Insiders' IQ and Abnormal Returns from Their Trading of Inside and Outside Stocks

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Abstract

We investigate corporate insiders' trading and find that they on average manage to successfully time their net purchases, not only in their inside stocks, but also in their outside stocks. Nevertheless, compared to their net purchases in outside stocks, they manage to generate substantially higher abnormal returns subsequent to their purchases in inside stocks, verifying the common notion in the insider trading literature that insiders on average exploit their access to superior information. We continue by investigating whether the cross-sectional variation in corporate insiders' cognitive ability, as measured by their IQ scores, explains the abnormal stock returns they earn from trading their inside and outside stocks. The results of analyzing archival data of male insiders in Sweden show that high-IQ insiders earn greater abnormal returns on their outside stock purchases than low-IQ insiders. For inside purchases, however, we do not find that high-IQ insiders perform better than low-IQ insiders. We interpret this finding as high-IQ insiders being more concerned with the reputational and legal risks of exploiting insider information than low-IQ insiders. Supporting this conjecture, we additionally find that high-IQ investors are less likely to do large sales of inside stocks before stock price declines, and seem to prefer selling stocks in former inside firm than to selling inside stocks. Finally, we find that low-IQ insiders having access to private information outperform high-IQ insiders having no access to such information, indicating that superior information is more important for stock market success than superior cognitive abilities. Our results remain after controlling for various insider- and firm-specific factors, including firm fixed effects.

JEL Classification: M41, G10, G30, K42

Keywords: Insider trading, IQ, abnormal returns, reputational risk

1. Introduction

Many studies show that corporate insiders use their information advantage to earn abnormal returns when trading their inside stocks ((e.g., Rozeff and Zaman 1998; Lakonishok and Lee 2001; Aboody, Hughes, and Liu 2005; Huddart and Ke 2007; Skaife, Veenman, and Wangerin 2013). There is also a growing body of literature pointing out the importance of individual investor's personal traits for the understanding of their financial performance in general (e.g., Barber and Odean 2001, Barnea et al. 2010, Grinblatt, Keloharju, and Linnainmaa 2012) and insider trading in particular (e.g., Davidson, Dey, and Smith 2014; Hillier, Korczak, and Korczak 2015; Kallunki, Mikkonen, Nilsson, and Setterberg 2016).

In this paper, we investigate corporate insiders' trading in their inside stocks, where they have an access to private information, vs. outside stocks, where they have no access to private information.[1] This setting enables us to compare the returns to insider trading, not only to the market return, but also to the returns from trading in outside stocks. Consequently, we are able to effectively separate the effects on trading performance from having access to superior information from the effects of superior stock-picking abilities. Previous studies report that investors' IQ is positively related to their success in the stock market (e.g., Grinblattet al. 2012). However, it is an unresolved question whether high-IQ investors' superior stock market performance is due to their above-average ability in investment decisions, their access to private information, or both. It is moreover unknown whether low-IQ insiders compensate for their lower outside stock returns due to their weaker investment ability by using more of their private information than high-IQ insiders. We

[1] Inside stocks are those owned by a person who holds an insider position in the firm. The register of Swedish insiders is maintained by the *Finansinspektionen* (the Swedish Financial Supervisory Authority), which is the corresponding regulatory authority in Sweden to the Securities and Exchange Commission (SEC) in the United States. Outside stocks refer to insiders' stock holdings in firms where they hold no insider positions.

address these issues by comparing the abnormal returns earned by high- and low-IQ insiders when they trade their inside and outside stocks.

Exploiting insider information also involves reputational and legal risks for insiders (Brochet 2010; Veenman 2012; Badertscher, Hribar, Jenkins 2011; Cohen, Malloy, Pomorski 2012). In particular, insider transactions perceived to be opportunistic are likely to receive adverse investor and media attention, thereby also increasing the probability of regulatory scrutiny. The risk of adverse publicity and legal consequences is higher for insider selling before the price declines than for insider buying before the price increases (e.g., Cheng and Lo 2006, Chen, Martin and Wang 2013, Dai, Parwada, and Zhang 2015).[3] Obviously, insiders can earn returns either by trading inside stocks based on their insider information at the cost of reputational and litigation risk and/or by using their above-average ability in trading outside stocks. In other words, they can choose to what extent to trade their inside vs. outside stocks to earn returns.

In our empirical analyses, we utilize data on the inside and outside stockholdings of 5,502 male insiders from Sweden over the period from 2000 and 2008. We obtain insiders' IQ scores from the Swedish National Service Administration (*Mönstringsenheten*), which until 2010 was the

[3] We have obtained supporting anecdotal evidence on whether or not insider selling involves greater risks than insider buying. First, we interviewed 10 market participants including financial analysts, business journalists and asset managers to ask how they assess the costs of engaging in insider selling vs. buying. They concluded that there is clearly greater reputational risk involved in insider selling before price declines than in buying before price increases. Many of them pointed out that buying insider stocks creates greater incentives for insiders and that the returns on insider buying are 'paper gains' in the sense that the end return for a given purchase is not known at the point of the purchase. Also, selling before price declines means that there is a reduction in an insider's incentives and that an insider is saving real money leaving the rest of the shareholders to take the loss. Second, we have manually searched for articles on insiders' selling or buying in the leading Swedish business journals (Affärsvärlden, Dagens Industri, Veckans Affärer and the business sections of the main newspapers (Dagens Nyheter and Svenska Dagbladet) during our sample period. These articles are written by journalists who report and discuss peculiar insider transactions they have observed. We found 85 news articles in total. Out of these articles, 55 were about insider selling and 30 about insider buying. Given that there are 1,629 insider sales and 3,716 insider buy transactions in our sample, insider selling receives clearly more media scrutiny than insider buying. Consequently, reputational risk can be regarded to be greater in insider selling due to greater media scrutiny.

governmental agency responsible for screening Swedish men for their mandatory military service. We obtain insiders' stockholdings from the Euroclear Sweden at the end of each semi-annual period, that is, on June 30 and December 31 each year.[4] For each of these six-month periods, we classify each insider's holdings as being either an inside or outside stock, depending on whether or not he is a registered insider in that firm.[5] We then calculate the changes in insiders' stockholdings and classify a given stock as a net purchase (a net sale), if the stockholdings increased (decreased) during the six-month period.[6] We calculate the market-adjusted buy-and-hold stock return over a one-, three-, and six-month period following each semi-annual period. In all our regressions, we control for various insider and firm-specific factors of stock returns, including insiders' wealth, age, educational background, diversification, liquidity needs, risk preferences, and the firm and period fixed effects.

We begin our analyses by examining the market-adjusted buy-and-hold returns following corporate insiders' net purchases in inside and outside stocks. The results show that this group of investors manage to time their purchases successfully, not only for their inside stocks, but also for their outside stocks (we only find weak evidence for net sales). This could potentially mean that these investors have above average stock-picking abilities.[7] In order to evaluate the value of private information to an insider, it is hence important to control for the insider's general stock-picking skills. In such an analysis, we find that the market-adjusted returns (over 3 months) subsequent to

[4] We use the terms "six-month period" and "semi-annual period" interchangeably throughout the paper.

[5] We include both direct and indirect holdings of insider stocks, and make sure to split-adjust the holdings of inside and outside stocks.

[6] Consequently, we cannot measure stock returns over periods immediately following a given insider transaction. However, a similar restriction also affects most studies on insider trading that use US data.

[7] An alternative explanation is that these investors receive private information of these firms through for example corporate networks. We try to address this issue by controlling for trades in outside stocks that used to be inside stocks, trades in outside stocks in the same industry in which the insider holds an insider position, and finally we control for the number of insider positions held by the insider as a proxy for centrality in corporate networks. .

their net purchases of inside stocks is almost three times higher than following their net purchases of outside stocks.[8] This is in line with insiders indeed exploiting their access to superior information.[9]

We continue by investigating whether the cross-sectional variation in corporate insiders' cognitive ability, as measured by their IQ scores, explains the abnormal stock returns they earn from trading their inside and outside stocks. Our results show that high-IQ insiders earn greater abnormal returns when buying outside stocks than low-IQ insiders.[10] This result is consistent with intelligence affecting returns when investors do not have access to corporate insider information. In addition, we notice that insiders earn higher returns when purchasing outside stocks that were previously their inside stocks, suggesting that they are better at interpreting publicly available information about former inside stocks or continue to obtain valuable firm-specific information about these stocks.

We continue by examining whether insiders' intelligence explains the abnormal returns they earn when trading their inside stocks. We find that, unlike for outside stocks, high-IQ insiders do not outperform low-IQ insiders when trading inside stocks. If anything, they seem to earn lower abnormal returns when they trade inside stocks compared to low-IQ insiders. In additional analyses, analyzing the decision to trade, we find that high-IQ are more likely to purchase outside stocks prior to a price increase than the low-IQ investors, whereas they are not more likely to purchase inside stocks prior to a price increase.

There are, at least, two potential explanations for this finding. First, it might suggest that cognitive abilities have a smaller role to play when insider information is available. Second, high-

[8] Results are robust in OLS-regressions with the inclusion of period- and individual-fixed effects.
[9] Similar to much insider trading research we obtain weaker results for net sales, suggesting that these trades are less driven by private information.
[10] We only find weak evidence that high-IQ insiders do not sell outside stocks before declines in stock prices to avoid losses. Grinblatt et al. (2012) report a similar asymmetry between purchases and sales, that is, they find that high-IQ investors buy before increases in stock prices but do not sell before decreases in prices to the same extent.

IQ insiders might choose not to exploit their private information to the same extent as low-IQ insiders because they are more concerned about the reputational and legal risks of profiting from insider information. Consistent with the latter explanation, we find that high-IQ investors are less likely than low-IQ investors to do large sales of inside stocks prior to a price decline. We also find indications of high-IQ investors being more inclined to sell stocks that used to be their inside stocks, than stocks in firms in which they currently hold an insider position.

If indeed, high-IQ insiders are more concerned with reputational risks from insider trading, they might choose to not trade at all. In univariate tests, we find that the insiders in our sample that chose not to trade have a significantly higher IQ. We cannot, however, verify this conjecture in a cross-sectional setting. To conclude, albeit some evidence of high-IQ investors avoiding insider trading with high adverse reputational effects, we admittedly cannot disentangle the exact mechanism that explains why high-IQ insiders do not outperform low-IQ insiders when trading inside stocks.

Finally, we address the question of what matters most for success in the stock market; superior information or superior cognitive abilities? Or phrased differently, can higher cognitive abilities, as measured by IQ, can compensate for having access no to private information. We find some evidence that high-IQ insiders earn greater abnormal returns on their inside stocks than high-IQ insiders earn on their trades in outside stocks, indicating that superior information is more important for stock market performance than superior cognitive abilities.

Our paper contributes to the literature in several ways. First, we contribute to the insider trading literature by being able to compare corporate insiders trading in their inside stocks to their trading in their outside stocks, and thus effectively disentangle the effects of superior ability from superior information. Second, we expand the insider trading literature by exploring whether insiders' intelligence is associated with their trading behavior. Our findings expand the literature on how different insiders consider the risks and returns to insider trading by showing that insiders'

intelligence is a determinant of their decisions to use their information advantage in insider trading. Third, we expand the behavioral finance literature by reporting that high-IQ investors' superior stock market performance is due to their above-average investment ability rather than their access to private information, thus addressing the concern raised in Grinblatt et al. 2012.

We organize the rest of the paper as follows. Section 2 describes the research design and provides descriptive statistics of our sample and the main variables, Section 3 presents the main results, and Section 4 describes various additional tests. Section 5 contains the concluding discussion.

2. Data and Methods

Data and sample

Our data come from various official databases maintained by the Swedish military, regulatory, tax, and police authorities (e.g., Kallunki, Nilsson, and Hellström 2009; Zerni, Kallunki, and Nilsson 2010). These data include complete information on insiders' IQ scores and their stock holdings in all listed Swedish firms. We use the official insider register maintained by the *Finansinspektionen* (the Swedish Financial Supervisory Authority) to identify insiders in all listed Swedish firms on a semi-annual basis, that is, on June 30 and December 31 each year. We include in our sample all insiders who held at least one inside stock and one outside stock during the sample period from 2000 to 2008.[11] We obtain insiders' stock holdings from *Euroclear Sweden*. This dataset contains each insider's complete stock holdings June 30 and December 31 each year in firms where he is registered as an insider (inside stocks) and in other firms in which he is not registered as an insider (outside stocks).

[11] We choose not to require that the insider make at least one trade, in order to be able to later also analyze the decision to trade or not. The results are, however, unaffected if we instead require insiders to make a trade in at least one inside and one outside stock during the sample period.

The American Psychological Association defines cognitive ability (IQ) as "*the ability to understand complex ideas, to adapt effectively to the environment, to learn from experience, to engage in various forms of reasoning, to overcome obstacles by taking thought*" (Neisser et al., 1996, p. 77). The term IQ is often used synonymously with intelligence and refers specifically to scores on intelligence tests. These kind of tests are frequently used in various settings including business, education, civil service, and the military. Insiders cognitive ability (IQ score) for the current study is obtained from psychometric tests administrated by the Swedish Military Forces. Military service in Sweden was compulsory until 2010. According to the Swedish Act on Liability for Total Defense Service, all males with Swedish citizenship had to attend the enlistment test at around the age of 18. Only those with severe handicap, institutionalized persons (both due to mental disorders or prison incarceration), or citizens living abroad are exempted from enlisting. The testing procedure aims at estimating an individual's ability to fulfill military services and to choose suitable individuals for different services. The enlistment test takes two days to carry out, and as a part of the drafting procedure, the recruits have to complete comprehensive test of their cognitive ability. It includes four separate parts, Instructions, Synonyms, Metal Folding, and Technical Comprehension. The test scores are summed and standardized to follow the stanine distribution (standard nine distribution). The stanine distribution partitions the normal distribution into nine categories, where one referring to low ability and nine referring to high ability, with an average of five which corresponds to an IQ score of about 100. The measure is similar to the Armed Forces Qualifications Test score (AFQT) used in the US, which is used to evaluate the aptitude and trainability of individuals eligible for enlistment (Levine and Rubinstein, 2013). As discussed by Lindqvist and Westman (2011) it was not possible to avoid military service by obtaining a low score on the IQ test. Nevertheless, one might expect that the motivation to do military service can have an effect on the test result (Borghans, 2008). With that said, in their descriptions of the history of psychometric testing in the Swedish Military Forces, both Beauchamp et al. (2011) and Carlstedt

2000) describe the history of psychometric testing in the Swedish Military Forces in detail and shows that the IQ score measures general intelligence very well. Also, Deary (2001) reports that IQ scores from cognitive-ability tests have validity that is almost unequalled in psychology. Existing research on cognitive ability has revealed that IQ remains relatively stable over the life course (e.g., Borghans et al., 2008, Beaver et al., 2013). An IQ score similar to the one used in this study has been used in recent studies in economics, and corporate governance to measure individual's cognitive ability in various decision making situations (e.g. Adams et al., 2015; Grinblatt et al., 2011, 2012, 2015; Keloharju et al., 2016).

We obtain data on insider specific control variables including their age, educational level, wealth, cash position and risk preferences from the Swedish Tax Authority (*Skatteverket*), Statistics Sweden (*Statistiska Centralbyrån*), and the Swedish Police Authorities (*Brottsförebyggande Rådet*). We match all these databases based on insiders' unique personal identity numbers (social security codes). Finally, the data on market prices and returns comes from FinBas (Swedish analog of CRSP) and the accounting data from Compustat Global.

On June 30 and December 31 each year, we identify whether an insider has been a net seller, a net buyer, or has not changed his holdings of inside and outside stocks during the past six months. Specifically, we first create a complete time series of an insider's holdings in all his outside and inside stocks.[14] We then calculate changes in an insider's holdings in a given stock on June 30 and December 31 each year. If an insider's holdings in the stock increased, we classify him as a net buyer of that stock during the past six months. Accordingly, if the insider's holdings in the stock decreased, we classify him as a net seller of that stock during the past six months.[15]

[14] That is, we enter zeros in the time-series when needed.

[15] We exclude observations where the change in the number of stocks is less than 11 or the value of the trade is below 10,000 SEK (approximately 1,100 USD).

There are two obvious limitations in our definition of an insider being a net seller or buyer. First, we can only measure insiders' *net* sales and purchases over six-month periods. Second, we cannot identify the exact time of the sales and purchase transactions during each period.

In our final sample, there are 5,502 insiders who own at least one inside and one outside stock over the sample period. Panel A of Table 1 reports the frequency distribution of insiders' IQ scores. The untabulated mean (median) IQ score is 7.04 (7.00), which is notably higher than in the sample used by Grinblatt et al. 2012. This is expected given that our sample consists of insiders who are in senior positions in their firms, whereas Grinblatt et al. 2012 focus on all investors.[16] Panels B and C of Table 1 show that the majority of the insiders are middle aged and hold various insider positions in their firms. Approximately 9 percent of the insiders hold a management position, and 25 percent are board members.

(Insert Table 1 about here)

Table 2 reports summary statistics on insiders' trading on their inside and outside stocks. Panel A (Panel B) of Table 2 reports the number of insiders' net purchases in their inside (outside) stocks and the average number of inside (outside) stocks they own. In our sample, there are 5,345 net changes in insiders' holdings in their inside stocks, of which 3,716 are net purchases and 1,629 are net sales. Accordingly, there are 107,033 net changes in insiders' holdings in their outside stocks, of which 57,262 are net purchases and 49,771 are net sales. The median portfolio for low-IQ (high-IQ) insiders contains 9.53 (9.88) outside stocks and 0.33 (0.37) inside stocks.

[16] Another difference is that our sample covers a larger age distribution, with insiders born between 1925 and 1979, whereas the sample in Grinblatt et al. covers investors born between approximately 1965 and 1984. We control for insiders' age in the multivariate regressions.

(Insert Table 2 about here)

Model specification

We explore the effect of an insider's intelligence on the abnormal stock returns he earns by estimating the following OLS regression separately for net sales and net purchases:

Model 1:

$$BHAR_{ijp} = \alpha_0 + \beta_1 IQ_i + \beta_2 INSIDE_{ijp} \times IQ_i + \beta_3 INSIDE_{ijp} + \beta_4 INSIDEBEFORE_{ijp} + \beta_5 NUMINS_{ip} + \beta_6 CLOSE_{ijp} + \beta_7 MGMT_{ijp} + \beta_8 AGE_{ip} + \beta_9 EDULEVEL_i + \beta_{10} WEALTH_{ip} + \beta_{11} DIVERSIFICATION_{ip} + \beta_{12} LIQUIDITY_{ip} + \beta_{13} RISKPREFERENCE1_{ip} + \beta_{14} RISKPREFERENCE2_i + \beta_{15} BOARDSIZE_{jp} + \beta_{16} BOARDPROPMEN_{jp} + \beta_{17} SPREAD_{jp} + \beta_{18} LNMV_{jp} + \beta_{19} PB_{jp} + \beta_{20} LEVERAGE_{jp} + \beta_{21} MOMENTUM_{jp} + \beta_{22} ROA_{jp} + \sum_{k=1}^{347} \varphi_k FIRM_k + \sum_{p=2000/06}^{2008/06} \gamma_p PERIOD_p + \varepsilon_{ijp},$$

where *i* denotes insider, *j* denotes firm, and *p* denotes semi-annual period ending on either June 31 or December 31 each year. The dependent variable in Model 1 is the market-adjusted buy-and hold return over a three-month period following insider *i*'s net purchase (net sale) during a semi-annual period *p* for firm *j* ($BHAR_{ijp}$). We include in Model 1 a set of insider- and firm-specific control variables as well as firm and period fixed effects. All variables are as described below and in Appendix 1.

Variable definitions

Insider's intelligence (Research variable 1)

We construct a dummy variable IQ_i, which equals one if an insider's IQ score is greater than 6, and zero otherwise. The military forces consider conscripts with IQ scores greater than 6 to

be high enough for a person being appointed to a higher officer position or to more complicated tasks such as platoon officer or signalist (Carlstedt, 2000).[18]

Dummy variable for inside vs. outside stocks (Research variable 2)

A dummy variable $INSIDE_{ijp}$ equals one, if the stock of firm *j* that an insider *i* has purchased or sold during the past six-month period is an inside stock, and zero if it is an outside stock. Inside stocks are those owned by a person who holds an insider position in the firm. The register on Swedish insiders is maintained by the *Finansinspektionen*. Outside stocks refer to insiders' stock holdings in firms in which they hold no insider positions.

Insider-specific control variables

We include in our model insider-specific control variables to control for individual investor characteristics that might affect their success in the stock market (e.g., Hillier et al. 2015). Since insiders in senior executive positions may have more timely access to valuable insider information than other insiders, we control for an insider's position by the dummy variable $MGMT_{ip}$, which takes the value of one if an insider belongs to the management team of his firm and zero otherwise.[19] We also control for an insider's investment experience by the variable AGE_{ip}, which is an insider's age at the time of the trade.

We also include in Model 1 the variable $EDULEVEL_i$ to control for an insider's educational level. The variable takes a value of zero if an insider's highest educational qualification is elementary school, a value of one if his highest qualification is high school, a value of two if the

[18] Grinblatt et al. 2012 also use dummy variables to measure levels of IQ, but categorize investors in seven groups. In Section 4, we test for the sensitivity on our results from using the original IQ score ranging from 1 to 9. Some of the results are sensitive to this measurement, indicating a non-linear relationship between IQ and abnormal returns subsequent to trades.

[19] This information is manually collected from annual reports.

insider has a two-year university degree, a value of three if the insider has a three-year university degree and, a value of four for a higher university degree. Since previous research finds that the level of an investor's wealth is associated with his financial sophistication and performance in the stock market (e.g., Grinblatt et al. 2012), we include in the model the variable $WEALTH_{ip}$, which is the natural logarithm of the value of total wealth owned by insider *i* at the end of the year prior to period *p*. Prior research has shown that the decision to trade might be explained by the need to diversify the portfolio or to generate liquidity (e.g., Jin and Kothari 2008, Kallunki et al. 2009). We control for insiders' portfolio rebalancing needs with the variable $DIVERSIFICATION_{ip}$ which measures the proportion of an insider's total personal wealth allocated to the specific stock.[20] To control for insider trading due to liquidity, we include in our model the variable $LIQUIDITY_{ip}$ which measures the value of an insider's yearly cash holdings minus its time-series mean over the sample. Both $DIVERSIFICATION_{ip}$ and $LIQUIDITY_{ip}$ are measured at the end of the year preceding period *p*.

Since individuals' cognitive abilities have been found to explain their risk-taking behavior (e.g., Dohmen, Falk, Huffman, and Sunde 2010; Grinblatt et al. 2012; Hvide and Panos 2014), we use the two proxies for the insider's personal risk preferences. The variable $RISKPREFERENCE1_{ip}$ measures the fraction of insider *i*'s wealth that is allocated to direct stockholdings at the end of the year prior to period *p*. In addition, a broad literature shows that criminal behaviour is an indicator of an individual's higher propensity to take risks (e.g. Ehrlich, 1973; Junger, West, and Timman 2001; Garoupa, 2003). The variable $RISKPREFERENCE2_{i}$ equals to one if an insider has been suspected or convicted of one or more crimes since 1974, and zero otherwise.

We also control for an insider's potentially better access to valuable, firm-specific information even after leaving the firm as an insider, because prior research shows that insider

[20] Results are not affected if we instead calculate $DIVERSIFICATION_{ijp}$ as the relation between the holding value of the specific stock and the value of the total portfolio of stocks.

information might be shared within corporate networks (e.g., Ahern 2017). Specifically, the variable $INSBEFORE_{ijp}$ equals one if a net trade is in an outside stock that used to be an inside stock in prior periods of the sample period, and zero otherwise. In addition, we include in our model an industry distance variable, because firms in closely related industries may belong to the same corporate networks.[21] Specifically, the variable $CLOSE_{ijp}$ is a dummy variable that takes a value of one if an insider's outside stock holding belongs to the same industry (based on two-digit SIC codes) as the firm in which he is classified as an insider, and zero otherwise.[22] Finally, we control for the possibility that insiders with multiple insider positions may be more central in corporate networks and thus might have better access to valuable private information. The variable $NUMINS_{ip}$ is the number of firms in which the insider is an insider.

Firm-specific control variables

We include in Model 1 several variables to control for the firm-specific determinants of abnormal stock returns. We control for the effect of firm size on abnormal stock returns by the variable $LNMV_{jt}$, which is the natural logarithm of the market value of equity at the end of the fiscal year prior to period *p*. In addition, we include and the ratio of market value of equity to the book value of equity (the variable PB_{jt}), the ratio of the firm's interest-bearing liabilities to the book value of assets (the variable $LEVERAGE_{jp}$), and the market-adjusted buy-and-hold return over the past six-month period prior to period *p* (the variable $MOMENTUM_{jp}$).[23] To control for the firms'

[21] Related research shows that insiders trade on public information about their firm's customer and suppliers. Specifically, Alldredge and Cicero (2015), using the methodology developed in Cohen and Frazzini (2008), measure economic links between firms and find that insiders appear to sale their own stock profitably based on public information about their main customers.

[22] Only 2.4 percent of insiders' trades in outside stocks belong to the same industry as the industry of the firm in which they are insiders.

[23] By controlling for $MOMENTUM_{jp}$ and PB_{jp} we are not only controlling for serial correlation in returns and the book-to-market effect, but also implicitly for contrarian investing behavior (e.g., Rozeff and Zaman 1998).

profitability, we also include in our model the variable ROA_{jp}, calculated as the ratio of annual earnings before interest and taxes to the lagged total assets in the fiscal year prior to period *p*. Following prior insider trading research (e.g., Skaife et al. 2013), we also add in our model three firm-specific, time-variant variables to capture the degree of information asymmetry and the level of corporate governance, that is, the mean bid-ask spread (the variable $SPREAD_{jp}$), the natural logarithm of board size (the variable $BOARDSIZE_{jp}$), and the proportion of male board members (the variable $BOARDPROPMEN_{jp}$).[24] To control for the effects of other possible determinants of stock returns,, we include the firm fixed effects in our model ($FIRM_j$).

Finally, we include in our model semi-annual period fixed effects to control for time-specific effects (PER_p). Because our data include multiple observations for the same firm, we control for the clustering of standard errors by firm, thereby allowing for correlation among observations for the same firm (Petersen 2009). We also winsorize all continuous variables to the 1st and 99th percentiles of their distributions to control for potential outlier/influential observations. Table 3 reports descriptive statistics for the variables used in the analyses.

(Insert Table 3 about here)

3. Empirical Results

Univariate analyses

Table 4 report the results of unconditional univariate analysis of the market-adjusted buy-and-hold return in the period subsequent to corporate insiders' trades in inside and outside stocks. Panel A (Panel B) of Table 4 reports the results for net purchases (net sales). We measure abnormal returns over three time periods: 1- , 3- and 6- months following the semi-annual period in which a net purchase / net sale has been recorded. The results of Table 4 indicate that corporate insiders

[24] We require at least 100 trading days over the period to calculate the mean spread.

manage to time their purchases successfully, both in inside stocks and in outside stocks. The returns following net purchases in inside stocks is however substantially larger, indicating that insiders' use their access to insider information in their trading.[25] In panel B we only find weak indications of net sales of inside stocks being followed by lower market-adjusted returns, than net sales of outside stocks. This weaker results for net sales is in line with prior research in insider trading. We believe our data allows for a powerful test on the value of insider information, being able to control for corporate insiders' average stock-picking ability as manifested in their returns to trading in outside stocks.

(Insert Table 4 about here)

Table 5 also reports the abnormal returns subsequent to trading inside and outside stocks, but now separately for low- and high-IQ investors.[26] Panel A (Panel B) of Table 5 reports the results for net purchases (net sales). We use the *t*-test (Wilcoxon test) to test whether the means (medians) of the abnormal returns over the three-month period following net purchases or net sales are different between low-IQ and high-IQ insiders, and between their inside and outside stocks.

The results for the net purchases reported in panel A of Table 5 show that, both high- and low-IQ insiders earn greater abnormal returns on their inside stock purchases than their outside stock purchases. This result indicates that insiders indeed use their information advantage when trading their inside stocks. However, for net sales, the results show that only low-IQ insiders sell their insider stocks prior to smaller abnormal returns, as opposed to their outside stocks. As for high-IQ

[25] In an OLS-regression with *BHAR* as the dependent variable and *INSIDE* as the independent variable, the coefficient on *INSIDE* is significant also when including individual- and period-fixed effects, or alternatively individual- and firm-fixed effects. Results are robust to the inclusion of the variables *INSBEFORE* and *CLOSE*.

[26] In the remaining analyses, we report only the results for three-month market-adjusted buy-and-hold returns.

insiders, there is no significant difference between the abnormal returns following the sales of inside and outside stocks.

The results reported in panel A of Table 5 show that the mean and median abnormal returns following the net purchases of outside stocks are significantly greater for high-IQ than low-IQ insiders. This result is consistent with cognitive abilities playing an important role in stock investing performance when investors do not have access to private information. As for insiders' net sales of their outside stocks, the results in panel B of Table 5 show no evidence that IQ is related to the abnormal returns. Panel A of Table 5 also shows that even though both groups of investors use their access to inside information, the high-IQ insiders' net purchases in their inside stocks do not outperform those made by low-IQ insiders. This result supports the notion that investors' cognitive abilities are less important in successful stock investments when insiders have access to private information.

We also note that low-IQ insiders that have access to insider information are able to outperform high-IQ insiders that having no access to insider information. In untabulated tests, we find that the abnormal returns subsequent to low-IQ investors net purchases of inside stocks is significantly higher than the abnormal returns subsequent to high-IQ investors net purchases of outside stocks (using a t-test and a Wilcoxon test, two-sided p-values are <0.0001 and <0.0001, respectively). Similarly, we find that low-IQ insiders time their net sales of inside stocks more successfully than the high-IQ investors time their net sales of outside stocks.[27] This results give preliminary indications of insider information being relatively more important for success in the stock market than superior cognitive abilities, and that high cognitive skills cannot compensate for lack of superior information.

(Insert Table 5 about here)

[27] The difference in mean and median BHAR between the two groups is significant (using a t-test and a Wilcoxon test, two-sided p-values are 0.0441 and 0.0276, respectively)

Multivariate analyses

Tables 6 and 7 report the results of estimating Model 1 to explore the relation between insiders' IQ and the abnormal stock returns they earn when trading their inside and outside stocks, controlling for other likely determinants of abnormal stock returns. Table 6 reports the results for net purchases and Table 7 for net sales. We add the control variables to Model 1 incrementally so that column 4 of Tables 6 and 7 reports the results for the full model.

Regarding the abnormal returns insiders earn on their outside stocks, the estimated coefficient of the variable IQ_i is significantly positive in all model specifications in Table 6, with the *t*-statistics varying from 2.47 to 3.32. This result is in line with the univariate results and shows that when insiders buy their outside stocks, for which they supposedly have no access to private information, high-IQ insiders are more successful than low-IQ insiders in their trading. High-IQ insiders' greater intelligence enables them to earn greater abnormal returns on their purchases of outside stocks than low-IQ insiders. However, the estimated coefficient of the variable *IQ* reported in Table 7 is not significant for insider sales, thereby indicating that high-IQ insiders are not able to time their sales of outside stocks more successfully than low-IQ insiders. The asymmetric effect of an investor's IQ on the profitability of purchases and sales has been reported in prior research (Grinblatt et al. 2012).

Regarding insiders' abnormal returns on their inside stocks, the results reported in Table 6 also show that high-IQ insiders do not outperform low-IQ insiders when buying inside stocks. In fact, the estimated coefficient of the interaction variable $INSIDE_{ijp} \times IQ_i$ is negative, indicating that high-IQ insiders earn lower abnormal returns on their purchases of inside stocks. We find similar results for the net sales, as the estimated coefficient of the interaction variable $INSIDE_{ijp} \times IQ_i$ reported in Table 7 is significantly positive. We investigate this result further in Section 4.

The results reported in Table 6 (Table 7) also show that low-IQ insiders earn greater positive (avoid negative) abnormal returns when buying (selling) their outside stocks than inside

stocks, suggesting that they exploit their access to insider information. Specifically, the estimated coefficient of the variable $INSIDE_{ijp}$ is significantly positive for purchases (Table 6) and negative for sales (Table 7). As for the purchases, the coefficient is, however, insignificant after including the time-varying, firm-specific control variables in the model (column 4 of Table 6). In particular, the size of the firm (the variable $LNMV_{ijp}$) is highly significant, and it subsumes the effect of the variable $INSIDE_{ijp}$, indicating that insiders tend to purchase outside stocks in larger firms compared to their inside stocks. In sensitivity tests, we note that this result is sensitive to the measurement of the size of the firm. When measuring the size as the natural logarithm of the firm's total assets, the coefficient on the variable INSIDE remains significant in all specifications.

Finally, we examine whether superior cognitive abilities can compensate for the lack of insider information in making successful investment decisions. Specifically, we test whether the estimated coefficient of the variable IQ_i is significantly different from that of the variable $INSIDE_{ijp}$. We report the results of these tests in Tables 5 and 6. The estimated coefficient of the variable $INSIDE_{ijp}$ is significantly greater than that of the variable IQ_i in all columns of Table 6 but the last column. In Table 7, the estimated coefficient of the variable $INSIDE_{ijp}$ is however not significantly smaller than that of the variable IQ_i. We are thus not able to verify the results about net sales from the univariate analyses. We cautiously interpret the results as indicative of insider information being more important than intelligence for the success in the stock market.

(Insert Tables 6 and 7 here)

4. Additional Analyses and Sensitivity Tests

Additional analyses

Reputation and legal risk of insiders' trading on their inside stocks

Our multivariate results reported in Tables 5 and 6 indicate that high-IQ insiders do not outperform low-IQ investors in their trading of inside stocks. There are, at least, two potential explanations for this finding. First, it might suggest that cognitive abilities have a smaller role to play when insider information is available. Second, high-IQ insiders might choose not to exploit their private information to the same extent as low-IQ insiders because they are more concerned about the reputational and legal risks of profiting from insider information.

In the following, we explore that latter explanation in more detail by estimating a logistic regression model of the insider's decision to purchase (sell) or not to purchase (sell) stocks before abnormal price increases (decreases). Specifically, we estimate the following model from a sample of semi-annual periods with net trades and those without net trades separately for insiders' trading in their inside and outside stocks.

Model 2:

$$\begin{aligned}\text{Prob}(TRADE_{ijp}) = \text{logit}(&\alpha_0 + \beta_1 IQ_i + \beta_2 BHAR_{ijp} \times IQ_i + \beta_3 BHAR_{ijp} + \beta_4 INSIDEBEF_{ijp} \\ &+ \beta_5 NUMINS_{ip} + \beta_6 CLOSE_{ip} + \beta_7 MGMT_{ijp} + \beta_8 AGE_{ip} + \beta_9 EDULEVEL_i + \beta_{10} WEALTH_{ip} \\ &+ \beta_{11} DIVERSIFICATION_{ip} + \beta_{12} LIQUIDITY_{ip} + \beta_{13} RISKPREFERENCE1_{ip} + \beta_{14} RISKPREFERENCE2_i \\ &+ \beta_{15} BOARDSIZE_{jp} + \beta_{16} BOARDPROPMEN_{jp} + \beta_{17} SPREAD_{jp} + \\ &\beta_{18} LNMV_{jp} + \beta_{19} PB_{jp} + \beta_{20} LEVERAGE_{jp} + \beta_{21} MOMENTUM_{jp} + \beta_{22} ROA_{jp} + \\ &\sum_{k=1}^{347} \varphi_k FIRM_k + \sum_{p=2000/06}^{2008/06} \gamma_p PERIOD_p + \varepsilon_{ijp}),\end{aligned}$$

where *i* denotes insider, *j* denotes firm, and *p* denotes semi-annual period. The dependent variable in Model 2 is a dummy variable that takes the value of one if insider *i* is a net seller of stock *j* during the semi-annual period *p*, and zero otherwise ($TRADE_{ijp}$). In the purchase (sales) regressions, the estimated coefficient on the interaction variable $BHAR_{ijp} \times IQ_i$ indicates whether high-IQ investors are more likely to purchase (sell) a stock prior to a price increase. We include in the model all control variables from Model 1 and cluster standard errors at the firm level. All variables are as described in Appendix 2.

The results reported in Table 8 show that, high-IQ investors are not more likely to buy inside stocks before stock price increases than low IQ-insider, but they do so for outside stocks (the variable $BHAR_i \times INSIDE_{ijp}$). This finding supports the findings in Table 6. The results for net sales (Table 9) show, however, no significant difference in how low- and high-IQ insiders choose to time their net sales of inside and outside stocks. If indeed the concern for adverse reputational effects explains high-IQ investors' lower returns from trading inside stocks, we would expect to see that they are also less likely to sell inside before a stock price decrease. In particular, prior research has shown the risk of litigation and adverse publicity due to trading on insider information is higher when insiders sell before a price decline than when they buy before a price increase (e.g., Cheng and Lo 2006, Dai et al. 2015).

(Insert Tables 8 and 9 here)

We further explore whether the concern for reputational and legal risks drives the high-IQ insiders' lower returns to trades in their inside stocks by re-estimating Model 1 in two subsamples where *ex ante* reputational and legal risks that insiders face from profitable insider trading are either low or high. In the insider trading literature, it has been suggested that the risk of reputational damage and litigation is higher for profitable large insider transactions (e.g., Seyhun 1998). This is

because insider trades are disclosed to the general public and large insider trades are more likely to be scrutinized by the financial press and outside investors. Hence, these insider trades are more likely to receive adverse investor and media attention, thereby increasing the probability of regulatory scrutiny as well (e.g., Dai et al. 2015).

We therefore consider large (small) insider trades to involve high (low) reputation and legal risk for the insider who makes the trade. The subsample of low (high) reputation and legal risk includes observations that belong to the quartile of smallest (largest) net trades.[28] Given that insider sales, as opposed to insider purchases, are more likely to be subject to the reputation and legal risk described above, we expect the effect of reputation and legal risk on insiders' decisions to engage in profitable insider trading to be more pronounced for insider sales than purchases. We expect no difference between small and large trades in outside stocks.

The untabulated results for the net purchases of inside stocks show that the interaction variable $INSIDE_{ijp} \times IQ_i$ in Model 1 is insignificant in the subsamples of both large and small insider purchase. In other words, there is no difference in the abnormal returns from insider purchases earned by high-IQ and low-IQ insiders between the subsamples of low and high reputational and legal risks of insider trading. As for the insider sales, the estimated coefficient on the interaction variable $INSIDE_{ijp} \times IQ_i$ is significantly positive (negative) for large (small) net insider sales.[29] In other words, when the reputational and legal risks of profitable insider trading are high, as in the case of large insider sales transactions, high-IQ insiders use insider information more cautiously than low-IQ insiders. However, when the *ex ante* risks from insider trading are low, as in the case

[29] In the sample of large (small) sales the estimated coefficient on the interaction variable (*INSIDE*IQ*) is 0.029 (-0.041) and the t-statistic is 2.59 (-2.49).

of small insider sales transactions, high-IQ insiders are also willing to exploit their access to insider information and thereby to earn greater returns from insider trading, similarly to low-IQ insiders.[30]

We also re-estimate Model 2 on the two subsamples of large and small net trades respectively. The untabulated results show that high-IQ insiders are more cautious when doing large sales of inside stocks prior to a price decrease, compared to low-IQ insiders (i.e. they are more likely to sell before a price increase). This is in line with high-IQ investors being more concerned with the reputational risks of insider trading than low-IQ investors.

One could argue that any insider that are concerned with the reputational effects from profitable insider trading, would refrain from trading at all.[31] In untabulated tests we find that the insiders in our sample that during the sample period do not trade at all (n=583) have significantly higher IQ (t-stat: 5.13) than the others (n=4,919). In a cross-sectional setting, we cannot find verify that high-IQ investors are less likely to trade insider stocks than low-IQ investors.

To conclude, we find some, albeit weak, indications of high-IQ insiders being more concerned with adverse reputational effects. Admittedly we cannot, however, rule out that there is an alternative explanation as to why high-IQ investors outperform low-IQ investors when trading outside stocks, but not inside stocks.

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[30] As for insiders' trading in their outside stocks, we find no evidence that high-IQ (or low-IQ) insiders have differential trading performance between the two subsamples. This is as expected, given that insiders' trading in their outside stocks does not involve reputational or legal risk.

[31] A potential concern of our identification strategy is that it during our sample period was possible for insiders to trade insider stocks thru unit link products, and thereby hide insider trading. It is not possible to track these trades (since it is essentially the bank who then owns the stocks), but from the tax authorities there is data on which investors that do own a unit link product. In our sample, there is no difference in IQ between those that own a unit link product (n=1,112) and those that do not (n=4,390). Testing for the mean difference the t-statistic is -0.41.

Insiders' trading in former inside stocks

Even though not an explicit research variable, corporate insiders' trading in outside stocks that used to be inside stocks warrants some investigation. The estimated coefficient for the variable $INSBEFORE_{ijp}$ is significantly positive for purchases in Table 6, indicating that insiders also earn greater abnormal returns on stocks of firms where they were previously insiders. Hence, insiders may be better at interpreting publicly available information about former inside stocks, or they may still have an access to valuable information through corporate networks even after leaving the firm as an insider. Interestingly, the results for net sales reported in Table 7 show the opposite, that is, the estimated coefficient on the variable $INSBEFORE_{ijp}$ is significantly positive. In other words, insiders are less successful in selling their prior inside stocks.

There are at least two potential explanations for these findings. First, after leaving their insider firms, insiders may want to dispose their holdings in those firms, thereby not basing their selling decision on insider information. Second, insiders may hold on to their former inside stocks for too long due to some nostalgia bias, and therefore fail to time the sales of these stocks successfully. Since prior studies show that investors' behavioral biases are more common among investors with lower cognitive abilities (e.g., Grinblatt et al. 2012), we expect the latter explanation to be more pronounced among low-IQ insiders.

Untabulated tests of re-estimating Model 1 (without the interaction variable) separately for net sales made by high-IQ insiders and those made by low-IQ insiders show that this indeed is the case. More specifically, we find that in the subsample of low-IQ investors' net sales, the estimated coefficient of the variable $INSBEFORE_{ijp}$ is significantly positive (t-stat = 2.32), whereas it is insignificant for high-IQ insiders' net sales. We interpret these results as consistent with low-IQ insiders showing more nostalgia bias than high-IQ insiders when disposing their former inside stocks.

5. Conclusions

In this study, we investigate corporate insiders' trading in their inside and outside stocks. Our results of analyzing the trading behavior of 5,502 male insiders in Sweden can be summarized as follows: First, we find that on average corporate insiders make successful purchases in both inside and outside stocks, indicating above-average stock-picking ability. The returns to purchases in inside stocks is however substantially larger if compared to purchases of outside stocks. By being able to compare the insider returns not only to the overall market, but also to the returns on their outside stocks, we are effectively able to separate the effect of superior information from superior cognitive ability. In this powerful setting, we verify that corporate insiders indeed seem to exploit their access to insider information.

Second, we find, in a cross-sectional investigation of cognitive ability, that high-IQ insiders earn higher returns on their purchases of outside stocks than low-IQ insiders. They are also more likely than low-IQ insiders to purchase outside stocks prior to a price increase. This finding is consistent with insiders' cognitive abilities playing an important role for success in the stock market when they do not have access to private information (e.g., Grinblatt et al. 2012).

Third, we find that high-IQ insiders earn smaller abnormal returns than low-IQ insiders when trading inside stocks. A potential explanation for this is that high-IQ insiders are less willing to exploit their access to private information than low-IQ insiders, because excess insider returns involve the risk of reputational damage and litigation (e.g., Cheng and Lo 2006; Dai et al. 2015). We find some support for this conjecture, observing that high-IQ insiders have lower returns to their inside stocks in settings where the *ex ante* reputational and legal risks are high. Specifically, we find that high-IQ insiders are less likely to do large sales of inside stocks before stock price declines.

Finally, we find some evidence that low-IQ investors having access to private information outperform high-IQ investors who do not have such information. We interpret this result as an

indication that having an access to private information is relatively more important than intelligence for the success in the stock market.

Appendix 1. Swedish Insider Legislation

Insider legislation has existed in Sweden since 1985, when the first law prohibiting trading in securities while in possession of non-public, company-related information was passed. This law was initially enforced in 1989, when Sweden got its first conviction for illegal insider trading, and regulations were further tightened in 1991 as the European Union Directive on the Regulation of Insider Trading (EEC Directive 89/592) was incorporated into Swedish law. Insider trading in Sweden is regulated by the Finansinspektionen, which is the corresponding authority to the SEC in the United States. Similarly to U.S. insiders who have to file their insider trades with the SEC, insiders in Sweden are required to report their insider holdings and insider stock trades to the Finansinspektionen, in accordance with The Act Concerning Reporting Obligations for Certain Holdings of Financial Instruments (2000:1087). The Finansinspektionen publishes the information on insiders' trades on a daily basis on their website. The reporting obligation period for insider trades in Sweden is five business days from the day of the trades, as of January 2001, while in the U.S. it is two days, as of August 2002.

During our study period, the Market Abuse Penal Act (2005:377) complying with the EEC Directive 2003/6/EC on insider dealing and market manipulation was enforced. In addition, as of June 2005, Swedish insiders are prohibited from trading in the firm's shares 30 days prior to the publication of earnings announcements. This trading ban replaced the short-term trading rule (effective since 1997) under which insiders were not allowed to engage in a round-trip transaction (e.g. a buy followed by a sale) during a three-month trading window. In comparison, insiders in the U.S. are penalized for trading profits earned fewer than six months subsequent to previous trades ("the short-swing rule" of the Section 16(b) of the Securities and Exchange Act 33 of 1934), but there is no legal rule that prohibits insiders from trading prior to earnings announcements.

Appendix 2. Variable Definitions

Variables used in the analyses

Variable	Description	Data Source
$BHAR_{ijp}$	The market-adjusted buy-and hold return over a three-month period following a semi-annual period *p* for firm *j*.	FinBas database
$TRADE_{ijp}$	A dummy variable equal to one if insider *i* increased (decreased) her holdings of stock *j* during a semi-annual period *p*, and zero otherwise.	Euroclear Sweden Group
IQ_i	A dummy variable equal to one if the insider holds a score between 7 and 9 on the mandatory intelligence test upon military enrollment, and zero otherwise.	Swedish military forces
$INSIDE_{ijp}$	A dummy variable equal to one if the stock holding is in a firm in which the stock owner is classified as an insider during the semi-annual time period *p*, and zero otherwise.	Swedish Financial Supervisory Authority
$INSIDEBEFORE_{ijp}$	A dummy variable equal to one if the stock holding is in a firm in which the stock owner was previously classified as an insider and owned the stock, and zero otherwise.	Euroclear Sweden Group
$NUMINS_{ip}$	The number of insider stocks owned by an insider *i* at the end of a semi-annual period *p*.	Euroclear Sweden Group
$CLOSE_{ijp}$	A dummy variable equal to one if the outside stock holding is in a firm that belongs to the same industry as a firm in which the stock owner is classified as an insider during the same semi-annual period *p*, and zero otherwise. Industries are classified as being the same if the SIC codes are the same on a two-digit level or lower.	Compustat Global
$MGMT_{ijp}$	A dummy variable equal to one if insider *i* holds a management position in the firm at the end of the semi-annual period *p*, and zero otherwise.	Swedish Financial Supervisory Authority
AGE_i	The fiscal year minus insider *i*'s birth year.	Euroclear Sweden
$EDULEVEL_i$	A category variable that takes the value of zero if insider *i*'s highest educational qualification is elementary school, a value of one if the highest qualification is high school, a value of two if the insider *i* has a two-year university degree, a value of three if insider *i* has a three-year university degree, and a value of four for a higher university degree.	Statistics Sweden
$WEALTH_{ip}$	The total worth of assets of investor *i* according to the tax filings in the year prior to period *p*.	Swedish Tax Authorities
$RISKPREFERENCE1_{ip}$	The ratio of the value of direct stock holdings to the value of total wealth of insider *i* according to the tax filings in the fiscal year prior to period *p*.	Swedish Tax Authorities
$RISKPREFERENCE2_{ip}$	A dummy variable that takes the value of one if insider *i* has been suspected or convicted of crime, and zero otherwise.	Swedish Police Authorities

$SPREAD_{jp}$	The mean bid-ask spread for firm *j* during period *p*-1.	FinBas database
$LNMV_{jp}$	The natural logarithm of the market value of shares for firm *j* multiplied by the number of shares outstanding from the fiscal year prior to period *p*.	FinBas database
PB_{jp}	The ratio of market value of shares for firm *j* to the book value of equity from the fiscal year prior to period *p*.	Compustat Global and FinBas
$LEVERAGE_{jp}$	The ratio of debt to assets for firm *j* for the fiscal year prior to period *p*.	Compustat Global
$MOMENTUM_{jp}$	The market-adjusted buy-and-hold return for firm *j* for the 12-month period prior to period *p*.	FinBas database
ROA_{jp}	The ratio of earnings before interest and tax to lagged total assets for firm *j* for the fiscal year prior to period *p*.	Compustat Global
PER_p	The sixteen dummy variables for the semi-annual time periods 2000/06 to 2008/12.	Euroclear Sweden
$FIRM_j$	The 347 dummy variables for the unique 347 firms in the sample.	Euroclear Sweden

Notes:

Appendix 1 presents the descriptions of all the variables used in the analyses. We address the presence of influential/outlier observations in the data by winsorizing all continuous variables at the 1st and 99th percentiles of their distributions.

References

Aboody, D., Hughes, J., and Liu, J. 2005. Earnings quality, insider trading, and cost of capital. *Journal of Accounting Research* 43 (5): 651–73.

Adams, R. B., M. Keloharju, and S. Knüpfer, S. 2015. Are CEOs born leaders? Lessons from traits of a million individuals. IFN Working Paper No. 1024; FIRN Research Paper No. 2436765; Harvard Business School Research Paper No. 16-044. http://ssrn.com/abstract=2436765.

Badertscher, B., S. Hribar, and N. Jenkins. 2011. Informed trading and the market reaction to accounting restatements. *Accounting Review* 86 (5): 1519–47.

Beauchamp, J., D. Cesarini, and M. Johannesson. 2011. The Psychometric Properties of Measures of Economic Risk Preferences. Working Paper, Harvard University.

Beaver, K., J. Schwartz, E. Connolly, J. Nedelec, M. Al-Ghamdi, and A. Kobeisy. 2013. The Genetic and Environmental Architecture to the Stability of IQ: Results from two Independent Samples of Kinship Pairs. *Intelligence* 41: 428-438.

Borghans, L., A.L. Duckworth, J.Heckman, and B. Ter Weel. 2008. The Economics and Psychology of Personality Traits. *Journal of Human Resources* 43: 972-1059.

Brochet, F. 2010. Information content of insider trades before and after the Sarbanes-Oxley Act. *Accounting Review* 85 (2): 419–46.

Carlstedt, B. 2000. Cognitive Abilities: Aspects of Structure, Process and Measurement. PhD dissertation. University of Gothenburg.

Chen, C., X. Martin, and X. Wang. 2013. Insider Trading, Litigation Concerns, and Auditor Going-Concern Opinions. *The Accounting Review* 88 (2): 365-393

Cheng, Q., and K. Lo. 2006. Insider trading and voluntary disclosures. *Journal of Accounting Research* 44 (5): 815–48.

Cohen, L., C. Malloy, and L. Pomorski. 2012. Decoding inside information. *Journal of Finance* 67 (3): 1009–1043.

Dai, L., J. T. Parwada, and B. Zhang. 2015. The governance effect of the media's news dissemination role: Evidence from insider trading. *Journal of Accounting Research* 53 (2): 331–66.

Davidson, R., A. Dey, and A. J. Smith. 2014. Executives' legal records, lavish lifestyles and insider trading activities. Working paper, University of Chicago.

Deary, I. J. 2001. Intelligence: A Very Short Introduction. Oxford University Press.

Dohmen, T., A. Falk, D. Huffman and U. Sunde. 2010. Are Risk Aversion and Impatience Related to Cognitive Ability? *The American Economic Review* 100 (3): 1238-1260.

Ehrlich, I. 1973. Participation in illegitimate activities: A theoretical and empirical investigation. *Journal of Political Economy* 81 (3): 521–565.

Garoupa, N. 2003. Behavioral economic analysis of crime: A critical review. *European Journal of Law and Economics* 15: 5–15.

Grinblatt, M., S. Ikäheimo, M. Keloharju, and S. Knüpfer. 2015. IQ and Mutual Fund Choice. *Management Science*, forthcoming.

Grinblatt, M., M. Keloharju, and J. T. Linnainmaa. 2011. IQ and Stock Market Participation. *Journal of Finance* 66: 2121-2164.

Grinblatt, M., M. Keloharju, and J. T. Linnainmaa. 2012. IQ, trading behavior, and performance. *Journal of Financial Economics* 104 (2): 339–62.

Hillier, D., A. Korczak, and P. Korczak. 2015. The impact of personal attributes on corporate insider trading. *Journal of Corporate Finance* 30:150–67.

Hvide, H. K., and G. A. Panos. 2014. Risk tolerance and entrepreneurship. *Journal of Financial Economics* 111 (1): 200–23.

Huddart, S., and B. Ke. 2007. Information asymmetry and cross-sectional variation in insider trading. *Contemporary Accounting Research* 24 (1): 195–232.

Inci, A. C., M. P. Narayanan, and H. N. Seyhun. 2014. Gender differences in executives' access to information. Working paper, Ross School of Business.

Junger, M., R. West, and R. Timman. 2001. Crime and Risky Behavior in Traffic: An Example of Cross-Situational Consistency. *Journal of Research in Crime and Delinquency* 38: 439–459.

Kallunki, J. P., H. Nilsson, and J. Hellström. 2009. Why do insiders trade? Evidence based on unique data on Swedish insiders. *Journal of Accounting and Economics* 48 (1): 37–53.

Kallunki, J. P., J. Mikkonen, H. Nilsson, and H. Setterberg. 2016. Tax noncompliance and insider trading. *Journal of Corporate Finance* 36:157–73.

Keloharju, M., S. Knüpfer. and J. Tåg. 2016. Equal Opportunity? Gender Gaps in CEO Appointments and Executive Pay. Working Paper. Harvard Business School.

Lakonishok, J., and I. Lee. 2001. Are insider trades informative? *Review of Financial Studies* 14 (1): 79–111.

Levine, R. and Y. Rubinstein. 2013. Smart and Illicit: Who Becomes an Entrepreneur and Does it Pay? Working Paper, National Bureau of Economic Research.

Lindqvist, E., and R. Vestman. 2011. The labor market returns to cognitive and noncognitive ability: Evidence from the Swedish enlistment. *American Economic Journal: Applied Economics* 3 (1): 101–28.

Neisser, U., G. Boodoo, T.J. Bouchard, W.A. Boykin, N. Brody, and S. Urbina. 1996. Intelligence: Knowns and Unknowns. *American Psychologist* 51: 77-101.

Petersen, M. A. 2009. Estimating standard errors in finance panel data sets: Comparing approaches. *Review of Financial Studies* 22 (1): 435–80.

Rozeff, M. S., and M. A. Zaman. 1998. Overreaction and insider trading: Evidence from growth and value portfolios. *Journal of Finance* 53 (2): 701–16.

Seyhun, H. N. 1998. *Investment Intelligence from Insider Trading*. Cambridge, MA: MIT Press.

Skaife, H. A., D. Veenman, and D. Wangerin. 2013. Internal control over financial reporting and managerial rent extraction: Evidence from the profitability of insider trading. *Journal of Accounting and Economics* 55 (1): 91–110.

Veenman, D. 2011. Disclosures of insider purchases and the valuation implications of past earnings signals. *Accounting Review* 87 (1): 313–42.

Zerni, M., J.P. Kallunki, and H. Nilsson 2010. The entrenchment problem, corporate governance mechanisms, and firm value. *Contemporary Accounting Research*, *27* (4): 1169–1206.

TABLE 1
Summary statistics on Swedish insiders

	# (Total = 5,502)	%
Panel A: Frequency distribution of insiders' intelligence (IQ score)		
1–3	76	1
4	205	4
5	606	11
6	1,121	20
7	1,334	24
8	1,314	24
9	846	15
Total	5,502	100
Low- vs. High-IQ insiders:		
Low IQ (IQ scores 1-6)	2,008	36
High IQ (IQ scores 7-9)	3,494	64
Total	5,502	100
Panel B: Year of birth		
<1950	2,012	37
1950–1959	1,806	33
1960–1969	1,239	23
≥ 1970	445	8
Total	5,502	100
Panel C: Position as an insider		
Management	472	9
Board member	1,357	25
Other position	3,673	67
Total	5,502	100

Notes:

1. The table reports summary statistics on 5,502 Swedish insiders in 347 listed firms with at least one inside and one outside stock holding over the period 2000-2008. Panel A reports the frequency distribution of insiders' IQ scores. Panels B and C report the distributions of insiders' year of birth and position as an insider, respectively.

TABLE 2
Summary statistics on insiders' trading in their inside and outside stocks

	Low-IQ insiders	High-IQ insiders	All insiders
Panel A: Inside stocks			
# of net inside purchases	1,231	2,485	3,716
# of net inside sales	589	1,040	1,629
All	1,820	3,525	5,345
# of inside stocks owned			
mean	0.57	0.60	
Median	0.33	0.37	
Panel B: Outside stocks			
# of net outside purchases	19,654	37,608	57,262
# of net outside sales	16,670	33,101	49,771
All	36,324	70,709	107,033
# of outside stocks owned			
mean	17.87	12.93	
Median	9.53	9.88	

Notes:

1. The table reports summary statistics on insiders' trading in their inside and outside stocks. The sample includes 5,502 insiders with at least one inside and one outside stock holding over the period 2000-2008. Inside (outside) stocks refer to stocks of firms where the person holds (does not hold) an insider position. Net purchases (sales) refer to an increase (decrease) in an insider's stock holdings in a firm during a semi-annual period.

2. Panel A (Panel B) reports the number of net purchases and sales in inside (outside) stocks during the sample period for all insiders and separately for Low- and High-IQ insiders. The mean and median numbers of inside (outside) stocks owned by Low- and High-IQ insiders are also reported.

TABLE 3
Descriptive statistics of the selected variables

Variable	Mean	Median	S.D.	Min	Max
Panel A: Net purchases of inside and outside stocks (N = 60,978)					
$BHARi_{ijp}$	0.011***	–0.002**	0.174	–0.423	0.800
IQ_i	0.657	1.000	0.475	0.000	1.000
$INSIDE_{ijp}$	0.061	0.000	0.239	0.000	1.000
$INSIDEBEFORE_{ijp}$	0.014	0.000	0.119	0.000	1.000
$NUMINS_{ip}$	0.625	0.000	0.923	0.000	11.000
$CLOSE_{ijp}$	0.022	0.000	0.147	0.000	1.000
$MNGT_{ijp}$	0.007	0.000	0.082	0.000	1.000
AGE_{ip}	52.537	53.000	10.715	21.000	82.000
$EDULEVEL_i$	3.465	4.000	0.926	1.000	4.000
$WEALTH_{ip}$	15.845	15.707	1.534	3.638	24.909
$DIVERSIFICATION_{ip}$	0.015	0.000	0.063	0.000	0.987
$LIQUIDITY_{ip}$	-3.529	-11.071	12.038	-19.184	19.587
$RISKPREFERENCE1_{ip}$	0.345	0.290	0.269	0.000	1.000
$RISKPREFERENCE2_{ip}$	0.083	0.000	0.276	0.000	1.000
$BOARDSIZE_{jp}$	2.290	2.398	0.388	0.693	2.996
$BOARDPROPMEN_{jp}$	0.740	0.750	0.168	0.167	1.000
$SPREAD_{jp}$	0.011	0.006	0.016	–0.005	0.187
$LNMV_{jp}$	23.106	23.171	2.402	16.640	26.836
PB_{jp}	4.197	2.486	4.434	0.474	21.724
$LEVERAGE_{jp}$	0.210	0.192	0.158	0.000	0.677
$MOMENTUM_{jp}$	0.071	–0.003	0.493	–0.782	2.174
ROA_{jp}	0.059	0.075	0.206	–1.057	0.517
Panel B: Net sales of inside and outside stocks (N = 51,400)					
$BHAR_{ijp}$	0.023***	0.006***	0.168	–0.423	0.800
IQ_i	0.664	1.000	0.472	0.000	1.000
$INSIDE_{ijp}$	0.032	0.000	0.175	0.000	1.000
$INSIDEBEFORE_{ijp}$	0.043	0.000	0.202	0.000	1.000
$NUMINS_{ip}$	0.595	0.000	0.935	0.000	11.000
$CLOSE_{ijp}$	0.023	0.000	0.151	0.000	1.000
$MNGT_{ijp}$	0.003	0.000	0.057	0.000	1.000
AGE_{ip}	53.226	54.000	10.639	21.000	82.000
$EDULEVEL_i$	3.446	4.000	0.938	1.000	4.000
$WEALTH_{ip}$	15.970	15.846	1.441	6.548	24.909
$DIVERSIFICATION_{ip}$	0.042	0.012	0.107	0.000	1.000
$LIQUIDITY_{ip}$	-3.829	-11.230	11.964	-19.184	19.587
$RISKPREFERENCE1_{ip}$	0.369	0.321	0.259	0.000	1.000
$RISKPREFERENCE2_{ip}$	0.087	0.000	0.282	0.000	1.000
$BOARDSIZE_{jp}$	2.292	2.398	0.382	0.693	2.996
$BOARDPROPMEN_{jp}$	0.735	0.750	0.171	0.167	1.000
$SPREAD_{jp}$	0.010	0.006	0.014	-0.005	0.187
$LNMV_{jp}$	23.051	23.171	2.226	16.640	26.836
PB_{jp}	3.570	2.326	3.676	0.474	21.724
$LEVERAGE_{jp}$	0.202	0.189	0.156	0.000	0.677
$MOMENTUM_{jp}$	0.138	0.050	0.485	–0.782	2.174
ROA_{jp}	0.074	0.082	0.187	–1.057	0.517

Notes:

1. The table reports descriptive statistics of the variables used in the analyses. The sample includes 5,502 Swedish insiders in 347 listed firms with at least one inside and one outside stock holding over the period 2000-2008. Panel A (Panel B) reports descriptive statistics for 60,978 (51,400) net purchases (net sales) of inside and outside stocks. Net purchases (sales) refer to an increase (decrease) in an insider's stock holdings in a firm during a semi-annual period.

2. All variables are defined as in Appendix 1. All continuous variables are winsorized to the 1st and 99th percentiles of their distributions.

3. For the three-month abnormal (market-adjusted) return following net purchases and sales (the variable $BHAR_{ijp}$), we test for a difference from zero using the *t*-test (Wilcoxon rank-sum test) for means (medians).

** Significant at the 5 percent level (two-tailed).
*** Significant at the 1 percent level (two-tailed).

TABLE 4
Univariate analyses of the abnormal returns subsequent to trades in inside and outside stocks

Variable:	*1 month $BHAR_{ijp}$*	*3 month $BHAR_{ijp}$*	*6 month $BHAR_{ijp}$*
Panel A: Net Purchases	Mean (Median)	Mean (Median)	Mean (Median)
Outside stocks N=57,262	0.014 (0.002)	0.010 (-0.004)	0.031 (0.013)
Inside stocks N=3,716	0.024 (0.004)	0.031 (0.014)	0.044 (0.015)
Diff: Outside-Inside	-4.17*** (2.32**)	–6.45*** (5.67***)	-2.58*** (0.69)
Panel B: Net Sales			
Outside stocks N=49,771	0.013 (0.005)	0.023 (0.007)	0.035 (0.015)
Inside stocks N=1,629	0.009 (0.000)	0.016 (-0.005)	0.020 (0.000)
Diff: Outside-Inside	1.28 (–2.56***)	1.39 (–2.59***)	2.12** (–3.07***)

Notes:

1. The table reports the results of univariate analysis of exploring the abnormal returns subsequent to insiders' net purchases and net sales in inside and outside stocks, respectively. $BHAR_{ijp}$ is calculated as the buy-and-hold market adjusted returns over 1, 3, or 6 months following the period of a net purchase or net sale. $AbnormalROA_{ijp}$ is calculated as the firm return on assets over the year following the net purchase or net sale, minus the industry ROA in which the firm operates (based on 2 digit SIC code). The sample includes 5,502 Swedish insiders in 347 listed firms with at least one inside and one outside stock holding over the period 2000-2008. Inside (outside) stocks refer to stocks of firms where the person holds (does not hold) an insider position. Net purchases (sales) refer to an increase (decrease) in an insider's stock holdings in a firm during a semi-annual period. Panel A (Panel B) reports the results for net purchases (net sales).

2. We test for difference in the mean (median) values of the abnormal returns in the period following net trades between outside and inside stocks by using a two-tailed t-test (Wilcoxon rank-sum test).

   * Significant at the 10 percent level (two-tailed).
   ** Significant at the 5 percent level (two-tailed).
   *** Significant at the 1 percent level (two-tailed).

TABLE 5
Univariate analyses of the effect of insiders' intelligence on abnormal returns of their inside and outside stocks

Variable: $BHAR_{ijp}$	Low-IQ insiders Mean (Median)	High-IQ insiders Mean (Median)	Diff: Low-High Mean (Median)
Panel A: Net purchases			
Outside stocks	0.006 (–0.009) N=19,654	0.012 (0.000) N=37,608	–3.80*** (–3.91***)
Inside stocks	0.038 (0.015) N=1,231	0.028 (0.012) N=2,485	1.47 (0.45)
Diff: Outside-Inside	-5.59*** (4.32***)	–3.95*** (2.59***)	
Panel B: Net Sales			
Outside stocks	0.024 (0.006) N=16,670	0.023 (0.008) N=33,101	0.41 (-0.44)
Inside stocks	0.007 (–0.012) N=589	0.021 (0.000) N=1,040	–1.44 (–1.17)
Diff: Outside-Inside	2.18** (–2.20**)	0.19 (–1.13)	

Notes:

3. The table reports the results of univariate analysis of exploring the effect of insiders' intelligence on the abnormal returns they earn from trading their inside and outside stocks. The sample includes 5,502 Swedish insiders in 347 listed firms with at least one inside and one outside stock holding over the period 2000-2008. Inside (outside) stocks refer to stocks of firms where the person holds (does not hold) an insider position. Net purchases (sales) refer to an increase (decrease) in an insider's stock holdings in a firm during a semi-annual period. Panel A (Panel B) reports the results for net purchases (net sales).

4. We use the *t*-test (Wilcoxon test) to test whether the mean (median) abnormal returns over the three-month period following net purchases or net sales are different between low-IQ and high-IQ insiders. In addition, we test for difference in the mean (median) values of the future three-month abnormal returns between outside and inside stocks by using a two-tailed t-test (Wilcoxon rank-sum test).

* Significant at the 10 percent level (two-tailed).
** Significant at the 5 percent level (two-tailed).
*** Significant at the 1 percent level (two-tailed).

TABLE 6
Multivariate analyses of insiders' intelligence and abnormal returns they earn when buying inside and outside stocks

	Dependent variable: $BHAR_{ijp}$			
Independent variables	(1)	(2)	(3)	(4)
IQ_i	0.003**	0.003***	0.003***	0.004***
	(2.47)	(2.79)	(2.88)	(3.32)
$INSIDE_{ijp} \times IQ_i$	–0.011	–0.011*	–0.012*	–0.012**
	(–1.53)	(–1.66)	(–1.87)	(–2.00)
$INSIDE_{ijp}$	0.017***	0.020***	0.015**	0.007
	(2.62)	(3.00)	(2.42)	(1.31)
$INSIDEBEFORE_{ijp}$	0.019**	0.021**	0.015**	0.003
	(2.44)	(2.58)	(2.01)	(0.50)
$CLOSE_{jp}$	–0.004	–0.004	–0.004	0.000
	(–0.84)	(–0.82)	(–0.93)	(0.05)
$NUMINS_{ip}$	0.000	0.000	–0.001	–0.001**
	(0.65)	(–0.42)	(–1.26)	(–2.24)
$MGMT_{ijp}$		0.009	0.007	0.007
		(1.11)	(0.86)	(0.79)
AGE_{ip}		0.000	0.000	0.000
		(–0.54)	(–0.95)	(–0.88)
$EDULEVEL_i$		–0.001	–0.001	–0.001
		(–1.35)	(–1.37)	(–1.45)
$WEALTH_{ip}$		0.001	0.001	0.000
		(1.05)	(1.44)	(0.60)
$DIVERSIFICATION_{ip}$		-0.028	-0.018	-0.006
		(-1.22)	(-0.83)	(-0.35)
$LIQUIDITY_{ip}$		0.000	0.000	0.000
		(–1.13)	(–0.99)	(-0.78)
$RISKPREFERENCE1_{ip}$		0.004*	0.004	0.004
		(1.78)	(1.41)	(1.38)
$RISKPREFERENCE2_i$		0.004	0.003	0.001
		(1.52)	(1.19)	(0.67)
$BOARDSIZE_{jp}$			–0.048	–0.030
			(–1.32)	(–0.85)
$BOARDPROPMEN_{jp}$			0.089	0.077
			(1.40)	(1.21)
$SPREAD_{jp}$			1.801***	0.595
			(5.07)	(1.39)
$LNMV_{jp}$				–0.072***
				(–4.64)
$PBjp$				–0.010
				(–1.57)
$LEVERAGE_{jp}$				–0.017
				(–0.25)
$MOMENTUM_{jp}$				–0.010
				(–0.84)
ROA_{jp}				–0.013
				(–0.38)
$\beta_3 - \beta_1$	–0.014**	–0.017***	–0.012*	–0.004
(INSIDE vs. IQ)	(–2.23)	(–2.54)	(–1.92)	(–0.70)
Intercept	Included	Included	Included	Included
Firm fixed effects	Included	Included	Included	Included
Period fixed effects	Included	Included	Included	Included
Adj. R^2	0.245	0.245	0.259	0.315
N obs.	60,978	60,978	60,978	60,978

Notes:

1. The table reports the results of estimating Model 1 on the sample of 60,978 net purchases to explore the effect of insiders' intelligence on the abnormal returns they earn when buying inside and outside stocks. The sample includes 5,502 Swedish insiders in 347 listed firms with at least one inside and one outside stock holding over the period 2000-2008. Inside (outside) stocks refer to stocks of firms where the person holds (does not hold) an insider position. Net purchases refer to an increase in an insider's stock holdings in a firm during a semi-annual period.

2. Model 1 is as follows:

$$BHAR_{ijp} = \alpha_0 + \beta_1 IQ_i + \beta_2 INSIDE_{ijp} \times IQ_i + \beta_3 INSIDE_{ijp} + \beta_4 INSIDEBEFORE_{ijp} + \beta_5 NUMINS_{ip} + \beta_6 CLOSE_{ijp} + \beta_7 MGMT_{ijp} + \beta_8 AGE_{ip} + \beta_9 EDULEVEL_i + \beta_{10} WEALTH_{ip} + \beta_{11} DIVERSIFICATION_{ip} + \beta_{12} LIQUIDITY_{ip} + \beta_{13} RISKPREFERENCE1_{ip} + \beta_{14} RISKPREFERENCE2_{ip} \beta_{15} BOARDSIZE_{jp} + \beta_{16} BOARDPROPMEN_{jp} + \beta_{17} SPREAD_{jp} + \beta_{18} LNMV_{jp} + \beta_{19} PB_{jp} + \beta_{20} LEVERAGE_{jp} + \beta_{21} MOMENTUM_{jp} + \beta_{22} ROA_{jp} + \sum_{k=1}^{347} \varphi_k FIRM_k + \sum_{p=2000/06}^{2008/06} \gamma_p PERIOD_p + \varepsilon_{ijp}$$

3. The dependent variable in Model 1 is the market-adjusted buy-and hold return over a three-month period following insider *i*'s net purchase during a semi-annual period *p* for firm *j* ($BHAR_{ijp}$). The independent variables include a dummy variable for high-IQ insiders (IQ_i), a dummy variable for insiders' net purchases in their inside stocks ($INSIDE_i$), and a two-way interaction variable $INSIDE_{ijp} \times IQ_i$. All other variables are defined as in Appendix 1. All continuous variables are winsorized to the 1st and 99th percentiles of their distributions.

4. Firm and semi-annual period fixed effects are included but are not reported for the sake of brevity. We control for the clustering of standard errors by firm and report the *t*-statistics within parentheses.

   * Significant at the 10 percent level (two-tailed).
   ** Significant at the 5 percent level (two-tailed).
   *** Significant at the 1 percent level (two-tailed).

TABLE 7
Multivariate analyses of insiders' intelligence and abnormal returns they earn when selling inside and outside stocks

	Dependent variable: $BHAR_{ijp}$			
Independent variables	(1)	(2)	(3)	(4)
IQ_i	–0.002	–0.002*	–0.002*	–0.001
	(–1.39)	(–1.66)	(–1.71)	(–0.75)
$INSIDE_{ijp} \times IQ_i$	0.018**	0.018**	0.019**	0.014*
	(2.00)	(2.11)	(2.23)	(1.82)
$INSIDE_{ijp}$	–0.017*	–0.009	–0.014*	–0.012
	(–1.95)	(–1.10)	(–1.67)	(–1.60)
$INSIDEBEFORE_{ijp}$	0.020***	0.023***	0.022***	0.013**
	(3.18)	(3.74)	(3.60)	(2.21)
$CLOSE_{jp}$	–0.004	–0.005	–0.004	0.000
	(–0.82)	(–0.90)	(–0.85)	(–0.03)
$NUMINS_{ip}$	0.001*	0.002***	0.002**	0.000
	(1.69)	(2.65)	(2.14)	(0.72)
$MGMT_{ijp}$		–0.012	–0.009	–0.011
		(–0.79)	(–0.64)	(–0.79)
AGE_{ip}		0.000	0.000	0.000
		(0.17)	(0.17)	(1.30)
$EDULEVEL_i$		0.001	0.000	0.000
		(0.47)	(0.36)	(0.43)
$WEALTH_{ip}$		–0.002**	–0.002**	–0.001**
		(–2.53)	(–2.54)	(–2.30)
$DIVERSIFICATION_{ip}$		–0.038***	–0.037***	–0.020**
		(–3.49)	(–3.42)	(–2.19)
$LIQUIDITY_{ip}$		0.000	0.000	0.000
		(–0.76)	(–0.44)	(0.37)
$RISKPREFERENCE1_{ip}$		–0.003	–0.002	0.000
		(–1.01)	(–0.77)	(0.09)
$RISKPREFERENCE2_i$		0.005**	0.005*	0.003
		(2.28)	(1.85)	(1.17)
$BOARDSIZE_{jp}$			–0.081**	–0.060
			(–2.34)	(–1.61)
$BOARDPROPMEN_{jp}$			0.077	0.073
			(1.16)	(1.22)
$SPREAD_{jp}$			0.993***	–0.254
			(2.83)	(–0.57)
$LNMV_{jp}$				–0.093***
				(–5.26)
$PBjp$				–0.007
				(–1.08)
$LEVERAGE_{jp}$				–0.004
				(–0.05)
$MOMENTUM_{jp}$				–0.004
				(–0.24)
ROA_{jp}				0.043
				(1.22)
$\beta_3 - \beta_1$	0.015*	0.007	0.011	0.011
(IQ vs. INSIDE)	(1.74)	(1.82)	(1.37)	(1.43)
Intercept	Included	Included	Included	Included
Firm fixed effect	Included	Included	Included	Included
Period fixed effects	Included	Included	Included	Included
Adj. R^2	0.224	0.224	0.230	0.298
N. obs.	51,400	51,400	51,400	51,400

Notes:

1. The table reports the results of estimating Model 1 on the sample of 51,400 net sales to explore the effect of insiders' intelligence on the abnormal returns they earn when selling inside and outside stocks. The sample includes 5,502 Swedish insiders in 347 listed firms with at least one inside and one outside stock holding over the period 2000-2008. Inside (outside) stocks refer to stocks of firms where the person holds (does not hold) an insider position. Net sales refer to negative changes in an insider's stock holdings in a firm during a semi-annual period.

2. Model 1 is as follows:

$$BHAR_{ijp} = \alpha_0 + \beta_1 IQ_i + \beta_2 INSIDE_{ijp} \times IQ_i + \beta_3 INSIDE_{ijp} + \beta_4 INSIDEBEFORE_{ijp} + \beta_5 NUMINS_{ip} + \beta_6 CLOSE_{ijp} + \beta_7 MGMT_{ijp} + \beta_8 AGE_{ip} + \beta_9 EDULEVEL_i + \beta_{10} WEALTH_{ip} + \beta_{11} DIVERSIFICATION_{ip} + \beta_{12} LIQUIDITY_{ip} + \beta_{13} RISKPREFERENCE1_{ip} + \beta_{14} RISKPREFERENCE2_{ip} + \beta_{15} BOARDSIZE_{jp} + \beta_{16} BOARDPROPMEN_{jp} + \beta_{17} SPREAD_{jp} + \beta_{18} LNMV_{jp} + \beta_{19} PB_{jp} + \beta_{20} LEVERAGE_{jp} + \beta_{21} MOMENTUM_{jp} + \beta_{22} ROA_{jp} + \sum_{k=1}^{347} \varphi_k FIRM_k + \sum_{p=2000/06}^{2008/06} \gamma_p PERIOD_p + \varepsilon_{ijp}$$

3. The dependent variable in Model 1 is the market-adjusted buy-and hold return over a three-month period following insider *i*'s net sale during a semi-annual period *p* for firm *j* ($BHAR_{ijp}$). The independent variables include a dummy variable for high-IQ insiders (IQ_i), a dummy variable for insiders' net sales in their inside stocks ($INSIDE_i$), and a two-way interaction variable $INSIDE_{ijp} \times IQ_i$. All other variables are defined as in Appendix 1. All continuous variables are winsorized to the 1st and 99th percentiles of their distributions.

4. Firm and semi-annual period fixed effects are included but are not reported for the sake of brevity. We control for the clustering of standard errors by firm and report the *t*-statistics within parentheses.

   * Significant at the 10 percent level (two-tailed).
   ** Significant at the 5 percent level (two-tailed).
   *** Significant at the 1 percent level (two-tailed).

TABLE 8
Insiders' intelligence and timing of purchases of inside and outside stocks

	Panel A: Likelihood of inside purchasing		**Panel B:** Likelihood of outside purchasing	
Independent variables	Estimate	(*p*-value)	Estimate	(*p*-value)
$BHAR_{ijp} \times IQ_i$	–0.154	(0.474)	0.193***	(0.000)
IQ_i	0.069	(0.214)	–0.017	(0.143)
$BHAR_{ijp}$	0.133	(0.542)	–0.134	(0.233)
$INSIDEBEFORE_{ijp}$			–0.012	(0.850)
$CLOSE_{jp}$			–0.014	(0.675)
$NUMINS_{ip}$	0.134***	(0.000)	–0.115***	(0.000)
$MGMT_{ijp}$	0.224**	(0.046)		
AGE_{ip}	–0.019***	(0.000)	–0.001	(0.344)
$EDULEVEL_i$	0.141***	(0.000)	–0.002	(0.751)
$WEALTH_{ip}$	–0.064***	(0.002)	0.161***	(0.000)
$DIVERSIFICATION_{ip}$	–0.855***	(0.000)	1.084***	(0.000)
$LIQUIDITY_{ip}$	0.003	(0.167)	0.006***	(0.000)
$RISKPREFERENCE1_{ip}$	–0.189	(0.131)	0.395***	(0.000)
$RISKPREFERENCE2_i$	0.139	(0.142)	–0.063	(0.662)
$BOARDSIZE_{jp}$	–0.304	(0.245)	–0.127	(0.888)
$BOARDPROPMEN_{jp}$	–0.121	(0.803)	0.057	(0.355)
$SPREAD_{jp}$	1.024	(0.562)	–7.315***	(0.002)
$LNMV_{jp}$	0.049	(0.571)	0.389***	(0.000)
PB_{jp}	0.019	(0.277)	0.071***	(0.001)
$LEVERAGE_{jp}$	0.607	(0.308)	1.008*	(0.080)
$MOMENTUM_{jp}$	–0.156**	(0.040)	–0.128	(0.133)
ROA_{jp}	–0.259	(0.268)	–0.594*	(0.085)
Intercept	Included		Included	
Firm fixed effects	Included		Included	
Period fixed effects	Included		Included	
Pseudo R^2	0.069		0.031	
N obs.	26,266		789,123	

Notes:

1. The table reports the results of estimating Model 2 from a sample of 3,716 (57,262) semi-annual periods with net inside (outside) purchases and 22,550 (731,861) semi-annual periods without net inside (outside) purchases to explore how insiders' intelligence affects the timing of inside (outside) purchasing. The sample includes 5,502 Swedish insiders in 347 listed firms with at least one inside and one outside stock holding over the period 2000-2008. Inside (outside) purchasing refers to purchasing in stocks of firms where the person holds (does not hold) an insider position. Net purchases refer to positive changes in an insider's stock holdings in a firm during a semi-annual period. Panel A (Panel B) reports the results for the timing of inside (outside) purchasing.

2. Model 2 is as follows:

$$\begin{aligned}\text{Prob}(TRADE_{ijp}) = \text{logit}(&\alpha_0 + \beta_1 IQ_i + \beta_2 BHAR_{ijp} \times IQ_i + \beta_3 BHAR_{ijp} + \beta_4 INSIDEBEF_{ijp} + \beta_5 NUMINS_{ip} \\ &+ \beta_6 CLOSE_{ijp} + \beta_7 MGMT_{ijp} + \beta_8 AGE_{ip} + \beta_9 EDULEVEL_i + \beta_{10} WEALTH_{ip} + \beta_{11} DIVERSIFICATION_{ip} \\ &+ \beta_{12} LIQUIDITY_{ip} + \beta_{13} RISKPREFERENCE1_{ip} + \beta_{14} RISKPREFERENCE2_{ip} \\ &\beta_{15} BOARDSIZE_{jp} + \beta_{16} BOARDPROPMEN_{jp} + \beta_{17} SPREAD_{jp} \\ &+ \beta_{18} LNMV_{jp} + \beta_{19} PB_{jp} + \beta_{20} LEVERAGE_{jp} + \beta_{21} MOMENTUM_{jp} \\ &+ \beta_{22} ROA_{jp} + \sum_{k=1}^{347} \varphi_k FIRM_k + \sum_{p=2000/06}^{2008/06} \gamma_p PERIOD_p + \varepsilon_{ijp})\end{aligned}$$

3. The dependent variable in Model 2 is a dummy variable that takes the value of one if insider *i* is a net purchaser of stock *j* during the semi-annual period *p*, and zero otherwise ($TRADE_{ijp}$). The

independent variables include a dummy variable for high-IQ insiders (IQ_i) and the market-adjusted buy-and hold return over a three-month period following a semi-annual period p for firm j ($BHAR_{ijp}$). The estimated coefficient on the interaction variable $BHAR_{ijp} \times IQ_i$ indicates whether high-IQ insiders are more likely to purchase a stock prior to a stock price increase. All other variables are defined as in Appendix 1. All continuous variables are winsorized to the 1st and 99th percentiles of their distributions.

4. Firm and semi-annual period fixed effects are included but are not reported for the sake of brevity. We control for the clustering of standard errors by firm and report the *p*-values within parentheses.

TABLE 9
Insiders' intelligence and timing of sales of inside and outside stocks

	Panel A: Likelihood of inside selling		**Panel B:** Likelihood of outside selling	
Independent variables	Estimate	(*p*-value)	Estimate	(*p*-value)
$BHAR_{ijp} \times IQ_i$	0.469	(0.110)	–0.049	(0.479)
IQ_i	–0.087	(0.291)	0.020	(0.185)
$BHAR_{ijp}$	–0.513*	(0.087)	0.147	(0.151)
$INSIDEBEFORE_{ijp}$			0.003	(0.956)
$CLOSE_{jp}$			0.078*	(0.088)
$NUMINS_{ip}$	–0.307***	(0.000)	–0.098***	(0.000)
$MGMT_{ijp}$	–0.039	(0.776)		
AGE_{ip}	–0.012**	(0.014)	–0.011***	(0.000)
$EDULEVEL_i$	–0.057	(0.258)	–0.057***	(0.000)
$WEALTH_{ip}$	0.134***	(0.000)	0.278***	(0.000)
$DIVERSIFICATION_{ip}$	1.845***	(0.000)	3.150***	(0.000)
$LIQUIDITY_{ip}$	–0.003	(0.357)	–0.001**	(0.049)
$RISKPREFERENCE1_{ip}$	0.206	(0.211)	0.009	(0.874)
$RISKPREFERENCE2_i$	0.179	(0.185)	0.089***	(0.002)
$BOARDSIZE_{jp}$	–0.158	(0.659)	0.011	(0.946)
$BOARDPROPMEN_{jp}$	–0.187	(0.669)	0.363	(0.153)
$SPREAD_{jp}$	3.684*	(0.072)	–8.193***	(0.000)
$LNMV_{jp}$	0.245**	(0.029)	0.216***	(0.001)
PB_{jp}	0.009	(0.668)	0.019	(0.140)
$LEVERAGE_{jp}$	–0.137	(0.847)	–0.284	(0.349)
$MOMENTUM_{jp}$	0.272***	(0.000)	0.261***	(0.000)
ROA_{jp}	0.351	(0.199)	–0.154	(0.369)
Intercept	Included		Included	
Firm fixed effects	Included		Included	
Period fixed effects	Included		Included	
Pseudo R^2	0.055		0.067	
N obs.	20,158		280,052	

Notes:

1. The table reports the results of estimating Model 2 from a sample of 1,629 (49,771) semi-annual periods with net inside (outside) sales and 18,529 (230,281) semi-annual periods without net inside (outside) sales to explore how insiders' intelligence affects the timing of inside (outside) selling. The sample includes 5,502 Swedish insiders in 347 listed firms with at least one inside and one outside stock holding over the period 2000-2008. Inside (outside) selling refers to selling in stocks of firms where the person holds (does not hold) an insider position. Net sales refer to negative changes in an insider's stock holdings in a firm during a semi-annual period. Panel A (Panel B) reports the results for the timing of inside (outside) selling.

2. Model 2 is as follows:

$$\begin{aligned}\text{Prob}(TRADE_{ijp}) = \text{logit}(&\alpha_0 + \beta_1 IQ_i + \beta_2 BHAR_{ijp} \times IQ_i + \beta_3 BHAR_{ijp} + \beta_4 INSIDEBEF_{ijp} + \beta_5 NUMINS_{ip} \\ &+ \beta_6 CLOSE_{ijp} + \beta_7 MGMT_{ijp} + \beta_8 AGE_{ip} + \beta_9 EDULEVEL_i + \beta_{10} WEALTH_{ip} + \beta_{11} DIVERSIFICATION_{ip} \\ &+ \beta_{12} LIQUIDITY_{ip} + \beta_{13} RISKPREFERENCE1_{ip} + \beta_{14} RISKPREFERENCE2_{ip} \\ &\beta_{15} BOARDSIZE_{jp} + \beta_{16} BOARDPROPMEN_{jp} + \beta_{17} SPREAD_{jp} \\ &+ \beta_{18} LNMV_{jp} + \beta_{19} PB_{jp} + \beta_{20} LEVERAGE_{jp} + \beta_{21} MOMENTUM_{jp} \\ &+ \beta_{22} ROA_{jp} + \sum_{k=1}^{347} \varphi_k FIRM_k + \sum_{p=2000/06}^{2008/06} \gamma_p PERIOD_p + \varepsilon_{ijp})\end{aligned}$$

3. The dependent variable in Model 2 is a dummy variable that takes the value of one if insider *i* is a net seller of stock *j* during the semi-annual period *p*, and zero otherwise ($TRADE_{ijp}$). The independent

variables include a dummy variable for high-IQ insiders (IQ_i) and the market-adjusted buy-and hold return over a three-month period following a semi-annual period p for firm j ($BHAR_{ijp}$). The estimated coefficient on the interaction variable $BHAR_{ijp} \times IQ_i$ indicates whether high-IQ investors are more likely to sell a stock prior to a stock price increase. All other variables are defined as in Appendix 1. All continuous variables are winsorized to the 1st and 99th percentiles of their distributions.

4. Firm and semi-annual period fixed effects are included but are not reported for the sake of brevity. We control for the clustering of standard errors by firm and report the *p*-values within parentheses.