ ,  $STOCKS_{ijt}$ ,  $EXERCISE_{ijt}$  and  $OPTIONS_{ijt}$  by the value of insider holdings (and, alternatively, by the value of all stock holdings and by the value of total wealth).

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**Table 1.**

Summary statistics on Swedish insiders

	N (Total = 1,723)	%
<i>Panel A: Gender</i>		
Males	1,524	88.45
Females	199	11.55
	1,723	100.00
<i>Panel B: Age (in years)</i>		
0 – 29	35	2.03
30 – 39	327	18.98
40 – 49	619	35.93
50 – 59	561	32.56
60 – 69	169	9.81
70 –	12	0.70
	1,723	100.00
<i>Panel C: Position as an insider</i>		
Board member	628	36.45
CEO	332	19.27
Other position	763	44.28
	1,723	100.00

Notes:

The table reports distributions of insiders' gender, age and position as insiders in our sample.

**Table 2.**

Summary statistics on Swedish insiders' taxable income, wealth and trading activity

	Mean	Median	Min	Max
Annual taxable income	1,447	885	0	28,012
Value of insider stockholdings	38,306	284	0	52,639,509
Value of outsider stockholdings	1,198	69	0	95,697
Value of other wealth	8,346	18	0	3,647,047
# of insider firms owned	1.23	1.00	1.00	8.0
# of outsider firms owned	4.91	3.00	0.00	65.00
# of sell transactions	2.56	1.00	1.00	68.00
# of buy transactions	2.39	1.00	1.00	66.00
Value of a sell transaction	1,930	232	10	440,440
Value of a buy transaction	1,481	113	10	437,536

Notes:

Annual taxable income and the values of insider stockholdings, outsider stockholdings, other wealth, buy-transaction and sell-transaction are in thousands of SEK. 1 SEK is equal to 0.14 USD.

**Table 3.**

Descriptive statistics of the key variables used in the regressions

Variable	Mean	Median	Standard deviation	Min	Max
<i>PORTF1<sub>ijt</sub></i>	0.017	0.000	0.184	-0.770	0.796
<i>PORTF2<sub>ijt</sub></i>	0.017	0.002	0.165	-0.873	0.729
<i>INCOME<sub>it</sub></i>	66.973	1.348	1,745	0.000	115,427
<i>GENDER<sub>i</sub></i>	0.921	1.000	0.269	0.000	1.000
<i>OVERCONF<sub>ij</sub></i>	0.025	0	0.155	0	1.000
<i>TAXBURDEN<sub>ijt</sub></i>	0.040	0	0.203	0	1.000
<i>LOSS_MOD<sub>ijt</sub></i>	0.040	0	0.196	0	1.000
<i>LOSS_LARGE<sub>ijt</sub></i>	0.021	0	0.145	0	1.000
<i>LOSS_MOD_DEC<sub>ijt</sub></i>	0.001	0	0.034	0	1.000
<i>LOSS_LARGE_DEC<sub>ijt</sub></i>	0.001	0	0.028	0	1.000
<i>LEADRET<sub>jt</sub></i>	0.165	0.000	0.735	-0.996	4.799
<i>LAGRET<sub>jt</sub></i>	0.117	0.044	0.529	-0.977	4.804
<i>STOCKS<sub>ijt</sub></i>	0.546	0	11.127	0	232.349
<i>EXERCISE<sub>ijt</sub></i>	0.040	0	0.867	0	30.298
<i>OPTIONS<sub>ijt</sub></i>	0.001	0	0.063	0	4.363
<i>VALUE<sub>ijt</sub></i>	2,225	935	4,854	0	229,433
<i>PRE<sub>jt</sub></i>	0.133	0.000	0.340	0.000	1.000
<i>POST<sub>jt</sub></i>	0.355	0.000	0.478	0.000	1.000
<i>LAG_1<sub>jt</sub></i>	0.001	0.000	0.042	-0.465	0.357
<i>LAG_2<sub>jt</sub></i>	0.001	0.000	0.041	-0.342	0.423
<i>LAG_3<sub>jt</sub></i>	0.001	0.000	0.043	-0.465	0.419
<i>LAG_4<sub>jt</sub></i>	0.001	0.000	0.042	-0.374	0.419
<i>LAG_5<sub>jt</sub></i>	0.001	0.000	0.038	-0.374	0.391
<i>RET<sub>jt</sub></i>	0.004	0.001	0.047	-0.465	0.440
<i>LEAD_1<sub>jt</sub></i>	0.001	0.000	0.039	-0.493	0.440
<i>LEAD_2<sub>jt</sub></i>	0.001	0.000	0.038	-0.465	0.419
<i>LEAD_3<sub>jt</sub></i>	0.001	0.000	0.037	-0.465	0.404
<i>LEAD_4<sub>jt</sub></i>	0.001	0.000	0.037	-0.293	0.404
<i>LEAD_5<sub>jt</sub></i>	0.001	0.000	0.039	-0.267	0.499
<i>EXEC<sub>ijt</sub></i>	0.555	1.000	0.497	0	1.000
<i>NINS<sub>it</sub></i>	1.155	1.000	0.357	1.000	3.162

Notes:

This table reports summary statistics of the variables used in the empirical analyses based on all 5,227 observations of insider transactions. All variables are as defined in Appendix 2.

**Table 4.**

Unconditional analysis of the determinants of insider trading

	Days with insider transactions	Days without insider transactions	T-test for difference
<i>Panel A: Sell transactions (N = 2,579)</i>			
<i>PORTF1<sub>ijt</sub></i>	0.057	0.004	<b>-10.44 (0.000)</b>
<i>PORTF2<sub>ijt</sub></i>	0.052	0.004	<b>-10.77 (0.000)</b>
<i>GENDER<sub>i</sub></i>	0.922	0.885	<b>-4.53 (0.000)</b>
<i>OVERCONF<sub>ij</sub></i>	0.016	0.014	-0.34 (0.731)
<i>TAXBURDEN<sub>ijt</sub></i>	0.020	0.051	<b>6.12 (0.000)</b>
<i>INCOME<sub>it</sub></i>	23.463	78.622	<b>2.64 (0.008)</b>
<i>LOSS_MOD<sub>ijt</sub></i>	0.029	0.046	<b>3.24 (0.001)</b>
<i>LOSS_LARGE<sub>ijt</sub></i>	0.016	0.050	<b>6.99 (0.000)</b>
<i>STOCKS<sub>ijt</sub></i>	0.024	0.001	<b>-2.11 (0.035)</b>
<i>EXERCISE<sub>ijt</sub></i>	0.080	0.001	<b>-3.24 (0.001)</b>
<i>OPTIONS<sub>ijt</sub></i>	0.001	0.009	1.26 (0.208)
<i>LEADRET<sub>jt</sub></i>	0.000	0.190	<b>10.39 (0.000)</b>
<i>LAGRET<sub>jt</sub></i>	0.207	0.054	<b>-10.69 (0.000)</b>
<i>VALUE<sub>ijt</sub></i>	2.175	1.401	<b>-9.43 (0.000)</b>
<i>PRE<sub>ijt</sub></i>	0.128	0.218	<b>8.54 (0.000)</b>
<i>POST<sub>ijt</sub></i>	0.319	0.204	<b>-9.43 (0.000)</b>
<i>NINS<sub>it</sub></i>	1.111	1.130	<b>2.22 (0.027)</b>
<i>Panel B: Buy transactions (N = 2,648)</i>			
<i>PORTF1<sub>ijt</sub></i>	-0.023	-0.010	<b>2.71 (0.007)</b>
<i>PORTF2<sub>ijt</sub></i>	-0.017	-0.000	<b>3.80 (0.000)</b>
<i>GENDER<sub>i</sub></i>	0.921	0.880	<b>-4.97 (0.000)</b>
<i>OVERCONF<sub>ij</sub></i>	0.034	0.017	<b>-3.75 (0.000)</b>
<i>LEADRET<sub>jt</sub></i>	0.300	0.253	<b>-2.05 (0.041)</b>
<i>LAGRET<sub>jt</sub></i>	0.028	0.063	<b>3.11 (0.002)</b>
<i>VALUE<sub>ijt</sub></i>	2.134	1.547	<b>-3.23 (0.001)</b>
<i>PRE<sub>ijt</sub></i>	0.125	0.264	<b>13.05 (0.000)</b>
<i>POST<sub>ijt</sub></i>	0.372	0.232	<b>-11.24 (0.000)</b>
<i>NINS<sub>it</sub></i>	1.198	1.131	<b>-6.75 (0.000)</b>

Notes:

The table reports the mean values of the main variables of interest on days with and without insider transactions. Specifically, we test whether the mean values of these variables are different between 2,579 (2,648) days with insider sell (buy) transactions and 2,579 (2,648) days without insider sell (buy) transactions in our matched-pair sample. All variables are as defined in Appendix 2.

Table 5.

Results of conditional analysis of insiders' motives for selling and buying insider stocks

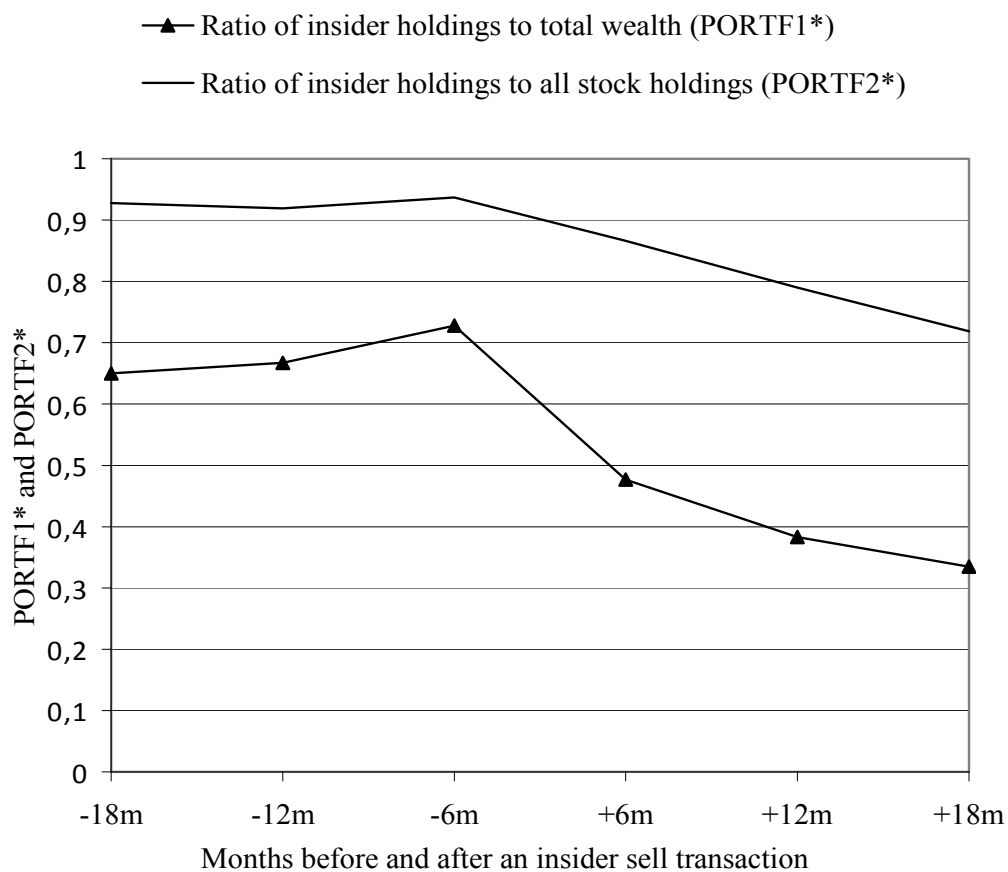
Variable	Panel A: Insider selling			Panel B: Insider buying		
	Expected sign	(1)	(2)	Expected sign	(3)	(4)
<i>INTERCEPT</i>		<b>-0.326</b> (0.000)	-0.361 (0.058)		<b>-1.162</b> (0.000)	<b>-1.162</b> (0.000)
<i>PORTF1<sub>ijt</sub></i>	+	<b>1.050</b> (0.000)		-	<b>-0.487</b> (0.000)	
<i>PORTF2<sub>ijt</sub></i>	+		<b>1.580</b> (0.000)	-		<b>-0.661</b> (0.001)
<i>GENDER<sub>i</sub></i>	+	<b>0.373</b> (0.001)	<b>0.366</b> (0.002)	+	<b>0.499</b> (0.000)	<b>0.507</b> (0.000)
<i>OVERCONF<sub>ij</sub></i>	-	-0.040 (0.981)	0.006 (0.983)	+	<b>0.984</b> (0.000)	<b>0.979</b> (0.000)
<i>TAXBURDEN<sub>ijt</sub></i>	-	<b>-1.159</b> (0.000)	<b>-1.164</b> (0.000)	n.a.		
<i>INCOME<sub>it</sub></i>	-	-0.000 (0.085)	-0.000 (0.086)	n.a.		
<i>LOSS_MOD<sub>ijt</sub></i>	-	<b>-0.455</b> (0.014)	<b>-0.423</b> (0.022)	n.a.		
<i>LOSS_LARGE<sub>ijt</sub></i>	-	<b>-1.341</b> (0.000)	<b>-1.319</b> (0.000)	n.a.		
<i>LOSS_MOD_DEC<sub>ijt</sub></i>	+	-0.022 (0.977)	-0.064 (0.936)	n.a.		
<i>LOSS_LARGE_DEC<sub>ijt</sub></i>	+	<b>3.023</b> (0.014)	<b>2.800</b> (0.023)	n.a.		
<i>STOCKS<sub>ijt</sub></i>	+	<b>1.457</b> (0.044)	<b>1.548</b> (0.036)	n.a.		
<i>EXERCISE<sub>ijt</sub></i>	+	<b>1.118</b> (0.026)	<b>1.057</b> (0.030)	n.a.		
<i>OPTIONS<sub>ijt</sub></i>	+	-0.656 (0.568)	-0.583 (0.551)	n.a.		
<i>LEADRET<sub>jt</sub></i>	-	<b>-0.620</b> (0.000)	<b>-0.628</b> (0.000)	+	0.066 (0.145)	0.062 (0.177)
<i>LAGRET<sub>jt</sub></i>	+	<b>0.666</b> (0.000)	<b>0.672</b> (0.000)	-	<b>-0.183</b> (0.030)	<b>-0.181</b> (0.032)
<i>VALUE<sub>ijt</sub></i>	+	<b>0.000</b> (0.000)	<b>0.000</b> (0.000)	+	0.000 (0.246)	0.000 (0.271)
<i>PRE<sub>j</sub></i>	-	<b>-0.403</b> (0.000)	<b>-0.410</b> (0.000)	-	<b>-0.779</b> (0.000)	<b>-0.773</b> (0.000)
<i>POST<sub>jt</sub></i>	+	<b>0.610</b> (0.000)	<b>0.604</b> (0.000)	+	<b>0.603</b> (0.000)	<b>0.604</b> (0.000)
<i>NINS<sub>it</sub></i>	-	<b>-0.280</b> (0.028)	<b>-0.261</b> (0.041)	+	<b>0.556</b> (0.000)	<b>0.549</b> (0.000)
Other variables in Models (3) and (4)		Included	Included		Included	Included
N		5,158	5,158		5,296	5,296

Likelihood ratio, $\chi^2$	<b>865.06</b> <b>(0.000)</b>	<b>887.04</b> <b>(0.000)</b>	<b>468.49</b> <b>(0.000)</b>	<b>472.84</b> <b>(0.000)</b>
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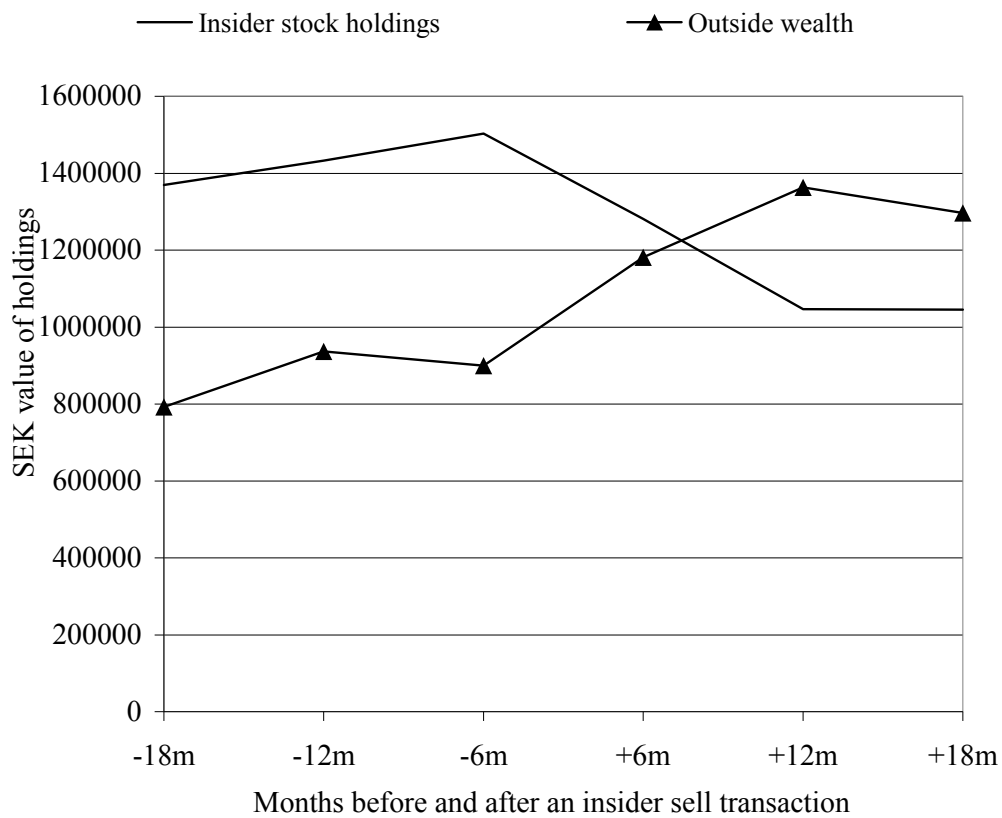
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Notes:

The table reports the results of estimating Models (3) and (4). The dependent variable is a dummy variable with a value of one if insider  $i$  sells (buys) stocks of firm  $j$  where she is an insider on day  $t$ , otherwise zero. All other variables are as defined in Appendix 2.



**Figure 1.** The degree of portfolio diversification around insider sell transactions (median values of all cases when an insider sells her insider stocks). The sell transaction takes place between months ‘-6’ and ‘+6’.



**Figure 2.** The SEK values of insider stock holdings and outsider wealth (the sum of outsider stocks holdings and other wealth) around insider sell transactions (median values of all cases when an insider sells her insider stocks). The sell transaction takes place between months ‘-6’ and ‘+6’.