Insider trading and gender*

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Abstract

We provide comprehensive, gender-based estimates of the performance of primary insiders' non-routine trades on the Oslo Stock Exchange. Regardless of gender, the time-series of insider holdings fail to indicate that insiders "buy low and sell high". However, there is evidence that the dramatic increase in the network of female directors following Norway's 2005 board gender-balancing law has increased the market reaction to female insider purchases. Moreover, female insider purchases spike following the market crash in 2008, both absolutely and relative to male insiders, which contradicts the conventional view that females are more risk averse than males.

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"If women must be more like men to break the glass ceiling, we might expect gender differences to disappear among directors."
— Renée Adams and Patricia Funk, *Management Science*, 2012 (abstract).

1 Introduction

As surveyed by Croson and Gneezy (2009), the literature on gender differences suggests that there are systematic dispositional differences between males and females. For example, data from laboratory settings, where the participants are typically students or workers, tend to indicate that females are more risk-averse than males (Eckel and Grossman, 2008; Sapienza, Zingales, and Maestripieri, 2009). On the other hand, Adams and Funk (2012) argue that this type of evidence may not carry over to the more select group of individuals in corporate leadership, who are rarely available for such experiments. That is, to be considered a candidate for a board seat in a male-dominated public corporation, females may have to develop core values and risk attitudes that are similar to male directors (above quote). After surveying directors in Swedish listed companies in year 2005, Adams and Funk conclude that female executives and directors are, if anything, somewhat *less* risk averse than their male counterparts.

We move the analysis of gender-based differences in core corporate insiders' risk aversion beyond survey data and into the stock-market arena. With the population of core insiders' trades and holdings on the Oslo Stock Exchange (OSE), 1986–2016, we examine two primary questions. The first is whether insider trades during the recent financial crisis indicate that top female insiders are more or less risk averse than male insiders. A major advantage of this approach is that it is based on individual investment decisions, which have potentially significant consequences for the individuals' wealth and professional reputation. Risk aversion undoubtedly plays a role in such investment decisions. Therefore, in the presence of gender-based differences in risk aversion, we expect the exogenous shock to stock return volatility during the financial crisis to cause gender-based differences in the direction and volume of trades during the crisis period.

Second, we investigate whether differences in director networks across male and female directors give rise to differences in access to inside information. For example, based on their evidence of differential insider trading performance, Inci, Narayanan, and Seyhun (2017) conclude that female executives have a disadvantage relative to males in access to inside information (even if they have equal formal status). On a

fundamental level, informal male networks may tend to disadvantage females, especially in organizations where they are under-represented (Moore, 1988; Lyness and Thompson, 2000). We contribute to the insider network debate by combining estimates of gender-based insider trading and performance with a significant exogenous shock to the female insider network on the OSE. The shock is Norway's mandatory board gender-balancing, which took place over the two-year period 2005-2007, and which increased the proportion of female directors in listed and unlisted public limited liability companies from 15% to 40% (Bertrand, Black, Jensen, and Lleras-Muney, 2019; Eckbo, Nygaard, and Thorburn, 2019). This resulting dramatic increase in the economy-wide female director network present a interesting quasi-experimental setting for identifying a network effect in insider trades.

We begin our empirical analysis by testing for gender-based differences in trading propensity and performance. In this analysis, which exploits our unique access to population data on core insiders' holdings and trades, we implement several approaches to performance measurement. These include a short-term event study (abnormal stock returns around insider purchases) and long-run performance of long-short portfolios of insider holdings. We follow the lead of Grinblatt and Titman (1993), Eckbo and Smith (1998) and Ferson and Khang (2002) and form portfolio weights using individual stock holdings data. Portfolio weights based on actual insider holdings allows estimation of the returns to insiders' time-varying investments in the firms where they are directors and executives. A holdings-based performance evaluation improves on the conventional returns-based approach, which does not account for the different holding periods across insiders (Ferson, 2010).

We report several interesting results. First, over the entire sample period 1986–2016, there is no evidence of statistically significant gender-based differences in insider trading performance. This conclusion holds whether or not when the estimation accounts for time-variation in risk exposures. The abnormal performance of the two gender-based portfolios, as well as of the long-short portfolio (long in male trades), are insignificantly different from zero—whether using Jensen (1968)'s alpha or holdings-based performance measures. In sum, without explicitly conditioning on Norway's mandatory board gender-balancing or the financial crisis, gender-based differences in the performance of insider trades are statistically insignificant.

We next investigate the effect on insider trading of the gender quota law, which was enacted in December of 2005 (Eckbo, Nygaard, and Thorburn, 2019). The law gave firms two years to comply—under the threat of forced liquidation—and all OSE-listed firms fully complied by the end of 2007.

Naturally, the influx of female board members lead to a substantial increase in the fraction of total insider trades performed by females. There is no evidence of statistically significant holdings-based portfolio performance for either male and female insiders before or after 2007. However, as argued by Inci, Narayanan, and Seyhun (2017) as well, access to a larger director network may increase the amount of inside information. Consistent with this argument, the short-term market (seven-day) reaction to female insider purchases is on average statistically insignificant before the quota law and significantly positive after 2007. Moreover, the post-2007 short-term market reaction is similar to that of male insider purchases. A consistent explanation is that the dramatic increase in the network of female directors has improved both the value and timing of female insider purchases. No such improvement in the market reaction is observed for male insiders whose network declined with the influx of female directors.

Third, we test for gender differences in director risk aversion using insider trading activity during the financial crisis period, 8/2008–12/2010. The stock market crash has two effects on the incentive for insiders to trade, both of which depend on the individual insider's risk aversion. The first is a rebalancing to maintain the optimal allocation between investments in risky and risk-free assets. The second incentive is to bet against the stock market (purchase more shares) if the market crash—in the insiders opinion—has caused the firm's stock to become undervalued.[1]

Under the conventional view that females are generally more risk averse than their males, female insiders should trade less than male insiders after the crash. However, we find the opposite. Conditional on a number of firm-specific characteristics that may also affect insider trades (such as trading costs and stock volatility), we show that female primary insiders not only increase their purchases in the stocks where they are insiders, they are also significantly more likely than male primary insiders to buy shares. This evidence directly contradicts the notion that females are more risk averse than males—as far as primary insiders go. As such, our evidence also supports the argument of Adams and Funk (2012) that the selection of females as executives and directors may require these individuals to be "more like men to break the glass ceiling" (above quote).

The paper closest in spirit and data to ours—to our knowledge the only other study linking insider trades to gender—is Inci, Narayanan, and Seyhun (2017). They use US data where the fraction of female core insiders remains relatively low throughout the sample period (1975–2012).[2] Their analysis

[1]For discussions of how experiencing market crashes may affect trading, see e.g. Malmendier and Nagel (2011), Weber, Weber, and Nosić (2012), Hoffmann, Post, and Pennings (2013), and Guiso, Sapienza, and Zingales (2018).

[2]In their sample, females make up about 4% of the purchases, both in number of transactions and volume.

does not single out trades during the financial crisis and so does not address gender-based differences in risk aversion. Moreover, since there is no major US exogenous director network shock, and given the significant differences in the two trading environments (both in terms of the market structure and legal system), a direct comparison of the results of the two papers is somewhat hazardous.

Having said that, Inci, Narayanan, and Seyhun (2017)'s evidence on gender-based insider-trading behavior is noteworthy also in our context. In particular, while none of our performance estimates show statistically significant trading profits—regardless of gender—Inci, Narayanan, and Seyhun (2017) report that both female and male primary insiders make positive abnormal stock returns over a fifty-day event window following the insider purchase date. Moreover, males earn significantly more than females in equivalent positions (3.2% versus 1.6%, respectively), suggesting that the superior male performance is not driven by males holding more senior positions overall. However, these gender differences disappear when they limit the sample to firms in which female trading is relatively high. They conclude that female executives in the US may have an informational disadvantage relative to males (even if they have equal formal status), and that informal networks plays an important role in attenuating this disadvantage. Based on our analysis of Norway's dramatic female director network increase caused by the quota law, we also infer that greater informal networks have likely benefited female insider trades.

The rest of the paper is organized as follows. Section 2 describes our insider trading data sources and provide trade summary statistics. Section 3 compares returns-based stock market performance of portfolios formed from trades of female and male insiders, respectively, while Section 4 presents insider performance using holdings-based metrics. In Section 5, we implement an event study to identify the short-term market reaction (if any) to insider trades, again classified by gender. In Section 6, we turn to the potential effect of the board reform on insider performance, while Section 7 provides evidence on gender-based trading activity during the financial crisis. Section 8 concludes the paper.

2 Data and sample description

2.1 Insider trading regulations and reporting

Our sample period starts in January of 1986 and ends in December of 2016. The period can be split into two. Prior to 1997, under Norway's first-generation insider trading laws, individual insiders were not legally required to report their trades. However, the OSE required listed firms to report the trades

of their insiders. Listed companies issued such reports to the OSE on a monthly basis, and the OSE made the reports publicly available through the exchange's library. These reports, which are analyzed in Eckbo and Smith (1998) as well (their sample period is 1986–1992), list the name of the insider and the quantity bought or sold. If the report does not give the exact trading date, we use the date of the company report to the OSE.

In 1996, Norway passed legislation ("Lov om Verdipapirhandel") adopting the European Union's (EU's) principles for insider trading regulations.[3] This legislation increased the speed and accuracy of individual insiders of OSE-listed firms, listed on the OSE. Moreover, for the first time, the law defines certain individuals as *primary* insiders, who are the main subjects of our analysis. Primary insiders include (1) top management, including the chief executive officer (CEO) and the chief financial officer (CFO), and (2) board members, including the board chairman (who, under Norwegian corporate law cannot also be the CEO). We place all remaining reporting insiders, including accountants and insiders' close family members, in a third group.

With the 1996 legislation, insiders must publicly report their trades within one day. Empirically, this typically happens before the beginning of the next trading day. The law also specifies certain insider trade blackout periods, including just prior to corporate earnings announcements. We collect insider trades from 1997 from OSE electronic records. To be included, the trade announcement must contain the name and position of the insider, the trade date, and the number of shares bought or sold. The report typically also include the balance (number of shares) held by the insider after the reported trade.

In addition to insider trading reports, we use firm-level data on board composition from the Brønnoysund Registry Centre.[4] This data source, which covers the years 1998–2016, provides director gender and board size. Figure 1 shows the evolution of board size and the number and percentage of females on the boards of OSE-listed Norwegian firms over the 1998–2016 period. In 1998, the percentage females was 10%, which increased to 40% as required to comply with the gender quota law by early 2008. We return to a more detailed discussion of the effect of the quota law and its effect on insider trading in Section 6 below.

Finally, we complement the insider trading data and board composition data with financial information such as stock prices, accounting information, and corporate events, either from the OSE data service

[3]Norway is under treaty obligation to adopts EU regulations, including EU restrictions on insider trades. There has been largely minor adjustments to EU's and Norways insider trading regulations between 1997 and the end of our sample period in 2016. For a summary of Norway's insider trading regulations, see sections 6 (Issuer's obligations) and 7 (primary insider's obligations) of NOU 2017:4.

[4]The data is sourced through the Norwegian School of Economics (Berner, Mjøs, and Olving, 2013).

or Datastream, interest rates from Norges Bank (The Norwegian Central Bank), and macroeconomic information from the Norwegian Bureau of Statistics (SSB).

2.2 Sample characteristics by gender

As per the first row in Panel A of Table 1, there were a total of 47,429 insider transactions over the 1986–2016 sample period.[5] This total is evenly split between the two sub-periods that are separated by the 1996 insider trading legislation. While trades in the second subperiod (1997-2016) form the bulk of the empirical tests below, we also provide performance estimates based on the earlier subperiod as this substantially overlaps with Eckbo and Smith (1998). While the earlier paper does not classify the insider trades by gender, we compare our performance estimates to theirs in the analysis below.

The second row of Table 1 shows that we succeed in classifying 38,504 of the 41,429 transactions by gender. While not tabulated, this represents a classification success rate of 81% over the thirty-year sample period, with a success rate of 88% in the most recent sub-period. We identify the insider's gender from his or her given name, which in Norway nearly always identifies the gender. For insiders with foreign names, we include only those where the gender is unambiguous from the given name.

The third row of Panel A shows that 56% (21,663) of the the gender-based insider trades are executed by primary insiders (management and board members), which increases from 33% in the early subperiod to 75% after 1996. This increase is in part a reflection of our attempt to backfill the insider's corporate position in the 1986–1996 data, when the insider trading reports did not reveal this information. We perform this backfilling manually using post-96 position information as well as comprehensive directorship data. However, this identification is likely somewhat less comprehensive than the case is for the 1997–2016 period where we are able to rely on the insider trading reporting itself.

To increase power of our tests to detect information-based insider trading performance, we filter out routine (repeat) trades, which are less likely to be based on valuable firm-specific private information. In this filtering, which is inspired by Cohen, Malloy, and Pomorski (2012), an insider trader in month t is labeled a "repeat performer" if the same insider traded in the same calendar month in each of the three years preceding the trade in month t. The elimination of repeat trades reduces the total number of

[5]This total transaction count includes trades in different firms by the same insider. This, however, happens only rarely: Eckbo, Nygaard, and Thorburn (2019) show that the dispersion of board seats is very high both before and after the the forced gender-balancing. For example, in 2008, 75% of all directors hold a single board seat only, with an additional 15% holding two seats only.

trades by gender-based primary insiders by 12%, from 21,663 to 19,108. Interestingly, this reduction in sample size is substantially less than the 50% reduction reported by Cohen, Malloy, and Pomorski (2012) for US insider trades. Below, we primarily implement this non-routine refinement when investigating information effects of insider trading.[6] The fourth and final row of Panel A shows that 88% (19,108) of the gender-based primary insider trades are non-routine.

Next, panels B and C of Table 1 describe differences in trading activity between male and female insiders—primary as well as all insiders. In Panel B, our inside transactions covers 649 OSE-listed firms over the 1986–2016 sample period. Of these, 466 firms have reported trades by female insiders, while there are only three firms without any trades by male insiders. Of the total of 16,473 distinct insiders, 3,003 or 18% are female. Moreover, 17.2% of the 5,967 distinct primary insiders are female.

The transaction value over the sample period totals NOK 161.6 billion for purchases and 84.9 billion for sales, all measured in 2016 constant kroner (deflated using the CPI from SSB). Of these totals, female insiders undertake only 1.1% of the value of purchases and 2.4% of the value of sales. In terms of individual transactions, females undertake a much larger percentage, as 13.2% of the total of 38,504 purchases and sales in Panel A are by female insiders. The value in NOK per transaction is, however, smaller on average for female insiders than for males. Since the distribution of NOK trade size is highly skewed, the median provides a better basis for comparison. Overall, for primary insiders, the median female NOK purchase size is about half that of the median male purchase.

In Panel C of Table 1, we follow Inci, Narayanan, and Seyhun (2017) and report, for each insider, the average annual number and value of his/her trades per year over the insiders' tenure period. This measure is not affected by the low fraction of female insiders early in our sample period, and therefore provides a more direct comparison of the trading intensities of male and female insiders. In this calculation, the first year of an insider's tenure period is the year of the first reported trade in our data, while the ending year is the year of the last reported trade. Thus, an insider with just one reported trade—or several trades within one year—are recorded as having a a tenure period of just one year. The results in Panel C show that male insiders tend to trade more in total NOK. However, trading intensity—the number of

[6] After year 1999, some insider purchases reflect stock option exercise. Prior to year 2000, stock options as a form of managerial compensation was so tax disadvantaged that they were essential not used by Norwegian companies (the exercise value was taxed as regular income in the year of the option grant). This tax disadvantage was substantially reduced in 1999. Note also that, since the grant date and vesting period are public information, stock purchases through option exercise are more predictable than other insider trades, which may affect stock prices *ex ante*. We do not attempt to single out trades associated with employee option exercise in our analysis below.

transactions per year over the insider's tenure period—is similar across male and female insiders, whether the insider is primary or not.

Finally, turning to the annual trading frequency, Figure 2 shows the annual percent of all primary insider trades that are performed by female executives and directors. As expected given the quota law, the percentage of female trades jumps after 2005. Table 2 provides additional information about this trend in terms of purchases and sales and trade size. Our subsequent portfolio performance analysis of gender-based primary insider trades is based on the sales and purchases in Table 2. While we follow Inci, Narayanan, and Seyhun (2017) and the insider-trading literature more generally, in focusing on insider purchases, our holdings-based portfolio weights by construction incorporate information on both insider sales and purchases over time.[7]

3 Returns-based portfolio performance analysis

We begin our performance analysis by examining the abnormal returns in calendar time to portfolios of firms with primary insider trades over the thirty-year sample period, 1986–2016. Because insiders report their trades on a monthly basis prior to 1997, in this section we estimate abnormal performance at a monthly frequency. That is, we rebalance the insider portfolios on a monthly basis, reflecting all insider trades that month, which produces a long run measure of performance. In Section 5 below, we also report short term measures of abnormal performance using daily stock returns (post-1996) and the market reaction to insider trades in event time.

3.1 Insider portfolio formation

We construct three different portfolios using the $N = 649$ OSE-listed firms with reported primary insider trades over the period of $T = 372$ months, 1986-2016. Let N_t denote the total number of OSE-listed firms in month t, and n_{t-1} the number of firms with insider purchases in the previous month. If ω_{it}^k denotes the weight of firm i in insider portfolio k at time t, the three different sets of portfolio weights are defined

[7]The extant literature suggests that stock sales are more likely than purchases to be based on private information.

as follows:

$$\omega_{it}^{k} = \begin{cases} \omega_{it}^{b} \equiv \begin{cases} 1/n_{t-1} & \text{buys} \\ 0 & \text{non-buys} \end{cases} & \text{(equal-weights, buys only)} \\ \omega_{it}^{ow} \equiv (s_{it}/S_{it}) / \sum_{i=1}^{N_t} (s_{it}/S_{it}) & \text{(insider-ownership-weights)} \\ \omega_{it}^{vw} \equiv h_{it} / \sum_{i=1}^{N_t} h_{it} & \text{(insider-value-weights)} \end{cases} \tag{1}$$

Starting with the first portfolio, after forming an equal-weighted portfolio of stocks with insider purchases in month $t-1$, the portfolio is held for one month, and then rebalanced at the end of month t. This portfolio is used to test whether firms on average exhibit abnormal performance in the month following insider purchases.

The second and third sets of portfolio weights follow Eckbo and Smith (1998) and use information on the actual stock holdings of primary insiders. This information is necessary to estimate the performance of the insiders themselves and not just the average one-month performance of firms in which insiders purchased shares. S_{it} denotes firm i's total number of shares outstanding in month t, of which insiders hold s_{it} shares. This insider holding is worth $h_{it} = p_{it}s_{it}$, where p_{it} is firm i's stock price at time t. The second set of portfolio weights, ω_{it}^{ow}, gives greater weights to firms in which insiders hold a larger ownership share of the outstanding stock. The third set of portfolio weights, ω_{it}^{vw}, gives greater weight to firms with relatively large absolute value of insider investment. Note also that since h_{it} depends on firm i's stock price, ω_{it}^{vw} changes over time even when insiders do not trade.

To construct ω_{it}^{ow} and ω_{it}^{vw}, we use the insider holdings (number of shares) contained in the insider reports to the OSE. If the holding is not reported, we reconstruct the holding by adding or subtracting the month's purchases or sales to the previous month's holding. In this reconstruction, because we are after the insider's total holdings, we do not remove routine trades. Moreover, we adjust for changes in the number of shares outstanding caused by stock splits and, absent information to the contrary, we assume that insiders purchase their pro rata share of stock issues. Finally, if a firm with positive insider holdings delist from the stock exchange, we assume that the insider's holding is brought to zero (sold) at the end-of-month price prevailing just prior to the month of delisting.[8]

[8] As for the initial and final share-holdings of individuals (added and subtracted on the dates when when they became or ceased to be insiders according to our records), we follow the convention in the extant literature of not treating these as *bona fide* information-based purchases or sales.

3.2 Returns-based performance metrics

The objective is to measure the performance of the three separate insider portfolios with equal-weights (buys) (ω_{it}^{b}), insider-value-weights (ω_{it}^{ow}), and insider-ownership-weights (ω_{it}^{vw}), classified by gender. Moreover, for each of the three portfolios, we also construct three sub-portfolios: one that is restricted to male insiders only, one restricted to female insiders only, and a third long-short (zero-investment) portfolio that is long in the male insider and short in the female insider portfolios, respectively. We apply two returns-based methods of portfolio performance evaluation that are common in the literature on mutual fund performance (Ferson, 2010; Wermers, 2011). In our application, let $r_{pt}^{e} = r_{pt} - r_{ft} = \sum_{i=1}^{N_t} \omega_{it}^{k}(r_{it} - r_{ft})$ denote the return in month t, in excess of the risk-free rate[9] r_{ft}, to an insider portfolio with weights ω_{it}^{k}. The two portfolio performance measures are two alternative measures of α_{pt} defined as follows (where superscript 'hat' indicates OLS estimate):

$$\alpha_{pt} = \begin{cases} \alpha_{pt}^{4f} \equiv r_{pt}^{e} - [\widehat{\beta}_{p}^{m}\,(r_{mt} - r_{ft}) + \widehat{b}_{p}^{SMB} SMB_t + \widehat{b}_{p}^{HML} HML_t + \widehat{b}_{p}^{MOM} MOM_t] \\ \alpha_{pt}^{rb} \equiv r_{pt}^{e} - [\widehat{\beta}_{p,t-1}^{rb}\,(r_{mt} - r_{ft})] \end{cases} \tag{2}$$

The first performance metric is the constant term α_{p}^{4f} in a four-factor return regression (Fama and French, 1993; Carhart, 1997). r_{mt} is the return on the equal-weighted market portfolio of OSE stocks, and the additional pricing factors SMB_t, HML_t and MOM_t are the returns to the FF-size factor (a portfolio of Small Minus Big stocks), the FF-value factor (a portfolio of High Minus Low book-to-market stocks) and the momentum factor (a long-short portfolio of stocks that is long in above-mean return and short in below-mean return over the past twelve months).[10]

The second portfolio-based performance metric, α_{pt}^{rb}, is an estimate of the constant term in the rolling-beta estimation of the one-factor Capital Asset Pricing Model (CAPM), which allows for time variation in the portfolio's (lagged) market risk factor exposure $\beta_{p,t-1}^{rb}$. We report the average of these constant terms, $\alpha_{p}^{rb} = \frac{1}{T}\sum_{t=1}^{T} \alpha_{pt}^{rb}$. The estimate of the portfolio beta, $\widehat{\beta}_{p,t-1}^{rb}$, is calculated as a weighted average of beta estimates for the stocks in the portfolio: $\widehat{\beta}_{p,t-1}^{rb} = \sum_{i=1}^{N_t} \omega_{it}\widehat{\beta}_{i,t-1}$. For each firm i, the beta $\widehat{\beta}_{i,t-1}$ is estimated using three years of daily returns prior to the current month and the Scholes and Williams (1977) lead-lag beta adjustment for non-synchronous trading.

[9] The risk-free rate is the monthly Norwegian Interbank Offered Rate (NIBOR).

[10] The factors are all generated within the OSE cross-section of stocks. See also Næs, Skjeltorp, and Ødegaard (2008) for information on OSE pricing factors.

3.3 Returns-based performance by gender

Table 3 summarizes the returns-based performance estimates for the portfolios of primary insiders. Panel A shows portfolio return descriptives, including average raw return, average excess return, and portfolio Sharpe Ratios calculated as $\text{mean}(r_p - r_f)/\text{sd}(r_p - r_f)$.[11] The Sharpe Ratio of the female insider portfolio with ownership weights (Column 4) is 0.17, which is higher than the 0.09 for the male portfolio (Column 5). For the portfolio with insider value-weights, however, the Sharpe Ratio is similar across males and females: 0.11 and 0.10, respectively (columns 7 and 8).

Turning to the four-factor performance estimate in Panel B, notice first that the market exposures of the male and female portfolios tend to be similar. As expected for broad based portfolios, the market betas are all statistically significant and close to one. Female portfolios tend to have higher exposures than male portfolios to the two Fama-French size and B/M factors (*SMB* and *HML*). There is, however, no significant difference in male and female portfolio exposures to the momentum factor (*UMD*). As to the four-factor alphas in the first row of Panel B, α_p^{4f} for the Equal-weighted (buys) portfolio is .023 for females and 0.006 for males, respectively, which are significant at the 10% level.

Most important, none the individual portfolio alpha-estimates are statistically significant at the 5% level or better. Moreover, the significance of the alphas of the long-short portfolios is even weaker. The lack of significance, and the consistently negative sign of the alphas of the long-short portfolios, clearly rejects the hypothesis that insider trades by males have better performance than those of females. This inference also holds when using the average rolling-beta estimation in Panel C of Table 3. Again, none of these recursive CAPM-alpha estimates, which allow for time variation in the estimated portfolio beta, are significant at the 5% level or better, nor are the alpha estimates of the long-short portfolios.

4 Holdings-based performance analysis

The two returns-based performance metrics discussed above (α_p^{4f} and α_p^{rb}) measure average monthly abnormal portfolio returns (if any). A strength of returns-based methodologies is their minimal information requirements: one needs only returns on the insider portfolio and the benchmark. However, returns-based measures ignore potentially important information in insiders' *actual* portfolio weights. It is one thing to measure the average monthly performance of firms held by insiders, and quite another to measure the

[11] For the long-short portfolios, the Sharpe ratio is $\text{mean}(r_p)/\text{sd}(r_p)$.

performance of the insiders' actual holdings. Only the latter can reveal whether insiders "buy low and sell high" over time. For example, an insider that purchases additional shares just prior to the release of new and positive information about the company may not realize the short-term positive stock price reaction if he/she holds the stock over a longer period. That is, the insiders themselves may not realize the average monthly abnormal performance indicated by a returns-based performance metric. Weighting the monthly portfolio returns by insiders actual holdings solves this measurement problem.

4.1 Holdings-based performance metrics

Insiders profit from private information by increasing the stock holding when future returns are likely to be higher than expected and reducing (not increasing) the holding when future returns are likely to be lower than anticipated by the market—resulting in a positive covariance between the change in the insiders' holdings and subsequent (abnormal) stock returns. The main difficulty in implementing this simple and intuitive performance measure is lack of access to data on individual investors' stock holdings on a broad basis. Thus, the initial applications of the covariance measure focused on examples of individual investment portfolios (Cornell, 1979; Copeland and Mayers, 1982). Grinblatt and Titman (1993) and Ferson and Khang (2002) substantially expand the methodology and data to include broader samples of US mutual funds and actively managed investment portfolios. In the prior literature on insider trades, Eckbo and Smith (1998) apply a conditional version of the covariance performance measure to the population of insider trades on the OSE (1985-1992)—a period with first-generation insider trading regulations in Norway—and fail to reject the hypothesis of zero abnormal performance.

Let $r_{i,t+\tau}$ denote the realized return to firm i over the time horizon $t+\tau$. Our holdings-based performance measure, *HM*, is the covariance between the one-period change in the insider portfolio holdings from $t-1$ to t ($\Delta\omega_{it}$) and the τ-period future abnormal stock return, $r_{i,t+\tau} - E\left[r_{i,t+\tau}\right]$:

$$HM = \frac{1}{T-2}\sum_{t=2}^{T}\frac{1}{N_t}\left(\sum_{t=1}^{N_t} Cov\left(\Delta w_{it}, (r_{i,t+\tau} - E[r_{i,t+\tau}])\right)\right) \tag{3}$$

To compute the abnormal return, $E[r_{i,t+\tau}]$ is the predicted return from a Fama-French-Carhart four factor model estimation. The four factor model is estimated in a similar manner to the earlier rolling beta CAPM estimation. That is, at date $t-1$ we estimate the four-factor model for each stock i using five years of data. This yields a (time varying) vector of coefficient estimates $\left\{\hat{\alpha}_{i,t-1}, \hat{\beta}^{m}_{i,t-1}, \hat{b}^{SMB}_{i,t-1}, \hat{b}^{HML}_{i,t-1}, \hat{b}^{MOM}_{i,t-1}\right\}$,

which we use to generate an estimate of the the expected return $E[r_{i,t+\tau}]$.

We calculate *HM* for two alternative lagged benchmark portfolio weights ($\omega_{i,t-1}$):

$$\Delta\omega_{it} = \begin{cases} \omega_{it}^{ins} - \omega_{i,t-1}^{ins} & \text{lagged insider portfolio weights} \\ \omega_{it}^{ins} - \omega_{i,t-1}^{m} & \text{lagged OSE market portfolio weights} \end{cases} \tag{4}$$

where the second measure uses firm i's "CAPM-buy-and-hold" weight in the OSE market portfolio ($\omega_{i,t-1}^{m}$) as the benchmark for evaluation the change in insider portfolio weight (ω_{i}^{ins}) from $t-1$ to t. Moreover, we consider three alternative future return time horizons ($t+\tau$):

$$\tau = \begin{cases} 1 \text{ month} & \text{short-lived insider information} \\ 3 \text{ months} & \text{intermediate-lived insider information} \\ 6 \text{ months} & \text{long-lived insider information} \end{cases} \tag{5}$$

We explore these three holding periods as *HM* will be positive only if the unobservable private inside information is made public and incorporated into the stock price during the period over which return is measured.

4.2 Holdings-based performance results

We test the null hypothesis that insiders do *not* trade on valuable inside information ($HM = 0$) against the alternative that they do ($HM > 0$). Table 4 reports the result of the estimation of *HM*, classified by gender. Note that, unlike for the returns-based tests in Table 3 above, it makes little sense to construct a long-short portfolio (male versus female). Rather, we test directly for equality of *HM* for male and female insiders and report the associated p-value in column (9) labeled p(diff).

There is little evidence in Table 4 to indicate that insiders know how to "buy low and sell high." All of the values of *HM* are statistically insignificant at conventional levels. These results fail to reject the hypothesis that the performances of male and female insiders are indistinguishable from zero. This result is basically consistent with our inference from the returns-based analysis above.

It is worth mentioning that a statistically insignificant estimate of *HM* does not exclude the possibility that *some* insiders realize positive abnormal returns from their trades. Recall that our portfolios of insider holdings are not centrally managed. Rather, they consist of a collection of independent holding-decisions

across individual insiders in different companies, who do not coordinate their trades. Thus, for *HM* to become significantly positive, a sufficient number of these individual traders must trade on valuable private information in a sufficient number of months. This is different from, say, measuring the performance of a centrally managed portfolio, where a single manager decides all the trades.[12]

In conclusion, there is little evidence of a non-zero long-run performance of our insider portfolios, whether sorted on gender or not. We therefore turn to an event-study analysis of the short term market reactions to insider trades. This helps answer the question of whether there is insider abnormal performance within a few days of the trades.

5 Short-term performance around insider purchases

In this section, we estimate the market reaction in event time around dates of insider purchases. We focus our event study on insider buys because the extant literature tends to conclude that stocks perform abnormally well following insider purchases, with negligible abnormal performance following insider sales.[13] In this part of our analysis, in order to increase power, we follow Cohen, Malloy, and Pomorski (2012) and screen out the small number of routine trades which, as explained above, are unlikely to be based on inside information. Moreover, as we use daily returns for our event study, we restrict the sample to the post-1996 period, where each insider has an obligation to report trades within 24 hours.

In the event study, we estimate the conditional abnormal return parameter Γ in the following one-factor return-generating process (the "market model"):

$$r^e_{it} = a_i + b_i r^e_{mt} + \Gamma D^{event}_{it} + \varepsilon_{it}, \tag{6}$$

where r^e_{mt} is the return on the market portfolio in excess of the risk-free rate on day t. In event time, the day of the insider purchase is labeled 'day 0', and we estimate abnormal stock returns over four windows around that day. The windows consist of the three trading days $(-1, 1)$, the seven days $(-1, 5)$, the twenty-seven days $(-1, 25)$, and the 52 days $(-1, 50)$ around the event day. For a given event window,

[12] With access to two correlated securities, a central portfolio manager may choose to buy one and sell the other for hedging purposes, even in the presence of private information. As demonstrated by Grinblatt and Titman (1989), when trading on private information, a portfolio manager with non-increasing absolute risk aversion (Rubinstein, 1973) will still produce a positive sum of the covariances across securities.

[13] See, e.g., Seyhun (1986, 1988), Lakonishok and Lee (2001), Jeng, Metrick, and Zeckhauser (2003), and Inci, Narayanan, and Seyhun (2017).

the abnormal return parameter Γ is the coefficient estimate of the dummy variable D_{it}^{event}, which takes on a value of one inside the event window and zero otherwise. Since Γ is the average daily abnormal return over the window, we report the cumulative abnormal return CAR as $\tau\Gamma$, where τ is the number of trading days in the window.[14]

Table 5 shows the results of the event study estimation for the period 1997–2016. Interestingly, the average CAR is significantly positive for both male and female insiders over the two shortest windows, $(-1, 1)$ and $(-1, 5)$. Moreover, there is little if any difference in the CAR across gender. Thus, the market appears to be receiving positive firm-specific information shortly after the insider trades, whether the trades are by male or female insiders. It is possible that the mandatory insider-trade reports themselves convey some of this information directly to the market, causing the information to be incorporated in stock pries sooner than otherwise—increasing the informational efficiency of market prices. Moreover, while not shown in the table, there is a tendency for the insider purchases to follow a multi-day negative abnormal return—as if they are to some extent timing the stock price rebound.[15]

These gender-based short-run inferences are somewhat comparable to those of Inci, Narayanan, and Seyhun (2017) on US data, except that the latter study finds that male insiders tend to outperform their female counterparts, which is not the case in our data.

6 Did the board reform affect female insider trading and performance?

Norway's 2003 board gender-balancing law increased dramatically the size of the network of female directors. The law, which requires a board to have at least 40% from each gender, was enacted in December of 2005 with full compliance required within two years (or face possible liquidation). As shown in Figure 1, the proportion of female directors in Norwegian OSE-listed companies rose from 15% in 2003 to 40% in 2008. The figure also shows that average board size has remained unchanged at five directors over the entire period 1998–2014. Thus, rather than expanding board size to make room for new female directors (and keep existing male directors), firms typically chose to replace male directors with females.

[14] See Thompson (1985) for a discussion of a conditional event parameter estimation of the type in Eq. (6). The traditional event study approach—using the residuals from the market model regression as explained in MacKinlay (1997)—yields similar abnormal return estimates. However, we prefer the estimation i Eq. (6) because it avoids double-counting cases where several insiders trade on the same or adjacent calendar days (the indicator variable takes a value of one for any and all insider trades in the event window). In a standard event study, one could remove such duplicates, but only on the same calendar day.

[15] Evidence of a stock price rebound around insider trades is also reported in event studies on US data (Seyhun, 1986, 1988; Lakonishok and Lee, 2001; Jeng, Metrick, and Zeckhauser, 2003; Inci, Narayanan, and Seyhun, 2017).

In the most comprehensive study of this act to date, Eckbo, Nygaard, and Thorburn (2019) show that the act had a statistically insignificant impact of the market values of firms listed on the OSE. This evidence is reassuring from our perspective as it means that the shock to the population of insiders, while dramatically increasing the female director network, did not also systematically affect the stock returns that we use to measure insider performance. Thus, in this section, we examine whether the exogenous increase in the female director network has affected the absolute and relative performance of female primary insiders' trades.

Inci, Narayanan, and Seyhun (2017) suggest that female primary insiders in the US may be at an informational disadvantage relative to male directors due to the latter group's access to a much more extensive network of directors and executives. Building on this argument, we propose the hypothesis that the greater female director network (both within firm and across firms) after 2007 substantially enhances inside information and therefore, possibly, trades based on that additional information. To test this hypothesis, we also concentrate on primary insiders, which is the group most impacted by the board reform.

Before presenting the performance analysis, Table 6 provide descriptive trading information for the two sub-periods 1997–2007 and 2008–2016 (using the same table format as Table 1 above). The fraction of the total number of insiders that are female increases from about 10% in the first subperiod to 22% in the second period. As expected, both the fraction of primary insider trades by females and the female insider transaction size increase substantially after the compliance deadline in 2007.

Tables 7 and 8 show the long-run primary insider performance using our returns-based and holdings-based performance measures, respectively, for the post-quota sample period 2008–2016. As for the total sample period results in tables 3 and 4 above, there is no evidence of statistically significant abnormal performance for any of the portfolios or abnormal return measures, whether the insiders are male or female. Thus, we reject the hypothesis that the exogenous increase in female director network that resulted from the quota law has impacted insider trading performance.

However, Table 9 displays interesting changes in the short-term female insider performance measured using the event study approach. First, the table shows a statistically significant increase in the average $CAR(-1,1)$ and $CAR(-1,5)$ for female insiders from essentially zero in the pre-quota period (1997–2007) to a significant 0.15% and 0.21% in the post-quota period (2008–2016), respectively. This increase may reflect a combination of two effects, both driven by the board reform. First, the female network

expansion may have given female insiders better access to valuable inside information, on which they trade occasionally. Second, the network expansion may have increased the stock market's confidence in the information conveyed by female insider trades. Notice also that there is no evidence that the board reform has changed the CAR of male insiders: they realize a significant average CAR of similar magnitude in both subperiods. In sum, according to Table 9, the board reform resulted in the average CAR of female insiders to become not only statistically significant but also of a magnitude that is now indistinguishable from the average CAR of male insiders.

In sum, while there is no evidence that the dramatic expansion of the female director network that happened leading up to year 2008 has had a measurable impact on the long-term, holding-period performance of primary insiders trades (male or female), the short-term performance of female trades has increased significantly, from zero to an average of 0.2% over the seven-day window following purchases. It is worth pointing out that this short-term performance does *not* represent realized abnormal return to the insider: as per our insider weight data, they did not sell those shares again after a seven-day holding period. However, the increase in the short-term CAR is interesting because it suggests that the board reform has increased the ability of female insiders to fine-tune their purchase orders and that outside investors give more weight to the information in these reported trades.

7 Insider trading during the financial crisis

The above empirical analysis examines gender-based insider performance both in general and specifically after the quota law mandating gender-balanced boards. Our third objective is to use observed insider trading activity during the financial crisis period 8/2008–12/2010 as a way to identify gender-based differences in director risk aversion.

7.1 Potential trading motives

As pointed out in the introduction, the stock market crash in September of 2008, which followed the dramatic bankruptcy of Lehman Brothers, likely had two effects on the incentive for insiders to purchase additional shares: (1) to take advantage of what insiders' considered temporary stock market underpricing, and (2) to restore an optimal share of equity in the individual insider's investment portfolio. Since the potential for underpricing was driven by an exogenous shock to the stock market, there is no

particular reason to expect the mispricing motive *per se* to create a differential trading response among male and female insiders.

However, the purchase demand created by either of the two motives depends on the individual insider's risk aversion. Betting on market underpricing and restoring the optimal pre-crisis asset allocation between risky and risk-free investments require (temporarily) over-weighting the insider holding and increasing the weight of the market portfolio after the exogenous decline in the market. Risk aversion attenuates both these two trading motives. Thus, in the cross-section of individual insiders, less risk averse insiders trade more.

As indicated in the introduction, the conventional view is that females tend to be more risk averse than males. The gender-based trade information below provides an important test of this proposition in a unique setting where individual insiders react to a dramatic shock to their investment opportunities.

7.2 Average annual trading propensity by gender

To examine the above trading propensity hypothesis, we first calculate the average firm-level fraction of female directors that trade in a given year. Here, we use the board data underlying Figure 1 above, which ends in 2014. The average annual fraction of directors that trade is plotted in Figure 3 for the period 1998–2014. The figure is interesting. In Panel A, the average fraction of female directors that purchase stock increases steadily to a peak in 2009—in the midst of the financial crisis. In Panel B, we see that 2009 is also the peak year for the fraction of male directors that purchase stocks. Thus *all* insiders, male and female, display a higher propensity to trade during the financial crisis than in other periods.

Interestingly, the average tendency to trade more during the financial crisis is more dramatic for female than for male directors. This is evidenced not only by the rate of increase in buy transactions in Panels A and B but also by the near-disappearance of sell orders in Panel C of Figure 1, which is unique to female directors.

Finally, it is worth pointing out that, in Panel A of Figure 1, some of the growth in female insider purchases prior to year 2007 is likely driven by the 2005 enactment of the gender-quota law: a new female director may for various reasons have wanted to hold stocks in the firm she just joined as director. This motive does not, however, drive the growth in insider purchases after 2006. As shown earlier in Figure 1, by the end of 2006, the percentage of female board members was already above 30%.

7.3 Cross-sectional analysis of trading propensities

The average annual trading propensities in Figure 1 hide a number of firm-specific influences on a director's willingness to trade shares in the firm. In Table 10, we report coefficient estimates from probit regressions of the likelihood of insider trades by gender using 3,997 firm-quarter observations, 1998–2014. In a given firm-quarter, the left-hand-side variable takes a value of one if there is an insider trade and zero otherwise. Since we use our trade-based OSE information in this estimation, the left-hand side variable again includes trades by all primary insiders—executives as well directors.

The explanatory of central interest is the indicator variable *Crisis 2008-10*, which takes a value of one if the trade occurs in the 30-month period 7/2008–12/2010. In addition, the firm-level control variables include the log of the market capitalization of the firm (*ln(Market Cap)*), the quarterly volatility of the firm's stock return (*Stock volatility*), last quarter's average daily relative stock spread (*Bid/Ask Spread*), the fraction of female directors (*Fraction women on board*), and the firm's stock beta estimated over the past 36 months (*Stock beta*). As before, we remove routine trades following the procedure in Cohen, Malloy, and Pomorski (2012).

The control variables in Table 10 are intuitive. First, larger firms have a greater number of primary insiders, which increases the likelihood of an insider trade. At the same time, larger firms are typically more liquid and subject to more intensive public scrutiny, which lowers the prospect for trading on valuable inside information. Second, as stock beta is a measure of systematic risk, more risk averse individuals may trade less as insiders in high-beta firms.[16] Third, stock volatility is highly correlated with a stock's idiosyncratic (extra-factor) risk. Fourth, the relative bid/ask spread measures trading cost, which may deter marginal insider trades. Finally, it is important to control for the fraction of female directors on the board, which varies substantially before gender-balancing, but also afterward as the legally mandated fraction depends on board size.[17]

The results of the probit estimation are interesting. Most important, the coefficient estimate for *Crisis 2008019* is positive and highly significant in Column (1). That is, female primary insiders purchase significantly more stock during the financial crisis, even after controlling for the various firm-specific trading influences. At the same time, *Crisis 2008019* is statistically insignificant for female insider sales

[16]This is in fact supported by Table 3 above, which shows that stock betas for portfolios held by female insiders are lower than stock betas for portfolios held by male insiders.

[17]For example, the fraction is 0.5 for a 4-member board, 0.4 for a five-member board, and 0.38 for a eight-member board. See Eckbo, Nygaard, and Thorburn (2019) for further details.

(Column 2), and for male insider trades (purchases or sales). Thus, both the univariate time-series in Figure 1 and the cross-sectional probit estimation in Table 10, strongly indicate that female insiders increased—rather than decreased—their purchases during the financial crisis.

8 Conclusion

This paper uses the population of insider trades reported to the Oslo Stock Exchange in a twenty-year period to investigate gender differences in (legal) insider trading by top management and directors. We construct stock portfolios representing these decisions and subject them to a battery of econometric methods for evaluating portfolio performance. We also compare the short-term market reaction to insider trades, and evaluate the consequences of two dramatic exogenous shocks: the 2005 enactment of Norway's pioneering board gender-balancing legislation, and the financial crisis of 2008.

Our main empirical findings are threefold. First, portfolios with weights constructed to reflect insiders' actual stock-holding show no evidence of abnormal insider performance at the monthly frequency, either over the total sample period (1998–2016) or in the period after gender-quota compliance (2008-2016). This conclusion is robust to varying performance metrics (both returns-based and portfolio holdings-based) and to varying the return horizon to capture long-lived inside information (up to six months following the trade date). Judging in particular from our novel holdings-based tests, which calculates the covariance between changes in insider stock holdings and subsequent abnormal stock returns, there is no evidence that insiders have the ability to buy low and sell high.

Second, there is evidence that, in the post-quota period, female insiders are better able to time their stock purchases to days in which the firm realizes short-term (up to seven days) positive abnormal stock returns. It is also possible that the dramatic increase in the female director network caused by the gender quota has contributed to this firm-level abnormal performance, as one effect of having access to a wider director (physical and informational) network. Moreover, the informational network effect may have increased the market's valuation of the signal implied by female insider purchases. As for male insiders, there is evidence of short-term abnormal performance following purchases both before and after the forced gender balancing. This abnormal performance is on average indistinguishable from that of female insiders after 2007.

The short-term firm-level abnormal return that we show exists following insider purchases is realized

by the insider themselves only if they also sell their shares after seven days. Our data on insider holdings show that this is literally never the case. This fact explains why the short-term firm-level performance does not show up as abnormal insider return in our portfolios based directly on insiders' actual stock holding periods. It is also a reminder to distinguish abnormal *firm* performance following insider purchases from the actual performance of the *insider*.

Third, we show that female primary insiders significantly increased their purchases during the financial crisis, which male insiders did not. Since it is unlikely that female insiders had better information than male insiders in terms of whether the crisis created a significant mispricing of their company's stock, the weight of this evidence points to a female director risk aversion that is no higher—and possibly lower—than male director risk aversion. This evidence is important as it is based not on surveys but directly on female insiders' investments, which are of substantial magnitude (the female director purchase transaction averages about sixty thousand U.S. dollars.) Given the sample selection of this paper, our evidence also supports the argument of Adams and Funk (2012) that the selection of females as executives and directors may indeed require these individuals to be "more like men" to break the glass ceiling.

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Figure 1: Average board size and proportion of female directors in Norwegian OSE-listed firms.

The figure shows the average board size (left axis), defined as the number of shareholder-elected directors, and the number (left axis) and fraction (right axis) of female directors. Year 2008 (indicated with a vertical line) is the first year in which all Norwegian-domiciled OSE-listed firms are in full compliance with Norway's board gender-balancing law. Board data are from the national *Brønnøysund Register Centre*, 1998-2014.

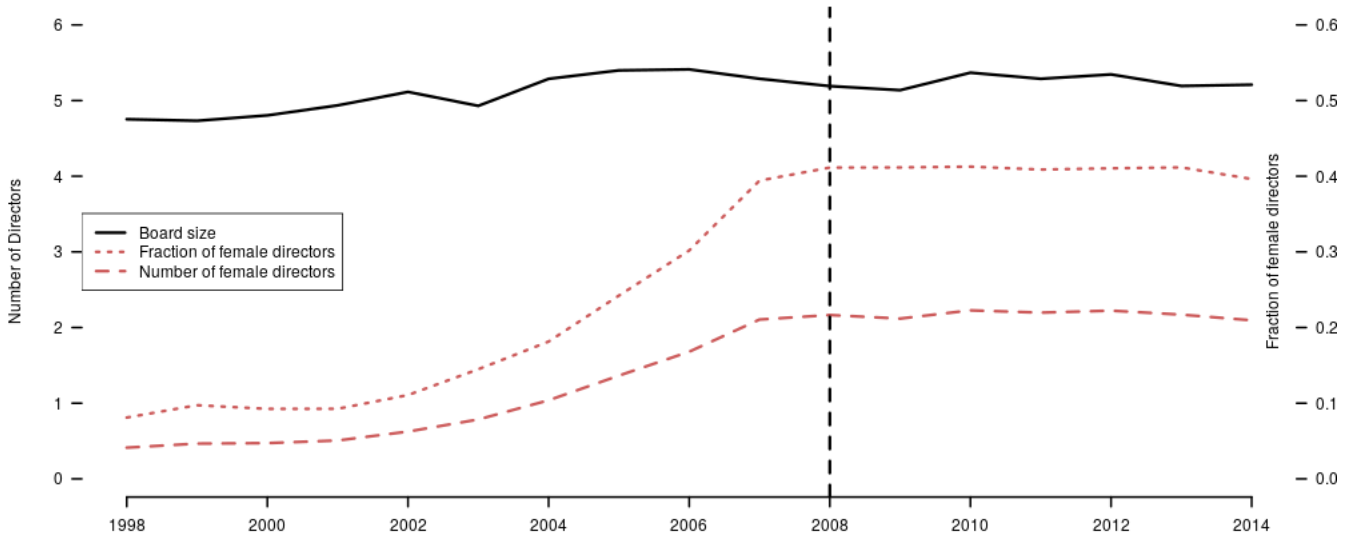


Figure 2: Annual percent of primary insiders' trades executed by females, OSE 1986-2016

The figure plots the number of female primary insider trades in percent of all primary insider trades. Firms are listed on the Oslo Stock Exchange (OSE). Year 2007 marks the deadline for complying with Norway's board gender-balancing law, which was enacted in 2005 and require a minimum of approximately 40% of shareholder-elected directors to be from each gender.

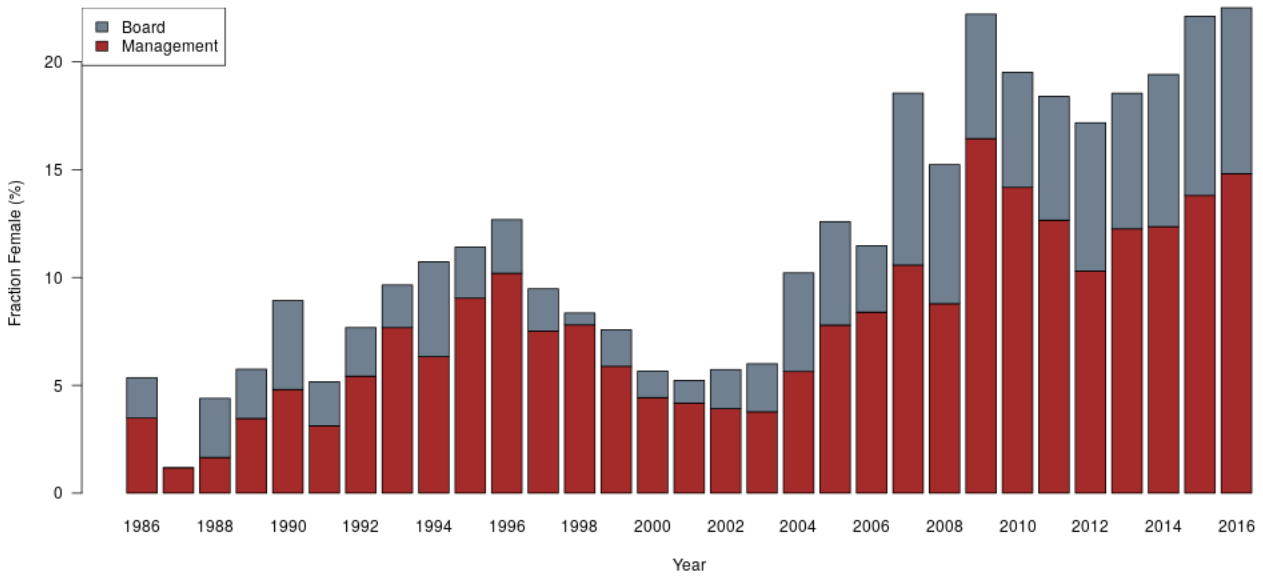
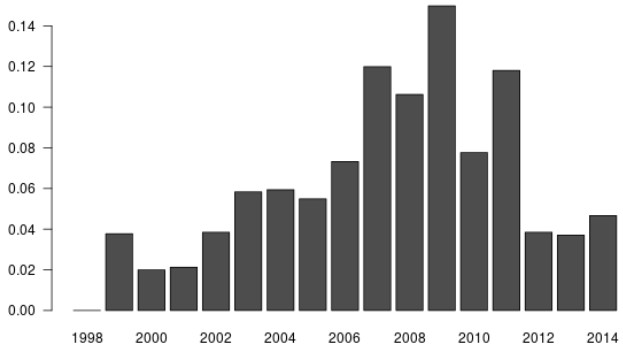


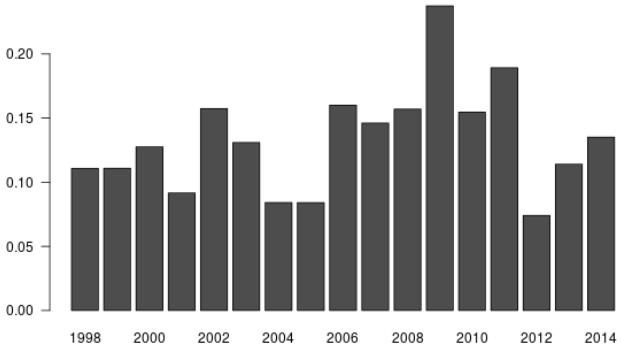
Figure 3: Annual average fraction of OSE-listed firms' directors that trade

The figure reports the annual average fraction of a board's directors, classified by gender, that report an insider purchase (panels A and B) or sale (panels C and D). Sample period 1998–2014.

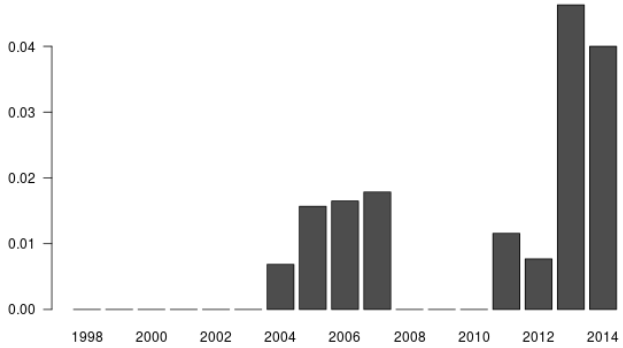
Panel A: Female buy trades



Panel B: Male buy trades



Panel C: Female sell trades



Panel D: Male sell trades

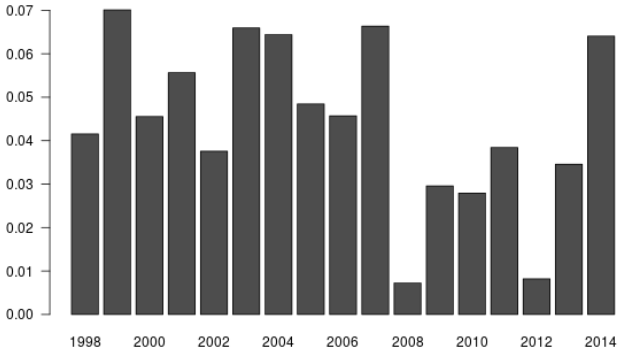


Table 1: Insider trading by gender: Sample descriptives

Primary insiders are directors and executives. Routine (repeated) trades are identified using the methodology of Cohen, Malloy, and Pomorski (2012): An insider trader in month t is a "repeat performer" if the same insider traded in the same calendar month in each of the three years preceding the trade in month t. In Panel B, the number of distinct insiders is the number of individuals with insider transactions (excluding insiders who never transact). Panel C characterizes insider trading on an individual trader basis, using the insiders' trading history. The trading history begins with the first reported trade and ends with the last reported trade. We first compute the annual number of trades and trade values for each insider, and then form the sample period average for each insider (including years without trades). Panel B then reports the averages of these per insider averages. All value as in constant 2016 NOK using the consumer price index supplied by the Norwegian Bureau of Statistics (SSB).

A: Total sample of insider trades

	1986–2016		1986–1997		1997–2016	
	N	%	N	%	N	%
Total insider transaction records	47,429		23,213		24,223	
Records with *gender identified*	38,504	100%	17,098	100%	21,412	100%
of which by *primary insiders*	21,663	56%	5,660	33%	16,009	75%
of which are *non-routine*	19,108	88%	4,484	79%	14,630	91%

B: Transaction totals and averages

	All insiders				**Primary Insiders**			
	Total	Male	Female	Female(%)	Total	Male	Female	Female(%)
Number of firms	649	646	466	71.8	556	554	302	54.3
Number of distinct insiders	16473	13481	3003	18.2	5967	6100	1028	17.2
Total transaction value (mill.)								
Buys	161671	159945	1726	1.1	68628	67729	899	1.3
Sells	84902	82835	2067	2.4	69583	68341	1242	1.8
Number of transactions								
Buys	27082	23364	3718	13.7	16063	14387	1676	10.4
Sells	11422	10060	1362	11.9	5600	5195	405	7.2
Average transaction (1,000)								
Buys	5970	6846	464		4272	4708	536	
Sells	7433	8234	1518		12425	13155	3066	
Median transaction (1,000)								
Buys	74	88	27		119	130	62	
Sells	215	255	66		415	446	137	

C: Individual insiders' trading intensity

	All insiders			**Primary insiders**		
	All	Female	Male	All	Female	Male
Number of trades in year						
Buys	1.19	1.11	1.21	1.21	1.13	1.23
Sells	1.16	1.12	1.17	1.13	1.06	1.14
Annual transaction value (1,000)						
Buys	3839	461	4554	3026	631	3429
Sells	9795	1697	11204	17486	3297	19037

Table 2: Annual primary insider trades by gender, OSE 1986-2016

This table shows the annual distribution of the total of 21,663 primary insider trades from Table 1. Primary insiders are directors and executives. 100K means NOK 100.000.

	Primary insider purchases					Primary insider sales				
	Number of transactions				% Female	Number of transactions				% Female
Year	<100K	>100K	Female	Male	by value	<100K	>100K	Female	Male	by value
1986	19	44	3	60	0.01	17	27	2	42	0.13
1987	49	86	2	134	0.41	34	36	0	70	0.00
1988	55	91	7	139	0.09	37	34	2	71	0.03
1989	72	129	12	189	0.18	37	68	3	102	0.10
1990	123	224	24	323	0.16	127	106	20	214	1.12
1991	83	223	16	290	10.02	158	121	10	270	0.58
1992	112	254	17	349	1.01	100	94	0	194	0.00
1993	131	248	18	361	0.53	145	151	31	265	0.60
1994	169	321	35	457	1.79	129	117	30	218	4.69
1995	183	226	37	373	0.47	227	110	27	311	0.68
1996	248	345	59	535	0.79	192	146	22	316	0.18
1997	353	488	60	781	0.43	281	111	20	372	0.20
1998	187	230	21	398	0.05	87	28	7	108	0.10
1999	477	554	60	977	0.78	270	105	18	357	0.28
2000	277	270	20	529	0.15	218	34	13	239	14.24
2001	227	221	18	431	3.25	154	54	6	202	2.22
2002	261	286	24	523	0.12	69	43	3	109	0.01
2003	159	196	18	338	1.38	120	63	6	177	0.05
2004	149	168	25	294	0.26	123	38	15	146	0.59
2005	163	143	32	278	2.49	156	32	16	174	0.10
2006	306	156	41	424	0.32	223	26	15	235	0.69
2007	429	213	104	539	0.37	145	13	13	146	2.49
2008	345	275	84	538	7.31	61	15	3	73	0.04
2009	520	643	205	971	6.49	104	33	17	120	0.35
2010	487	531	162	866	14.50	98	31	14	115	3.00
2011	508	425	139	797	4.76	65	26	10	81	21.79
2012	314	191	66	440	1.45	80	24	17	87	14.17
2013	349	198	68	479	1.46	97	32	19	110	14.79
2014	402	247	91	559	2.77	96	35	20	111	25.61
2015	338	284	102	521	10.35	53	26	13	66	4.23
2016	295	302	106	494	10.37	69	38	13	94	2.39
All	7790	8212	1676	14387	1.44	3772	1817	405	5195	1.93

Table 3: Returns-based primary insider portfolio performance, 1986–2016.

The performance estimates reported in this table are based on monthly portfolio returns and rebalancing. The three sets of portfolio weights are defined in Eq. (4) in the text. The Equal-weights (buys) portfolio (columns 1-3) equal-weighs firms with insider purchases in month t. The Insider-ownership-weight of firm i (columns 4-6) is the insiders' percentage ownership of firm i divided by the sum of the percentage insider holdings across all OSE firms. The Insider-value-weight (columns 7-9) of firm i is the value of insider holdings in i divided by the value of all insider holdings in all OSE firms. The Male-female portfolio is long in male and short in female insider weights. In Panel A, Sharpe Ratio is $\text{mean}(r_p - r_f)/\text{sd}(r_p - r_f)$ and, for the long-short portfolio, $\text{mean}(r_p)/\text{sd}(r_p)$. The two performance metrics, α_p^{4f} in Panel B and α_p^{rb} in Panel C, are defined in Eq. (2) in the text. The first is the constant term in a four-factor Fama-French-Carhart regression, while the second is the average constant term in a rolling-beta CAPM regression. Standard errors are in brackets, with p-values indicated as *=p<0.1, **=p<0.05, ***= p<0.01.

Portfolio:	**Equal weights (buys)**			**Insider-ownership weights**			**Insider-value weights**		
	Female	Male	Male− Female	Female	Male	Male− Female	Female	Male	Male− Female
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
A: Average raw returns and Sharpe Ratio									
$(1/N)\sum r_{pt}$	0.0381	0.0247	−0.0144	0.0198	0.0138	−0.0049	0.0136	0.0132	0.0012
$(1/N)\sum r^e_{pt}$	0.0340	0.0197		0.0165	0.0088		0.0086	0.0082	
Sharpe Ratio	0.1593	0.2128	−0.0804	0.1740	0.0929	−0.0537	0.0973	0.1066	0.0173
B: Four-factor alpha estimate									
α_p^{4f}	0.023*	0.006*	−0.019	−0.0002	−0.001	−0.007	−0.003	0.00001	−0.0003
	(0.013)	(0.003)	(0.011)	(0.006)	(0.004)	(0.006)	(0.003)	(0.003)	(0.004)
β_p^m	1.354***	1.299***	0.076	0.897***	0.974***	0.215*	1.192***	1.109***	−0.089
	(0.247)	(0.064)	(0.219)	(0.108)	(0.082)	(0.113)	(0.065)	(0.049)	(0.070)
b_p^{SMB}	0.222	0.243***	−0.008	0.400***	0.072	−0.317**	0.091	−0.262***	−0.352***
	(0.290)	(0.080)	(0.258)	(0.126)	(0.103)	(0.132)	(0.081)	(0.062)	(0.088)
b_p^{HML}	−0.146	−0.113	0.068	0.273**	−0.150*	−0.387***	0.042	−0.187***	−0.256***
	(0.269)	(0.070)	(0.239)	(0.114)	(0.089)	(0.119)	(0.070)	(0.053)	(0.077)
b_p^{UMD}	−0.004	−0.026	−0.081	0.074	0.149*	−0.141	0.001	0.066	0.068
	(0.236)	(0.059)	(0.209)	(0.094)	(0.076)	(0.098)	(0.060)	(0.045)	(0.065)
Observations	280	371	280	272	371	272	368	371	368
$\overline{R}^2$	0.090	0.533	−0.013	0.211	0.275	0.073	0.488	0.611	0.057
C: Average rolling-beta CAPM estimate of alpha									
α_p^{rb}	0.0263**	0.0091**	−0.0181*	0.0042	0.0011	−0.0079	0.0004	−0.0030	−0.0097*
	(0.012)	(0.003)	(0.011)	(0.005)	(0.004)	(0.005)	(0.005)	(0.004)	(0.005)
$\overline{\beta}_p^{rb}$	1.11	1.09	−0.01	0.66	0.94	0.29	1.14	1.28	0.24

Table 4: Holdings-based primary insider performance, 1986–2016.

The holdings-based estimates in this table are based on covariances between monthly changes in insider holdings (weights) and subsequent returns, as follows:

$$HM = \frac{1}{T-2}\sum_{t=2}^{T}\frac{1}{N_t}\left(\sum_{t=1}^{N_t} Cov\left(\Delta w_{it},\ r_{i,t+\tau} - E[r_{i,t+\tau}]\right)\right)$$

where Δw_{it} is the change in the weight of stock i in the insider portfolio from month $t-1$ to t, and $r_{i,t+\tau} - E[r_{i,t+\tau}]$ is the abnormal returns over the subsequent τ months ($\tau = 1, 3, 6$). Δw_{it} is either the monthly change in insider holdings, $w_{it}^{ins} - w_{i,t-1}^{ins}$, or the monthly change in insider holdings relative to the firm's weight in the OSE market portfolio (a CAPM "buy and hold" weight). $E[r_i, t+\tau]$ is the predicted return using the Fama-French-Carhart risk factors estimated using five years of monthly data prior to time t. The columns labelled p(diff) report the p=value for the difference between the male and female portfolio performance metrics. The p-values are calculated using standard errors that are robust to autocorrelation. Standard errors are in brackets, with p-values indicated as: *=p<0.1, **=p<0.05, ***= p<0.01.

Portfolio:	**Equal weights (buys)**			**Insider-ownership weights**			**Insider-value weights**		
Weight; Return	Female	Male	p(diff)	Female	Male	p(diff)	Female	Male	p(diff)
$Cov(\Delta w_{it};\ Ret_{i.t+\tau})$	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
A: Short-lived insider information: one-month future return horizon ($T = 1$)									
Δ_{it}: *lagged insider portfolio weights*									
$Cov(w_{it}^{ins} - w_{i,t-1}^{ins}\ ;\ r_{i,t+1} - E[r_{i,t+1}])$	0.0114	0.0053	0.73	0.0012	−0.0008	0.26	0.0011	−0.0002	0.45
Δ_{it}: *market portfolio weights*									
$Cov(w_{it}^{ins} - w_{i,t-1}^{m}\ ;\ r_{i,t+1} - E[r_{i,t+1}])$	−0.0018	0.0011	0.78	0.0054	−0.0016	0.25	−0.0028	−0.0025	0.94
B; Intermediate-lived inside information: three-month future return horizon ($T = 3$)									
Δ_{it}: *lagged insider portfolio weights*									
$Cov(w_{it}^{ins} - w_{i,t-1}^{ins}\ ;\ r_{i,t+3} - E[r_{i,t+3}])$	0.0167*	0.0059	0.49	0.0025	−0.0002	0.19	0.0023	−0.0003	0.25
Δ_{it}: *market portfolio weights*									
$Cov(w_{it}^{ins} - w_{i,t-1}^{m}\ ;\ r_{i,t+3} - E[r_{i,t+3}])$	0.0001	0.0026	0.99	0.0102	−0.0012	0.49	−0.0117	−0.0052	0.52
C: Long-lived insider information: six-month future return horizon ($T = 6$)									
Δ_{it}: *lagged insider portfolio weights*									
$Cov(w_{it}^{ins} - w_{i,t-1}^{ins}\ ;\ r_{i,t+6} - E[r_{i,t+6}])$	0.0081	0.0038	0.89	0.0024	0.0002	0.27	0.0008	−0.0006	0.68
Δ_{it}: *market portfolio weights*									
$Cov(w_{it}^{ins} - w_{i,t-1}^{m}\ ;\ r_{i,t+6} - E[r_{i,t+6}])$	0.0024	0.0052	0.72	0.0099	0.0004	0.88	−0.0232	−0.0077	0.38

Table 5: Cumulative abnormal returns (CAR) around the day of insider purchases, 1997–2016

The table reports the cumulative abnormal abnormal stock return $CAR \equiv \tau\Gamma$, where Γ is the average daily abnormal return over τ days in event time centered on the day of insider purchases (day 0) and estimated using the following one-factor return-generating process (the 'market model'):

$$r_{it}^{e} = a_i + b_i r_{mt}^{e} + \Gamma D_{it}^{event} + \varepsilon_{it},$$

where r_{mt}^{e} is the return on the market portfolio in excess of the risk-free rate on day t, and D_{it}^{event} is a dummy variable that takes a value of one inside the event window and zero otherwise. There are four alternative event windows around day 0: three days $(-1, 1)$, seven days $(-1, 5)$, twenty-seven days $(-1, 25)$, and 52 days $(-1, 50)$. The estimation in Panel A (Panel B) uses trades of primary female (male) insiders only, and it removes routine trades as in Cohen, Malloy, and Pomorski (2012). P-values are indicated by: *=p<0.1, **=p<0.05, ***=p<0.01.

Event windows:	$(-1, 1)$	$(-1, 5)$	$(-1, 25)$	$(-1, 50)$
A: Female Insiders				
CAR	0.012***	0.014***	0.007	0.005
	(0.001)	(0.001)	(0.0004)	(0.0003)
$Obs.$	643,261	643,261	643,261	643,261
$\overline{R}^2$	0.030	0.030	0.030	0.030
B: Male Insiders				
CAR	0.015***	0.014**	−0.001	−0.016
	(0.001)	(0.001)	(0.001)	(0.0004)
$Obs.$	1,013,513	1,013,513	1,013,513	1,013,513
$\overline{R}^2$	0.005	0.005	0.005	0.005

Table 6: Insider trade descriptives before and after quota compliance (1997–2007 versus 2008–2016)

The tables replicate the descriptives in Table 1 for two sub-periods: 1997–2007 and 2008–2016. In Panel A, the number of distinct insiders is the number of primary insiders with transactions (excluding insiders who never transact). Panel B characterizes insider trading on an individual trader basis, using the insiders' trading history. The trading history begins with the first reported trade and ends with the last reported trade. We first compute the annual number of trades and trade values for each insider, and then form the sample period average for each insider (including years without trades). Panel B then reports the averages of these per insider averages. All value as in constant 2016 kroner (NOK) using the consumer price index supplied by the Norwegian Bureau of Statistics (SSB). Data only for primary insiders.

A: Transaction totals and averages

	Primary Insiders							
	1997–2007				2008–2016			
	Total	Male	Female	Female(%)	Total	Male	Female	Female(%)
Number of distinct insiders	3394	3059	335	9.9	2913	2612	640	22.0
Total transaction value (million)								
Buys	45438	45229	208	0.5	9787	9261	526	5.4
Sells	54892	54235	657	1.2	5522	4995	528	9.6
Number of transactions								
Buys	5935	5512	423	7.1	6688	5665	1023	15.3
Sells	2397	2265	132	5.5	983	857	126	12.8
Average transaction (1,000)								
Buys	7656	8206	493		1463	1635	514	
Sells	22900	23945	4978		5618	5828	4187	
Median transaction (1,000)								
Buys	138	147	56		127	144	82	
Sells	742	793	168		505	611	195	

B: Individual insiders' trading frequency and intensity

	Primary insiders					
	1997–2007			2008–2016		
	All	Female	Male	All	Female	Male
Number of trades in year						
Buys	1.29	1.23	1.29	1.27	1.16	1.30
Sells	1.16	1.08	1.17	1.15	1.09	1.16
Annual transaction value (thousands)						
Buys	7529	698	8273	1725	613	1995
Sells	29795	6266	31652	5704	2107	6298

Table 7: Post-quota returns-based primary insider portfolio performance (2008–2016).

This table replicates the analysis in Table 3 for the period 2008–2016 after all OSE-listed companies were in full compliance with the quota law. The performance estimation uses monthly portfolio returns and rebalancing. The three sets of insider portfolio weights are defined in Eq. (4) in the text. The Equal-weights (buys) portfolio (columns 1-3) equal-weighs firms with insider purchases in month t. The Insider-ownership-weight of firm i (columns 4-6) is the insiders' percentage ownership of firm i divided by the sum of the percentage insider holdings across all OSE firms. The Insider-value-weight (columns 7-9) of firm i is the value of insider holdings in i divided by the value of all insider holdings in all OSE firms. The Male-female portfolio is long in male and short in female insider weights. In Panel A, Sharpe Ratio is $\text{mean}(r_p - r_f)/\text{sd}(r_p - r_f)$ and, for the long-short portfolio, $\text{mean}(r_p)/\text{sd}(r_p)$. The two performance metrics, α_p^{4f} in Panel B and α_p^{rb} in Panel C, are defined in Eq. (2) in the text. The first is the constant term in a four-factor Fama-French-Carhart regression, while the second is the average constant term in a rolling-beta CAPM regression. Standard errors are in brackets, with p-values indicated as *=p<0.1, **=p<0.05, ***= p<0.01

Portfolio:	**Equal weights (buys)**			**Insider-ownership weights**			**Insider-value weights**		
	Female	Male	Male−Female	Female	Male	Male−Female	Female	Male	Male−Female
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
A: Average raw returns and Sharpe Ratio									
$(1/N)\sum r_{pt}$	0.0434	0.0208	−0.0209	0.0080	0.0048	−0.0032	0.0102	0.0065	−0.0037
$(1/N)\sum r_{pt}^e$	0.0414	0.0189		0.0061	0.0029		0.0083	0.0046	
Sharpe Ratio	0.1569	0.1982	−0.0965	0.0603	0.0440	−0.0325	0.1376	0.0651	−0.0720
B: Four-factor alpha estimate									
α_p^{4f}	0.031	0.004	−0.027	−0.004	−0.006	−0.004	−0.0004	−0.004	−0.006
	(0.027)	(0.007)	(0.023)	(0.010)	(0.004)	(0.010)	(0.004)	(0.004)	(0.005)
β_p^m	1.482**	1.691***	0.212	0.988***	1.170***	0.198	1.013***	1.096***	0.099
	(0.676)	(0.172)	(0.571)	(0.246)	(0.108)	(0.253)	(0.090)	(0.104)	(0.133)
b_p^{SMB}	0.493	0.230	−0.251	0.153	0.057	−0.092	−0.277***	−0.474***	−0.193
	(0.661)	(0.168)	(0.558)	(0.240)	(0.106)	(0.247)	(0.088)	(0.101)	(0.130)
b_p^{HML}	−0.487	−0.185	0.280	0.045	−0.104	−0.147	−0.121	−0.076	0.046
	(0.686)	(0.172)	(0.579)	(0.247)	(0.109)	(0.254)	(0.090)	(0.104)	(0.134)
b_p^{UMD}	−0.320	0.062	0.365	0.217	−0.050	−0.263	0.132*	0.129	0.001
	(0.524)	(0.132)	(0.443)	(0.189)	(0.083)	(0.195)	(0.069)	(0.080)	(0.102)
Observations	106	108	106	108	108	108	108	108	108
$\overline{R}^2$	0.032	0.519	−0.028	0.113	0.595	0.008	0.669	0.677	0.007
C: Average rolling-beta CAPM estimate of alpha									
$\overline{\alpha}_p^{rb}$	0.0346	0.0114*	−0.0235	−0.0004	−0.0040	−0.0055	−0.0034	−0.0060	−0.0046
	(0.025)	(0.006)	(0.021)	(0.009)	(0.004)	(0.009)	(0.009)	(0.005)	(0.009)
$\overline{\beta}_p^{rb}$	1.11	1.09	−0.008	0.67	0.98	0.31	1.24	1.40	0.16

Table 8: Post-quota holdings-based primary insider performance (2008–2016)

The holdings-based estimates are based on covariances between monthly changes in insider holdings (weights) and subsequent returns, as follows:

$$HM = \frac{1}{T-2}\sum_{t=2}^{T}\frac{1}{N_t}\left(\sum_{t=1}^{N_t} Cov\left(\Delta w_{it},\ r_{i,t+\tau} - E[r_{i,t+\tau}]\right)\right)$$

where Δw_{it} is the change in the weight of stock i in the insider portfolio from month $t-1$ to t, and $r_{i,t+\tau} - E[r_{i,t+\tau}]$ is the abnormal returns over the subsequent T months ($T = 1, 3, 6$). Δw_{it} is either the monthly change in insider holdings, $w_{it}^{ins} - w_{i,t-1}^{ins}$, or the monthly change in insider holdings relative to the firm's weight in the OSE market portfolio w_{it}^{m} (a CAPM "buy and hold" weight). $E[r_i, t+\tau]$ is the predicted return using the Fama-French-Carhart risk factors estimated using five years of monthly data prior to time t. The columns labelled p(diff) report the p=value for the difference between the male and female portfolio performance metrics. The p-values are calculated using standard errors that are robust to autocorrelation. Standard errors are in brackets, with p-values indicated as: *=p<0.1, **=p<0.05, ***= p<0.01.

Portfolio:	**Equal weights (buys)**			**Insider-ownership weights**			**Insider-value weights**		
Weight; Return	Female	Male	p(diff)	Female	Male	p(diff)	Female	Male	p(diff)
$Cov(\Delta w_{it};\ Ret_{i.t+\tau})$	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
A: Short-lived insider information: one-month future return horizon ($T = 1$)									
Δ_{it}: *lagged insider portfolio weights*									
$Cov(w_{it}^{ins} - w_{i,t-1}^{ins}\ ;\ r_{i,t+1} - E[r_{i,t+1}])$	0.0156	0.0125***	0.85	0.0014	0.0004	0.70	0.0008	−0.0006	0.28
Δ_{it}: *market portfolio weights*									
$Cov(w_{it}^{ins} - w_{i,t-1}^{m}\ ;\ r_{i,t+1} - E[r_{i,t+1}])$	−0.0044	−0.0062	0.71	0.0033	−0.0041	0.39	0.0008	0.0014	0.88
B; Intermediate-lived inside information: three-month future return horizon ($T = 3$)									
Δ_{it}: *lagged insider portfolio weights*									
$Cov(w_{it}^{ins} - w_{i,t-1}^{ins}\ ;\ r_{i,t+3} - E[r_{i,t+3}])$	0.0145	0.0103*	0.87	0.0018	0.0007	0.72	0.0009	−0.0024*	0.06
Δ_{it}: *market portfolio weights*									
$Cov(w_{it}^{ins} - w_{i,t-1}^{m}\ ;\ r_{i,t+3} - E[r_{i,t+3}])$	−0.0029	−0.0113	0.35	0.0069	−0.0048	0.53	0.0004	0.0070	0.41
C: Long-lived insider information: six-month future return horizon ($T = 6$)									
Δ_{it}: *lagged insider portfolio weights*									
$Cov(w_{it}^{ins} - w_{i,t-1}^{ins}\ ;\ r_{i,t+6} - E[r_{i,t+6}])$	0.0188	0.0094*	0.50	0.0011	0.0012	1.00	0.0016	−0.0041*	0.09
Δ_{it}: *market portfolio weights*									
$Cov(w_{it}^{ins} - w_{i,t-1}^{m}\ ;\ r_{i,t+6} - E[r_{i,t+6}])$	0.0173	−0.0061	0.08	0.0168	−0.0006	0.51	0.0058	0.0208	0.24

Table 9: Cumulative abnormal returns (CAR) for insider purchases before and after quota compliance

The table reports the cumulative abnormal abnormal stock return $CAR \equiv \tau\Gamma$, where Γ is the average daily abnormal return over τ days in event time centered on the day of insider purchases (day 0) and estimated using the following one-factor return-generating process (the 'market model'):

$$r_{it}^{e} = a_i + b_i r_{mt}^{e} + \Gamma D_{it}^{event} + \varepsilon_{it},$$

where r_{mt}^{e} is the return on the market portfolio in excess of the risk-free rate on day t, and D_{it}^{event} is a dummy variable that takes a value of one inside the event window and zero otherwise. There are four alternative event windows around day 0: three days $(-1, 1)$, seven days $(-1, 5)$, twenty-seven days $(-1, 25)$, and 52 days $(-1, 50)$. The estimation in Panels A and C (Panels B and D) uses trades of primary female (male) insiders only, and it removes routine trades as in Cohen, Malloy, and Pomorski (2012). P-values are indicated by: *=p<0.1, **=p<0.05, ***=p<0.01.

Event windows:	$(-1, 1)$	$(-1, 5)$	$(-1, 25)$	$(-1, 50)$
A: Female Insiders 1997–2007				
CAR	0.0039	−0.0008	−0.0150	−0.0151
	(0.002)	(0.001)	(0.001)	(0.0005)
$Obs.$	306,808	306,808	306,808	306,808
$\overline{R}^2$	0.040	0.040	0.040	0.040
B: Male Insiders 1997–2007				
CAR	0.0163***	0.0148***	0.0117	0.0104
	(0.001)	(0.001)	(0.0003)	(0.0003)
$Obs.$	527,318	527,318	527,318	527,318
$\overline{R}^2$	0.021	0.021	0.021	0.021
C: Female Insiders 2008-2016				
CAR	0.0154***	0.0212***	0.0172	0.0161
	(0.002)	(0.001)	(0.001)	(0.0004)
$Obs.$	336,453	336,453	336,453	336,453
$\overline{R}^2$	0.026	0.026	0.026	0.026
D: Male Insiders 2008-2016				
CAR	0.0167**	0.0083	−0.0141	−0.0429
	(0.002)	(0.002)	(0.001)	(0.001)
$Obs.$	486,195	486,195	486,195	486,195
$\overline{R}^2$	0.003	0.003	0.003	0.003

Table 10: Insider trading propensity during the financial crisis

The table reports coefficient estimates in probit regressions of the likelihood of insider trades by gender using firm-quarter observations. In a given firm-quarter, the left-hand-side variable takes a value of one if there is an insider trade and zero otherwise. The firm-level explanatory variables are the log of the market capitalization of the firm, stock volatility (the quarterly volatility of the firm's stock return), bid/ask spread (last quarter's average daily relative stock spread), the fraction of board members which are female, stock beta (estimated over the past 36 months), and the dummy variable Crisis 2008-10, which takes a value of one during the financial crisis period 07/2008–12/2010. The estimations removes "routine" trades following the procedure in Cohen, Malloy, and Pomorski (2012). The estimation period is 1998-2014. Statistical significance is indicated by p-values as follows: *=p<0.1, **=p<0.05, ***=p<0.01.

	Female primary insiders		**Male primary insiders**	
	Purchases	Sales	Purchases	Sales
	(1)	(2)	(3)	(4)
Constant	−4.409***	−2.184**	−2.680***	−1.873***
	(0.565)	(1.043)	(0.357)	(0.436)
ln(Market Cap)	0.131***	0.037	0.087***	0.029
	(0.026)	(0.044)	(0.017)	(0.020)
Stock volatility	−2.027	1.869	4.651***	3.945**
	(2.951)	(5.201)	(1.526)	(1.838)
Bid/Ask Spread	−1.437	−25.579***	−3.589***	−4.489***
	(1.922)	(7.629)	(1.091)	(1.420)
Fraction women on board	0.359	−0.691*	0.030	−0.579***
	(0.235)	(0.370)	(0.145)	(0.177)
Stock beta	−0.124*	−0.214*	−0.013	0.115**
	(0.073)	(0.115)	(0.043)	(0.050)
Crisis 2008–10	0.364***	−0.021	0.115	−0.144
	(0.104)	(0.218)	(0.076)	(0.104)
Observations	3,997	3,997	3,997	3,997